

Guidelines for Victorian Dairy Feedpads and Freestalls

FIRST EDITION 



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FOREWORD

With uncertainty in seasonal water availability and fluctuations in supplementary feed and fertiliser costs, there has been significant changes in the dairy industry over recent years to adjust farming practices to a more intensive form to counteract influences that may have adverse impacts on milk production.

This trend has seen a dramatic shift from traditional pasture based dairying systems, whereby farmers have relied predominantly on home-grown feed, to a more intensified management approach. Permanent and semi-permanent infrastructure such as feedpads and freestalls have been utilised in order to facilitate a sustained production through the increased importation of supplementary feeds.

The establishment of feedpads and freestalls are not a quick fix solution to address issues of feed utilisation and wastage. They require thorough planning and significant investment, that will result in changes to the farms management and system. Therefore any changes to the farm system should not be a short-term decision.

Feeding cows is the fundamental component of the dairy farming system and any feedpad or freestall developments must be suitably integrated into the farms existing physical attributes, taking into account the farms long-term objectives and management decisions.

These guidelines are intended to provide referral agencies, service providers and dairy farmers of Victoria with a clear and concise overview of all the elements that require consideration when undertaking the initial development and longer term management of these more intensive facilities.

The information in these guidelines is a collation of current planning and technical information compiled to:

- assist the dairy industry and advisers to make informed decisions with respect to dairy feedpad and freestall operations
- raise awareness of industry, government and community expectations to minimise any adverse impact on the environment
- establish a key reference source enabling new proposals to progress smoothly through the various planning stages
- demonstrate that the dairy industry has an ongoing commitment to support farmers undertake farming system changes.

Scott McDonald
Department of Primary Industries – Victoria
On behalf of the Steering Committee

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Geoffrey Gardiner Dairy Foundation

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ABBREVIATIONS

AS	Australian Standards
CMA	Catchment Management Authority
DairyGains	Management of Dairy Effluent – 2008 DairyGains Victorian Guidelines
DCFWG	Dairy Cattle Feedpad Working Group
DCFWG Guidelines	Feedpad Guidelines for the Goulburn Broken Catchment
DPC	Dairy Practices Council
DPCD	Department of Planning and Community Development
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EMP	Environmental Management Plan
LPPF	Local Planning Policy Framework
Manure Database	Effluent and Manure Management Database for the Australian Dairy Industry
NRAES	Northeast Regional Agricultural Engineering Service
NZS	New Zealand Standards
SPPF	State Planning Policy Framework
THI	Temperature Humidity Index
TS	Total Solids
VCAT	Victorian Civil and Administrative Tribunal
VPP	Victoria Planning Provisions
VS	Volatile Solids
NZS	New Zealand Standards



OVERVIEW

SECTION OVERVIEW	APPLICABLE TO:
<p>Section 1 – Introduction Describes the purpose and intent of the guidelines and the main types of dairy feedpads covered by the document.</p>	<p>All guidelines users</p> 
<p>Section 2 – Planning and Legislative Requirements Discusses the Victoria Planning Provisions in relation to dairy feedpads, and identifies the situations when dairy cattle feedpads may require planning approval. It also summaries the roles of the responsible authority and referral authorities in the planning permit application process.</p>	<p>Local government planners Referral authorities Dairy farmers Design consultants Feedpad operators</p> 
<p>Section 3 – Planning Permit Application Process Outlines the local council permit application documentation, assessment process and the entities a permit applicant should consult prior to submitting an application.</p>	<p>Local government planners Dairy farmers Design consultants</p> 
<p>Section 4 – Amenity and Environmental Issues Outlines the key potential amenity and environmental issues that should be considered for new feedpad developments or expansions to existing sites, and recommended practices to minimise amenity and environmental impacts.</p>	<p>Local government planners Referral authorities Dairy farmers Design consultants Feedpad operators</p> 
<p>Section 5 – Farm Design and Operation Elements Discusses the six elements that should be considered in the siting, design, operation and management of new feedpad developments or expansions to existing sites. It also includes a checklist that the responsible authority can use to determine if a planning permit application contains sufficient information for the assessment process to start.</p>	<p>Local government planners Referral authorities Dairy farmers Design consultants Feedpad operators</p> 
<p>Section 6 – Site Preparation and Earthworks Outlines the site investigation and selection considerations in relation to preferred soil types and pad preparation principles.</p>	<p>Local government planners Referral authorities Dairy farmers Design consultants</p> 
<p>Section 7 – Feedpad and Freestall Design Details the types of feedpads using text, photographs and figures. It outlines the recommended design and management principles for feedpads and freestalls; and the main construction materials.</p>	<p>Dairy farmers Design consultants Feedpad operators Farm veterinary consultants</p> 

Local government planners	Referral authorities	Dairy farmers	Design consultants	Feedpad operators	Farm veterinary consultants



SECTION OVERVIEW

APPLICABLE TO:

Section 8 – Manure Management

Discusses manure management principles and the standards to be used when designing a manure management system.

Dairy farmers
Design consultants
Feedpad operators



Section 9 – Animal Health and Welfare

Discusses how design, construction and management affect cattle health and welfare. It also discusses key health and welfare issues; and management practices that should be considered for feedpad and freestall systems.

Dairy farmers
Design consultants
Feedpad operators
Farm veterinary consultants



Section 10 – Dairy Cattle Cooling

Discusses how to identify heat load on dairy cattle and prevent heat stress; and practical design and management principles for cooling cattle.

Dairy farmers
Design consultants
Feedpad operators



Section 11 – Water Supply

Outlines requirements for drinking water quantity and quality, water point location and management.

Dairy farmers
Design consultants
Feedpad operators



Section 12 – Feed Storage and Management

Summarises the main feed storage methods and the recommended principles for efficient feed preparation and delivery.

Dairy farmers
Design consultants
Feedpad operators



Section 13 – Occupational Health and Safety

Outlines the on-farm considerations to ensure a safe working environment is provided for staff, visitors and contractors.

Dairy farmers
Design consultants
Feedpad operators



Section 14 – References

All guidelines users



Section 15 – Appendices

Provides supporting information to assist guideline users.

All guidelines users



Section 16 – Glossary

Explains key terminology used throughout the guidelines.

All guidelines users



Local government planners Referral authorities Dairy farmers Design consultants Feedpad operators Farm veterinary consultants





1. INTRODUCTION

In recent years, drier seasonal conditions, uncertainty about water availability, fluctuating 'supplementary' feed and fertiliser costs combined with lower milk prices have resulted in a significant shift by the dairy industry in Victoria to more intensive production systems. In particular, more feedpads and some freestalls have been built to facilitate dairy production.

A feedpad is an enclosed area where dairy cattle are provided with a portion of their daily feed requirement as hay, silage, grain or mixed feed for all or part of the year. An effectively sited, designed, constructed and managed feedpad should provide cattle with easy access to feed, minimise feed wastage and prevent adverse impacts on amenities and the surrounding environment (i.e. natural resources such as soil, water and air). Feedpads can be classified according to their permanency (e.g. semi-permanent or permanent) and the manure management method used (e.g. scraping or flood washing).

Semi-permanent Feedpad: usually consists of a formed earthen or rubble pad located adjacent to the dairy or the main farm laneway. Feed can be placed directly on to the ground or rubber matting, or in modular steel or concrete troughs (see Figure 1.1 and Figure 1.2). Accumulated manure is scraped away from the pad. Earthen and rubble pads cannot be flood washed to remove manure.

Permanent Feedpad: usually consists of a concrete pad located adjacent to the dairy or the main farm laneway. The pad generally consists of a concrete feed alley that is used by vehicles for delivering feed (drive alley) and a separate alley that cattle stand on whilst feeding (feed alley) (see Figure 1.3). The pad usually has a longitudinal slope of 0.5–3% (i.e. along the entire pad length). Accumulated manure can either be scraped or vacuumed from the alleys; or flood washed in to a containment sump or pond.

Freestall: a type of permanent feedpad that also includes a bedding area for cattle to lie down. It is generally covered (roofed) and may also include a loafing area for cattle to stand, ruminate or idle. Planning the siting and design of the freestall with future expansion in mind will allow an effectively sited permanent feedpad to be retrofitted into a freestall using a process of staged development (see Figure 1.4).

Loose housing: a type of permanent feedpad with a bedded area for the cattle to lie down in an unrestricted space (see Figure 7.6). The bedded area may be deep bedded straw or compost bedded pack.

Section 7 provides further detail on the types, design and layout of feedpads and freestalls (including additional photographs).

The main planning and design principles used for a feedpad can be applied to a freestall. Therefore for the purpose of this document, the term 'feedpad' refers to both feedpad and freestall, unless stated otherwise.

The intent of the guidelines is to provide dairy farmers with options to improve farm production, whilst also protecting the local environment and amenities through the provision of a broad framework of recommendations for planning, design and management of Victorian dairy cattle feedpads. The guidelines include detailed information regarding statutory planning, siting, engineering design, animal health and welfare, manure management, water supply and feed storage. The guidelines should be used by the:

**AN EFFECTIVELY
SITED, DESIGNED,
CONSTRUCTED
AND MANAGED
FEEDPAD SHOULD
PROVIDE CATTLE
WITH EASY ACCESS
TO FEED, MINIMISE
FEED WASTAGE
AND PREVENT
ADVERSE IMPACTS
ON AMENITY AND
THE SURROUNDING
ENVIRONMENT**



Figure 1.1 – Semi-permanent Feedpad with rubble drive alley and 2 hot wires



Figure 1.2 – Semi-permanent Feedpad with concrete modular troughs and a central hot wire



Figure 1.3 – Permanent Feedpad with central drive alley and 2 feed alleys



Figure 1.4 – Freestall with individual cow stalls

- **responsible authority** to assist in their consideration of dairy feedpads; to provide technical information for managing and assessing the potential environmental and amenity issues associated with a feedpad planning permit application; and to understand acceptable design and management practices.
- **dairy farmers, design consultants, feedpad operators and industry service providers** to understand the accepted design and management practices for housing, handling and managing cattle health and welfare in an intensive production system.

While the guidelines provide guidance on animal health and welfare, as well as the occupational health and safety issues associated with feedpad management, they are not intended to be used by the responsible authority, referral authorities and approval bodies to assess these aspects of a proposed development. These matters are addressed through other legislative processes.

The guidelines are based on the best national and international technical information available at the time of publication. They are underpinned by two key outcomes that relate to:

1. Environment
2. Production

**1. Environment Key Outcomes**

The Environment is protected by ensuring that feedpads are sited, designed, constructed and managed to ensure that they do not:

- release contaminated runoff beyond the property boundary
- cause adverse impacts on surface water or groundwater quality
- cause adverse impacts on land
- cause adverse impacts on the amenity of surrounding sensitive uses.

2. Production Key Outcomes

Feedpads are sited, designed, constructed and managed to:

- increase milk production and improve milk composition
- meet industry standards for cattle health and welfare, and animal husbandry.

It should be emphasised that the guidelines do not override or replace applicable federal, state or local government legislation, regulation, plans or policies. Also, developers need to be aware that development proposals may be assessed in a manner or scope outside that provided in the guidelines. Operators must also observe their responsibilities under workplace health and safety, animal welfare and other relevant legislation.



2. PLANNING AND LEGISLATIVE REQUIREMENTS

2.1. Introduction

When considering the development of a new feedpad or the expansion to an existing system, it is important to bear in mind the legislation that might apply. In particular, it is necessary to consider:

- whether a feedpad is an allowable use having regard to the zoning of the site and other relevant planning provisions
- whether a planning permit is required
- whether an EPA Victoria Works Approval is required
- which other government authorities may be involved in the assessment of any planning permit application and the information they might require.

2.2. Victorian Planning Framework

Each municipality has a planning scheme which sets out the policies and provisions for the use, development and protection of land for an area. Planning schemes consist of both state content, directly from the **Victorian Planning Provisions (VPP)**, and local requirements, guided by the VPP and the *Planning and Environment Act (1987)*. The strategic foundation of planning schemes is provided in the **State Planning Policy Framework** and the **Local Planning Policy Framework** sections of the scheme.

The **State Planning Policy Framework (SPPF)** is part of the VPP and is included in every planning scheme in Victoria. It contains general principles for use and development and specific state planning policies on settlement, environment, housing, economic development, infrastructure, and particular uses and development. Responsible authorities must consider and give effect to these principles and policies in their decision-making. The **Local Planning Policy Framework (LPPF)** contains a municipal strategic statement and local planning policies developed by the planning authority (usually the municipal council). The LPPF sets out the local and regional strategic policy context for a municipality, demonstrating how the broader state planning policies will be achieved or implemented. It identifies long term

directions for land use and development in the municipality and presents a vision for its community and other stakeholders. The policies contained in both the SPPF and LPPF are implemented through the relevant zone, overlay and particular provisions requirements of the planning scheme.

The planning scheme maps identify the **zone** which applies to each piece of land within the municipality. The zone provides controls relevant to the intended use of that land. If additional controls are required, an **overlay** may also apply to an area of land. Overlays generally relate to environmental considerations; inundation; landscape; heritage; built form; and land and site management issues. Overlays affect subdivisions; and buildings and works.

While Zones and Overlays are selected from a suite available in the VPP, some local requirements may be included through a **schedule** to the zone or overlay.

All planning schemes also include Particular Provisions, General Provisions, and land use definitions, which form part of the VPP.

It is important to refer to all sections of the planning scheme when considering the requirements that might apply to a particular use or development.

Planning schemes are available at local Council offices, as well as online at <http://www.dse.vic.gov.au/planningschemes/>

2.2.1. How does the Planning Scheme Apply to the Use and Development of Dairy Feedpads?

The SPPF encourages sustainable agriculture and the support of effective agricultural production. In relation to intensive animal industries, it is policy to facilitate their establishment and expansion in a manner consistent with the protection of the environment.

**IT IS IMPORTANT
TO REFER TO ALL
SECTIONS OF THE
PLANNING SCHEME
WHEN CONSIDERING
THE REQUIREMENTS
THAT MIGHT APPLY TO
A PARTICULAR USE OR
DEVELOPMENT**



A dairy farm is defined in the VPPs as 'Extensive animal husbandry' which is land used to keep or breed farm animals, including birds, at an intensity where the animals' main food source is obtained by grazing, browsing, or foraging on plants grown on the land. This includes any emergency and supplementary feeding or incidental penning and housing of cattle provided they *obtain the majority of food from the land*. In the Farming Zone, land can be developed and used for extensive animal husbandry without requiring a planning permit, while in other rural zones a planning permit may be required.

A dairy feedpad comes under the definition of 'Intensive animal husbandry' which is defined as land used to keep or breed farm animals, including birds, by *importing* most food from outside the enclosures. It does not include: an abattoir or sale yard; emergency and supplementary feeding if incidental to the use of land for extensive animal husbandry; or the penning and housing of animals, including birds, for brooding, weaning, dipping or other husbandry purposes if incidental to the use of land for extensive animal husbandry.

There are no zones within Victorian planning schemes where intensive animal husbandry can be undertaken without a planning permit. A planning permit can be applied for in the following rural zones:

- Farming Zone
- Rural Activity Zone
- Green Wedge Zone

Intensive animal husbandry is prohibited in most zones, including the Rural Living Zone, Rural Conservation Zone and Green Wedge A Zone.

Where a feedpad is proposed on an existing dairy farm and the cattle are to be supplied with the *majority* of their feed requirements while they are within the feedpad, a planning permit for intensive animal husbandry will be required.

Sometimes a feedpad is established on a dairy farm (extensive animal husbandry) for emergency and supplementary feeding purposes only. Where this is a temporary

arrangement, there is no need for a permit. Over time the use of this feedpad may change to provide for more regular supplementary feeding of cattle for the purpose of production, growth or finishing. When this occurs, a planning permit would be required for intensive animal husbandry.

It is essential that dairy farm operators identify whether their feedpad falls under the definition of extensive animal husbandry or intensive animal husbandry.

Table 2.1 identifies the 'use' requirements for extensive and intensive animal husbandry uses under each land use zone. It provides guidance as to whether or not a feedpad is an allowable use in a particular zone and whether a planning permit will be required.

In addition to the planning permit requirement for the use of a site for intensive animal husbandry, any associated 'buildings and works', including earthworks, may separately trigger the need for a planning permit. For example, within the Farming Zone a permit is required to construct or carry out earthworks which change the rate of flow or the discharge point of water across a property boundary, or earthworks which increase the discharge of saline ground water. Additional triggers are listed relating to buildings. (Refer to Clause 35.07-4 of the VPP.)

Schedules are used to identify specific needs, circumstances and requirements of individual municipalities that may apply to a Zone or Overlay. It is essential to check if any overlays and schedules apply to your land before:

- selecting a feedpad site and investing too much time or expense in the preparation of a planning permit application
- commencing any use or development.

For example, for a site within a Land Subject to Inundation Overlay (LSIO), a permit would be required to construct a fence, unless a schedule to this overlay specifically states that a permit is not required. A schedule to the LSIO in one municipality specifies that a permit is required for any earthworks that are not covered by a certified Whole Farm Plan. In this instance,

**INTENSIVE ANIMAL
HUSBANDRY IS
PROHIBITED IN THE
RURAL LIVING ZONE,
RURAL CONSERVATION
ZONE AND GREEN
WEDGE A ZONE.**


Table 2.1 – Land Use Zonings, Section and Permit Requirements for Dairy Feedpads

Zoning	Extensive Animal Husbandry	Intensive Animal Husbandry
Residential Zones including R1Z, R2Z, R3Z, LDRZ, TZ	Section 2, permit required	Section 3, prohibited
Residential Zone (MUZ)	Section 2, permit required	Section 2, permit required
Industrial Zones including IN1Z, IN2Z, IN3Z	Section 1, no permit required	Section 3, prohibited
Business Zones including B1Z, B2Z, B3Z, B4Z, B5Z	Section 2, permit required	Section 3, prohibited
Rural Living Zone (RLZ)	Section 2, permit required	Section 3, prohibited
Green Wedge Zone (GWZ)	Section 1, no permit required	Section 2, permit required
Green Wedge A Zone (GWAZ)	Section 2, permit required	Section 3, prohibited
Rural Conservation Zone (RCZ)	Section 2, permit required	Section 3, prohibited
Farming Zone (FZ)	Section 1, no permit required	Section 2, permit required
Rural Activity Zone (RAZ)	Section 1, no permit required	Section 2, permit required
Urban Floodway Zone (UFZ)	Section 1, no permit required	Section 2, permit required
Urban Growth Zone (UGZ)	Section 1, no permit required	Section 3, prohibited

additional environmental protection measures may be required to demonstrate that the proposed buildings and works will not have adverse impacts during those times when the land is inundated.

Clarification on any of these matters can be provided by a planning officer at your local Council.

2.2.2. How Do the Planning Requirements Apply to Me if I Want to Construct a Feedpad to Assist with Supplementary Feeding of My Cattle?

Some farm operators may wish to build a feedpad to assist with supplementary feeding of cattle without increasing their stocking rates. If the number of cattle are not increased and the cattle still obtain the majority of their feed by grazing, browsing or foraging on plants grown

on the land then extensive animal husbandry is being practiced, and a planning permit will not be required for the use of the site as a feedpad. However, other aspects of the development may trigger the need to obtain a planning permit or other approvals; such as removal of native vegetation, buildings and works, development in flood prone areas, construction of roads or farm access points. It is therefore important to check with your local Council to clarify your obligations.

Regardless of whether a planning permit is required, the guidelines will assist the farm owner and design consultant in addressing key issues to ensure the development is of a high standard and meets relevant environmental, amenity, health and welfare standards.



2.2.3. How do the Planning Requirements Apply to Me if I Want to Construct a Feedpad to Increase the Productivity of My Farm?

Some farm operators may wish to build a feedpad to increase the productivity of the farm by supplying the majority of feed in the feedpad. This enables the farm to be stocked at a higher rate than it otherwise would be if relying on the farm’s pastures only. This is intensive animal husbandry and will require a planning permit. With intensive farming practices there can be increased environmental and amenity risks that must be addressed at the planning and design stage. It is also important that substantial developments are consistent with the purposes of the zone, local planning policy and strategies. A well designed, sited and managed feedpad will minimise the potential for any adverse impacts on the surrounding area.

Other aspects of the development may also require planning or other approvals (e.g. removal of native vegetation, overlay requirements, development in flood prone areas, construction of roads or farm access points). It is therefore important to check with your local Council to clarify your obligations.

The guidelines will assist the farm owner and design consultant to address key issues at the planning and design stage to ensure the development is of a high standard and meets relevant environmental, amenity, health and welfare standards. It will also enable the responsible authority to identify relevant environmental and amenity requirements to assist in the assessment of a planning permit application and minimise the potential for any adverse impacts.

- State Environment Protection Policy – Ground Waters of Victoria (1997)
- State Environment Protection Policy – Prevention and Management of Contamination of Land (2002)
- State Environment Protection Policy – Air Quality Management (2001)
- Interim Guidelines for Control of Noise from Industry in Country Victoria (or any subsequent document)

It is important to note that the environment protection framework in Victoria places the onus of environment protection on those that manage the land (on-site and surrounding natural resources). The legislation and policies listed above may impose additional requirements on the development and operation of a feedpad.

To comply with the objectives of the *Environment Protection Act (1970)*, a feedpad operator must:

- contain and reuse all the manure deposited on dairy tracks, underpasses and the feedpad complex (most commonly applied back on to pastures or crops)
- ensure that manure does not enter surface waters (including dams, impoundments, rivers, creeks and all waterways where rainfall is likely to collect)
- ensure that manure does not enter ground waters either directly or through infiltration (e.g. excessive seepage from ponds or from stockpiled manure)
- ensure that manure does not contaminate land (i.e. regular applications of manure on to a small land area may result in excessive nutrient levels in the soil)
- ensure that offensive odours do not impact beyond property boundaries.

An EPA Victoria Works Approval is required for an intensive animal husbandry enterprise with a capacity exceeding 5000 head.

2.3. Environment Protection Framework

EPA Victoria administers the *Environment Protection Act (1970)*, as well as other related policies and regulations. These can be summarised as follows:

- *Environment Protection Act (1970)*
- State Environment Protection Policy – Waters of Victoria (2003)

IT IS IMPORTANT TO NOTE THAT THE ENVIRONMENT PROTECTION FRAMEWORK IN VICTORIA PLACES THE ONUS OF ENVIRONMENT PROTECTION ON THOSE THAT MANAGE THE LAND



2.4. Other Relevant State Legislation and Policies

There are a number of other State legislation and policies that may impose additional requirements on the development and operation of a feedpad. These include:

- *Aboriginal Heritage Act (2006)*
- *Occupational Health and Safety Act (2004)*
- *Environment Protection and Biodiversity Conservation Act (1999)*
- *Catchment and Land Protection Act (1994)*
- *Water Act (1989)*
- *The Water Act (2002)* (Irrigation Farm Dams) amended the *Water Act (1989)* to cover irrigation and commercial dams on or off waterways
- *Flora and Fauna Guarantee Act (1988)*
- *Planning and Environment Act (1987)*

Appendix A provides a brief description of the legislation outlined above.

2.5. Role of Government Agencies in the Planning Permit Application Process

Municipal (local) Councils are generally the responsible authority for the administration and enforcement of planning schemes. This means that they are responsible for assessing planning applications for feedpad applications. They are also responsible for monitoring and enforcing compliance with planning permit conditions and the planning scheme.

Prospective applicants are encouraged to consult with the responsible authority early in the planning process to:

- confirm the land use zone of their planned feedpad site
- confirm whether a feedpad is allowed in that zone. If so, a planning permit will be required
- determine if a planning permit is required for the buildings and works, removal of native vegetation or other components associated with the development of the feedpad
- identify any applicable overlays or schedules, and the limitations these impose on the application

- identify any specific information that needs to accompany the planning permit application
- identify any statutory referral authorities or other agencies that the responsible authority intends to notify or consult for advice in regards to your planning application. The responsible authority can also direct prospective applicants to useful contacts within other government agencies. These agencies and contacts should be consulted to ascertain their information requirements in respect to the planning permit application.

Section 4 summarises the key amenity and environmental issues associated with feedpad operations. Section 5 discusses key farm design and operation elements applicable to feedpad developments. Addressing the standards in Section 5 will satisfy most concerns that a Council may have with regard to feedpad siting, design, construction and management.

Some of the government authorities that may have a statutory or non-statutory role in the planning permit process for feedpad developments include:

- EPA Victoria
- Department of Primary Industries
- Catchment Management Authority
- Rural and Urban Water Authorities
- Department of Sustainability and Environment
- VIC Roads

Table 3.1 (see Section 3.4) outlines the reasons why particular referral authorities may be involved in providing comment on a feedpad application. It is important to note that the responsible authority is only obliged to notify the bodies specified in Clause 66 of the VPP. Other bodies may also be consulted at the discretion of the responsible authority, where relevant to their consideration of an application.

If a referral authority objects to the granting of a planning permit, the Council must refuse the application. Agencies who are required only to be notified of an application do not have power to cause it to be refused.



2.6. Summary

A planning permit may be required for a dairy farm with a feedpad for emergency and supplementary feeding purposes only, if:

- an overlay applies to the site
- native vegetation is to be removed
- buildings and works trigger a permit requirement.

A planning permit will be required if:

- a permanent feedpad is to be established (intensive animal husbandry)
- a feedpad established for emergency and supplementary feeding purposes starts to be used for more regular feeding for the purpose of production, growth or finishing
- native vegetation is to be removed
- buildings and works trigger a permit requirement.

A planning permit and EPA Victoria works approval will be required if:

- the feedpad is intensive animal husbandry and has a planned capacity of greater than 5000 head.

References

DairyGains 2008, *Management of Dairy Effluent – 2008 DairyGains Victorian Guidelines*, Department of Primary Industries on behalf of DairyGains, Victoria.

Department of Planning and Community Development – *Planning: a short guide*, <http://www.dse.vic.gov.au/DSE/nrenpl.nsf/LinkView/A57D7D5B3CCBDED6CA257315002118EDAC43B43AC2C43365CA257316001ECE78#plan> (Accessed on 10/07/2009).

DCFWG 2002, *Dairy cattle feedpad guidelines for the Goulburn Broken Catchment*, Goulburn Broken Catchment Management Authority, Shepparton. <http://www.gbcma.vic.gov.au/downloads/DairyFeedPadGuidelinesMay2002/FrontSection.pdf> (Accessed on 10/07/2009).

Victoria Planning Provisions, <http://www.dse.vic.gov.au/planningschemes/VPPs/> (Accessed on 10/07/2009).



3. PLANNING PERMIT APPLICATION PROCESS

3.1. Introduction

If a planning permit is required for the development or expansion of a feedpad, a systematic approach should be followed to streamline the application process. This may shorten the planning phase and reduce associated costs. Initial discussions with the responsible authority, referral authorities and other approval agencies should eliminate unsuitable sites and identify any special requirements or information that needs to accompany the planning permit application.

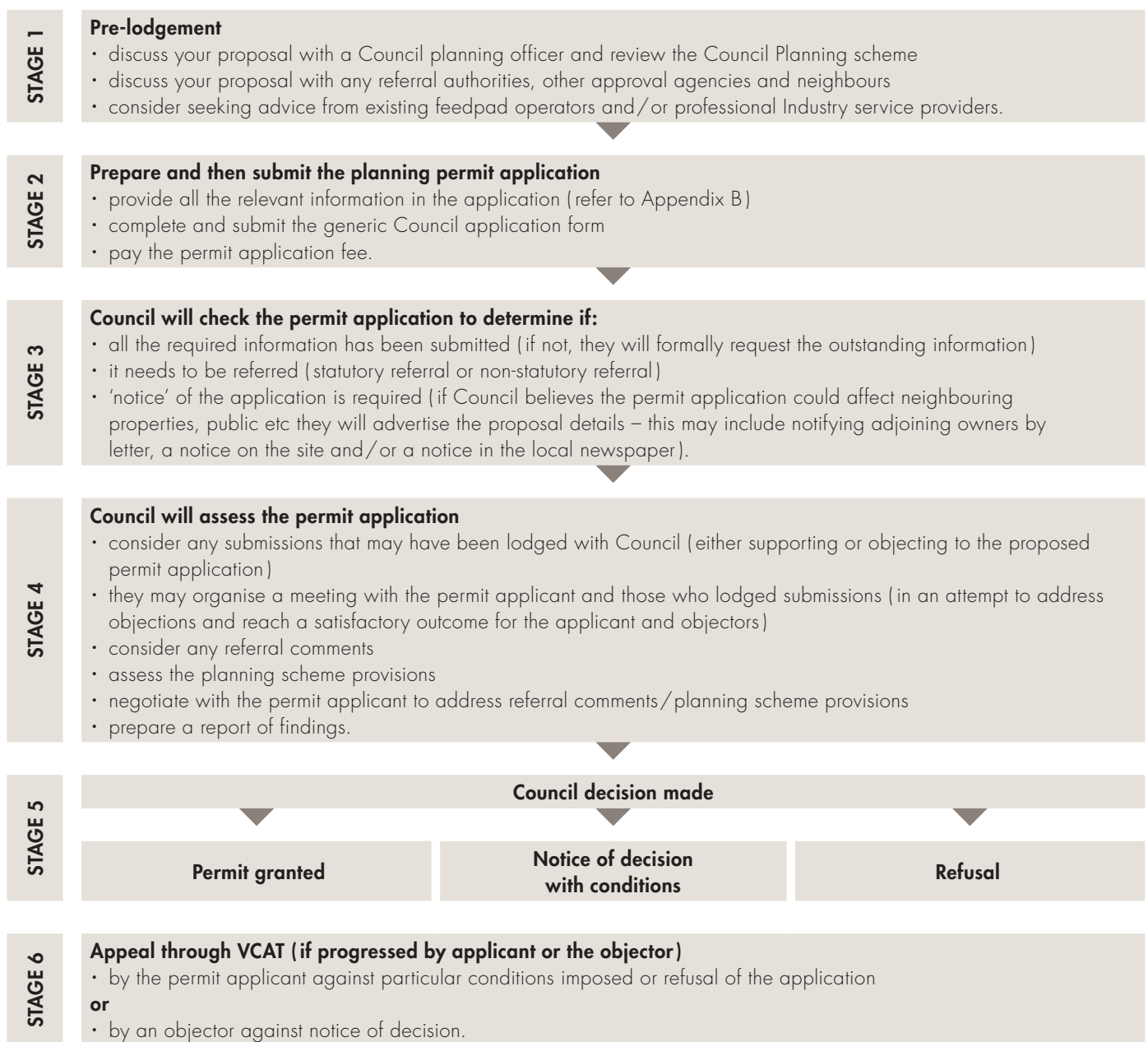


Figure 3.1 – Victorian Council Permit Application and Assessment Process



The following information supports the schematic shown in Figure 3.1.

3.2. Stage 1: Pre-lodgement

3.2.1. Identify What Information Already Exists

Any existing whole farm plans, development or management plans, effluent management plans, nutrient management plans, aerial photographs, existing planning approvals, land title information, feature surveys, standard operating procedures and contingency plans should be collected as these provide useful base information for preparing a planning permit application.

3.2.2. Consult with Council

The proposal should be discussed with Council very early in the process. The planning officer will be able to identify:

- the zoning of the proposed location and identify any relevant overlays or schedules
- if a planning permit can be granted for intensive animal industry in that zone
- whether a planning permit is required for any buildings and works
- any other requirements of the planning scheme
- any specific information that needs to accompany your planning application
- relevant statutory or non-statutory referral authorities that may need to be notified or consulted in regards to the application.

Similar information can be accessed at: <http://www.vic.gov.au/property-planning/planning-land-use/planning-resources.html>

3.2.3. Consult with Referral Agencies and other Approval Bodies

Referral authorities and other approval bodies will identify any specific concerns about a site and the information that will need to accompany an application to address those concerns.

3.2.4. Consult with Neighbours

Early disclosure of the proposed development may provide an opportunity to address any concerns that neighbours might have. Most neighbours appreciate the opportunity to be included in discussion before they receive a formal notification in the mail advising that a development has been proposed next to their property.

3.2.5. Consult with Other Feedpad Operators and Industry Service Providers

Detailed design and management information will be required by the responsible authority, referral authorities and other approval bodies. Engaging an experienced consultant may reduce the planning and application preparation time because of their prior experience with proposals of this nature. Other feedpad operators or industry associations may also be able to offer good advice on siting, design, construction and management.

3.3. Stage 2: Submitting your Planning Application

An application is made to the Council planning department using a standard planning application form (supplied by Council) which must be accompanied by the prescribed fee, Certificate of Title, detailed plans and other supporting information. It can be useful to lodge this information with a cover letter or report which provides an overview of the site details and proposal.

Appendix B lists information that may be typically required to assess a feedpad permit application. This should be used as a guide only. You should consult Council directly to determine their requirements, which may vary depending on the location and size of the proposal.

The applicant must lodge three completed copies of the planning permit application and all documentation with the responsible authority.

THE COUNCIL

PLANNING

DEPARTMENT

MAY SEND THE

APPLICATION TO

OTHER DEPARTMENTS

WITHIN COUNCIL OR

EXTERNAL AGENCIES

FOR COMMENT.



3.4. Stage 3: Referral and Notice of the Application

The planning officer will first undertake a preliminary assessment to ensure the application is complete. The Council planning department may then send the application to other departments within Council (e.g. engineering services, environmental health services) and external agencies for comment. These external agencies may be statutory referral authorities that

the planning scheme requires Council to refer to, or non-statutory referral authorities that Council may wish to consult at their discretion. The referral and notice provisions are outlined in Clause 66 of the VPP. Table 3.1 outlines some of the agencies that may be consulted in the assessment of a feedpad permit application.

Referral authorities and bodies required to be notified may request further information if they consider information provided with the application is inadequate for them to assess the proposal.

Table 3.1 – Referral Authorities

Authority	Statutory or Non-Statutory Referral of Permit Applications
EPA Victoria	<p>Statutory referral:</p> <ul style="list-style-type: none"> • has a planned capacity of greater than 5000 head <p>Non-statutory:</p> <ul style="list-style-type: none"> • the responsible authority may request comment or guidance if the planned capacity is less than 5000 head
Department of Primary Industries	<p>Non-statutory:</p> <ul style="list-style-type: none"> • the responsible authority may request comment or guidance from an industry perspective to support the planning application
Catchment Management Authorities	<p>Statutory referral:</p> <ul style="list-style-type: none"> • if the proposed location is covered by a flood or land subject to inundation overlay <p>Non-statutory:</p> <ul style="list-style-type: none"> • the responsible authority may request comment or guidance if there is potential to impact on a waterway; ground and surface water quality (e.g. nutrients, salinity); or if construction may alter existing flooding characteristics; or result in property runoff (to either surface and/or ground waters)
Rural Water Authorities	<p>Statutory referral:</p> <ul style="list-style-type: none"> • if the proposed location is in, or near a Declared Special Water Supply Catchment Area (Specific land uses are prohibited in several catchments. This information can be sourced from the relevant CMA) <p>Non-statutory:</p> <ul style="list-style-type: none"> • the responsible authority may request comment or guidance if there is potential to impact on authority infrastructure (supply and drainage channels); or ground and surface water quality (e.g. nutrients, salinity); or if construction may alter existing flooding characteristics; or result in property runoff (to either surface and/or ground waters) <p>Note:</p> <p>In irrigation areas the responsible authority may request confirmation that the proposed site has legal and physical access to water (e.g. flood washing water if a licensed quantity doesn't already exist). This is not part of the statutory referral process. Water licensing is legislated through the <i>Water Act (1989)</i></p>
Department of Sustainability and Environment	<p>Statutory referral:</p> <ul style="list-style-type: none"> • if native vegetation is to be either lopped, removed or destroyed
Vic Roads	<p>Statutory referral:</p> <ul style="list-style-type: none"> • if proposing to create or alter access to, or subdivide land adjacent to, a road declared as a freeway or an arterial road under the management of the <i>Road Management Act (2004)</i>



3.5. Stage 4: Council to make a decision

If the responsible authority supports the application it will grant a planning permit with conditions. If Council refuses to grant the permit, a 'Refusal to Grant a Permit' notice will be issued that identifies the grounds for the refusal.

If Council fails to make a decision about the application within 60 days, an application for a review can be made with the Victorian Civil and Administrative Tribunal (VCAT). The 60 days must be calculated in accordance with Regulation 30 of the Planning and Environment Regulations (1998), which excludes time spent waiting for a response for any further information requests.

If the permit application is refused an application for a review can be made. This must be done within 60 days of the responsible authority giving notice of the refusal. As a matter of courtesy, tell the council planner you have lodged an application for review before you are formally instructed to do so by VCAT.

If the responsible authority grants the permit with conditions, the permit applicant can apply for a review of the conditions. This must be done within 60 days of the permit being issued, or the Notice of Decision to Grant a Permit being given.



3.6. Summary

- Appendix B lists information that may be typically required to assess a feedpad permit application
- The involvement of referral authorities is often influenced by the scale, and potential impact the proposed location may have on surrounding sensitive land uses.
- Both the applicant and any neighbours who objected to the proposal can apply to have the application reviewed by VCAT if they are not satisfied with the responsible authorities' decision.

References

DCFVG 2002, Dairy cattle feedpad guidelines for the Goulburn Broken Catchment, Goulburn Broken Catchment Management Authority, Shepparton, <http://www.gbcma.vic.gov.au/downloads/DairyFeedPadGuidelinesMay2002/FrontSection.pdf> (Accessed on 10/07/2009).

Department of Planning and Community Development – Planning: a short guide, <http://www.dse.vic.gov.au/DSE/nrenpl.nsf/LinkView/A57D7D5B3CCBDED6CA257315002118EDAC43B43AC2C43365CA257316001ECE78#plan> (Accessed on 10/07/2009).



4. AMENITY AND ENVIRONMENTAL ISSUES

Key objectives

This section:

- identifies the key potential amenity and environmental issues associated with feedpad operations
- identifies the recommended principles to minimise the risk of environmental issues
- provides a practical overview for those who may not be familiar with feedpad operations.

4.1. Amenity Issues

Amenity refers to the comfortable enjoyment of life and property, particularly with regard to odour, dust, noise, light and visual appearance.

Odour

Odour is becoming an increasingly important issue as milking herds grow, particularly where there are non-agricultural land uses in the locality such as rural residential lots. The potential for odour to cause nuisance to neighbours cannot be dismissed. Those developing feedpads may need to use odour assessment tools to guide decisions on where to locate them. In general, operators should have some understanding of odour generation and dispersion so they can implement effective odour control strategies.

Odour is generated during the anaerobic decomposition of organic matter in manure and spilt feed. In particular, emissions are an issue when manure becomes very wet. Common odour sources at dairy farms include solids separation systems, ponds, manure/compost stockpiles, feedpads, loafing areas, laneways, silage and high moisture content feeds.

Factors that influence odour generation by dairy farms include:

- the number of cattle
- farm management and operation
- feed types
- moisture content of the manure
- type of feedpad and manure handling equipment
- manure management practices. (Refer to Section 8 for more detail) For example:
 - *Feedpad and loafing area cleaning frequency*: farms that do not remove manure frequently (e.g. monthly scraping of an earthen pad) generate more odour than those that either scrape or flood wash frequently (e.g. on a daily basis). Fresh manure does not generally emit offensive odours. However, if there is a significant depth of manure on the pad surface and this becomes wet after rain, significant levels of offensive odour will be generated for several days.
 - *Maintenance of entire feedpad and loafing areas*: small areas of accumulated manure and wet patches within these areas can produce significant amounts of odour. Hence, attention to detail is important when cleaning around fences, fence posts and laneways (generally hard to access locations around the feedpad) if odour levels are to be minimised. Similarly, potholes and low patches in the feedpad and loafing areas need repairing as water pooling in these areas promote anaerobic breakdown of manure.
 - Handling and distribution of manure and recycled effluent.
 - Desludging of ponds (i.e. removal of accumulated slurry manure).
 - Disturbing manure/compost stockpiles.



The likelihood of odour causing a nuisance at nearby sensitive land uses also depends upon:

- local meteorological conditions (i.e. in particular prevailing wind direction and strength)
- topographical features that affect transport and dispersion of odorous air (e.g. terrain, height and density of vegetative cover)
- distance between the odour source and sensitive uses
- the type of sensitive use (e.g. house, town).

Generally, the greater the frequency, intensity, duration and offensiveness of an odour, the greater the likelihood of annoyance and complaints. Where the timing of odorous activities can be controlled, these should be scheduled to occur when dispersion will be enhanced as a result of prevailing meteorological conditions. Unstable atmospheric conditions (e.g. a hot windy day) result in faster dispersion of odours than stable atmospheric conditions (e.g. an overcast, cool day with no wind).

Dust

Dust can be a physical irritant and may also pose a respiratory or allergenic risk. Dust from dairy farms may originate from traffic movements, cattle laneways, earthen feedpads, loafing areas; manure handling and distribution equipment and manure reuse. Like odours, dust dispersion is enhanced under unstable atmospheric conditions. However, dry, windy conditions also promote dust generation from outdoor areas.

Noise

The milking shed; feed preparation areas; and manure handling and management areas may generate some noise. However, truck and traffic movements are most likely to cause nuisance. The potential for noisy activities to cause nuisance depends primarily on the level of noise created and the time of day it occurs. However, it also depends upon atmospheric conditions, local topography; and natural and artificial barriers. Surrounding sensitive uses (e.g. neighbouring houses) are more susceptible to noise during the early morning or night, when there is greater potential to interrupt sleep.

Light spill

Light spill from roadways, parking areas and dairy farm sheds and feedpads can impact nearby residences. Most dairy farms will use artificial lighting as milking generally occurs in the early morning and late afternoon (during the winter months milking often occurs before and/or after dawn and dusk). Strategically locating lights or providing shields to prevent light spill onto surrounding sensitive land uses prevents nuisance from occurring.

Visual amenity

While dairy farms, like other agricultural enterprises are an acceptable part of the rural landscape, the construction of several large feedpads may significantly alter the landscape character. Careful siting including the use of topographic or vegetative buffers, or landscaping can minimise the impact.

**DUST CAN BE A
PHYSICAL IRRITANT
AND MAY ALSO POSE
A RESPIRATORY OR
ALLERGENIC RISK**



4.2. Avoiding the Adverse Amenity Issues

Most amenity issues can be managed through:

- **providing an adequate separation distance to nearby sensitive land uses.** Feedpads and manure management and reuse systems should be adequately separated from sensitive land uses. This minimises the risk of the dairy farm causing offensive odour and dust levels at sensitive land uses, under both usual and abnormal conditions. Where practicable, the greater the separation distance to sensitive land uses, the lower the likelihood of nuisance from odour and dust. The location of on-farm roadways and property access should also be considered.
- **best practice siting, design, construction and management.** Where practicable, sites that offer topographic or vegetative screening should be selected (additional vegetation may also be proposed as part of the planning permit process). Facilities should be designed and constructed to promote ease of cleaning and management. Regular cleaning reduces the odour generation rate. Timing odorous activities to occur under conditions that are unlikely to promote odour dispersion reduces the odour levels at sensitive land uses. Alerting neighbours before odorous activities occur (e.g. pond solids removal) and not undertaking these on weekends reduces the likelihood of complaints.

FEEDPADS AND MANURE MANAGEMENT AND REUSE SYSTEMS SHOULD BE ADEQUATELY SEPARATED FROM SENSITIVE LAND USES.

4.3. Environmental Issues

The main environmental issues pertaining to dairy farms are associated with:

- runoff or leaching of nutrients and/or manure to surface or ground water
- management of nutrient and salt levels in soils where solid manure or recycled effluent has been spread.

Surface water protection relies on the provision of:

- adequate buffers to waterways, channels, dams and other surface waters
- effective manure containment, handling and reuse practices
- effective containment and handling of runoff from the storage of high moisture feedstuffs (e.g. orange pulp, silage).

Dairy farms can prevent adverse impacts to surface waters by:

- frequently and thoroughly cleaning milking sheds and yards, feedpads and loafing areas to ensure that manure does not accumulate to excessive levels
- installing physical barriers (e.g. earthen bunds or banks) as required to minimise the amount of stormwater runoff that can enter feedpads, loafing areas, the milking area and yards, manure management systems and manure/compost stockpiles
- ensuring that manure and runoff from milking sheds and yards, feedpads and loafing areas and feedstuff storage areas is collected and stored using an appropriately designed system
- ensuring solid manure and recycled effluent is applied at sustainable rates. Solid manure and recycled effluent must be spread at rates and at times when off-site movement of nutrients is unlikely to occur (e.g. not when the soil is very wet or rainfall is imminent). The nutrients, salts and water in manure must be spread on land at rates that are balanced by plant growth and evapotranspiration.



Ground water protection relies on the provision of:

- effective design and construction of areas or facilities where manure concentrates or recycled effluent is stored
- ensuring solid manure and recycled effluent is applied at sustainable rates. Solid manure and recycled effluent must be spread at rates and at times when leaching of nutrients is unlikely to occur (e.g. not when the soil is very wet). The nutrients, salts and water in manure must be spread on land at rates that are balanced by plant growth and evapotranspiration.

Dairy farms can prevent adverse impacts to ground water by:

- ensuring feedpads, loafing areas, catch drains, ponds and manure/compost stockpiles are constructed to a suitable standard to minimise leaching
- ensuring the base of ponds are at least 1 metre above the highest seasonal water table
- ensuring solid manure and recycled effluent is applied at sustainable rates. Application of manure at excessive levels, either as a once-off application or over time, can result in nutrient or salt leaching to groundwater.

References

Dairy Australia 2008, *Effluent and manure management database for the Australian dairy industry*. Dairy Australia, Melbourne, <http://www.dairyingfortomorrow.com/index.php?id=48> (Accessed 23/08/2009).

2009, *Victorian Code for Broiler Farms*, Department of Primary Industries, Melbourne.



5. FARM DESIGN AND OPERATION ELEMENTS

Key objectives

This section details the following six key elements regarding feedpad siting, design, operation and management:

1. location, size and environment protection
2. design, layout and construction
3. traffic, site access and property roadways
4. manure and carcass management
5. landscaping
6. farm operation and management.

The information provided for each element can be used by planners as a guide to help them assess the proposed development or expansion against local planning policies. Objectives, standards and recommended measures are provided for each element.

Objectives: an objective describes the desired outcome to be achieved from the completed development and operation of a feedpad. All proposed feedpads should satisfy the objectives for each element.

Standards: a standard identifies the requirements to meet an objective. In most cases, a standard is expressed as a design or operational requirement. All permit applications should consider the relevant standards.

Recommended measures: this is an approach, action, practice or method that if incorporated into a development proposal would be considered adequate to meet the standard. However, alternative measures that achieve compliance with the standards and hence the objectives may also be acceptable. The onus is on the applicant to demonstrate that the objectives and standards can be met with equivalent or superior performance.

However, alternative measures that achieve compliance with the standards and hence the objectives may also be acceptable. The onus is on the applicant to demonstrate that the objectives and standards can be met with equivalent or superior performance.

Design or management consideration: provide a practical context for government authorities, design consultants and feedpad operators when considering the siting, design, construction and management of a farm.

5.1. Location, Size and Environment Protection

Objective

To ensure the feedpad, manure management system, manure and compost stockpiles and reuse areas are located and sized to:

- minimise the risk of adverse amenity impacts on nearby existing, planned and potential future sensitive uses as a result of odour, dust and noise
- allow for future expansion (this should be considered, even if it may seem unlikely now)
- minimise the likelihood of adverse affects on the use and development of nearby land
- avoid the removal of native vegetation
- avoid pollution of ground and surface waters
- minimise soil erosion
- avoid adverse impacts on the visual quality of the landscape.

Standard – Amenity and environmental protection

Adverse impacts on the amenity of the surrounding area are minimised by ensuring a feedpad, manure management system, manure and compost stockpiles and reuse area are adequately separated from existing sensitive uses, surface and ground water resources and the farms' property boundaries.

Recommended Measures

The size, design and management of the proposed facility, along with prevailing meteorological conditions and topographical features are considered in determining the separation needed to protect the amenity of nearby sensitive uses and water supplies.



The feedpad complex, manure and compost stockpiles and/or reuse areas should be located at least:

- 800 metres from any potable water supply off-take controlled by a statutory authority
- 200 metres from any waterway supplying potable water.

The external boundary of the feedpad complex, manure and compost stockpiles should be at least:

- 50 metres from the closest property boundary.

Effluent ponds should be located at least:

- 300 metres from a neighbouring house
- 200 metres from a farm bore or spear point
- 50 metres from the property boundary
- 60 metres from irrigation channels and drains (required by Goulburn Murray Water)
- 45 metres from the vat room (required by milk factory quality assurance programs)
- 1 metre above the highest seasonal water table (especially in relation to the base of effluent ponds, feedpad and manure storage areas).

Design Considerations

There are currently no mandatory requirements governing the location of dairy feedpads, ponds and manure reuse areas. However, various industry stakeholders and government authorities may recommend specific separation or buffer distances from sensitive uses, roadways, property boundaries and water supplies. The recommended distances listed above were referenced from the Victorian Code for Cattle Feedlots and a Department of Primary Industries Agnote. In some limited, site specific circumstances the separation may need to be greater. For example, the separation provided to a sensitive use located down slope in a drainage valley may need to be greater because cold air naturally moves down valleys particularly during stable atmospheric conditions, which restricts odour dispersion.

Feedpad sites also need to be protected from flooding. They should generally be sited above the 1 in 100 year average recurrence interval flood height. In some cases it might be possible to protect the site using levees or similar structures. Any development within a 'land subject to inundation' or 'floodway' overlay will be referred to the local floodplain management authority (i.e. the local CMA or water authority).

Groundwater depth (especially the highest seasonal depth) must be considered when selecting a feedpad site. The base of the feedpad and any manure/compost stockpiles should be at least one metre above the highest seasonal water table. A site specific hydrogeological investigation may be required depending on the proposed pond depth, soil permeability and the beneficial use/vulnerability of ground water resources.

It is always a good idea to provide enough physical space and separation distance to cater for a potential future expansion or staged development. Examples of future expansion or change include:

- an increased herd size, requiring extension of the feedpad to provide feeding space for the additional cattle
- conversion of a permanent concrete feedpad into a freestall, necessitating provision of sufficient space on each side of the feedpad to allow for construction of the stalls and / or loafing area
- changing the feedpad cleaning method from scraping to flood washing, necessitating the need to provide adequate space to install the tank, containment sump and ponds to manage the slurry manure produced from washing the alleys.

Standard – Protecting the visual quality of the landscape

Buildings and works are sited to avoid the removal of native vegetation, and use the existing vegetation and topography of the site to minimise visual impacts for off-site uses.

**THE BASE OF THE
FEEDPAD AND ANY
MANURE / COMPOST
STOCKPILES SHOULD
BE AT LEAST ONE
METRE ABOVE THE
HIGHEST SEASONAL
WATER TABLE**



Recommended Measures

- Buildings and works are not located on steep slopes (greater than 20%).
- Buildings are orientated to utilise the natural slope.
- Buildings are positioned such that the topography shields them from view.
- Existing ridgeline vegetation is maintained to avoid breaking the ridgeline silhouette.

Design Considerations

Rare or threatened species or ecological communities must be considered when selecting a feedpad site since these must be protected. As a first step, it is useful to know the Ecological Vegetation Class of the proposed site, which assists in identifying the presence of threatened or endangered species or ecological communities. This can be searched using DSE Interactive Maps (<http://www.dse.vic.gov.au>). The '*Native vegetation: planning permit applicant's kit*' provides an outline of the planning process involving native vegetation management. This can be downloaded from the DSE website.

Archaeological and heritage values must be considered when selecting a feedpad site since it is illegal to damage or destroy these. To determine the presence of known cultural heritage places and objects contact the Secretary of the Department of Planning and Community Development (DPCD) – Aboriginal Affairs Victoria. The DPCD can access the Victorian Aboriginal Heritage Register to determine the presence of recorded heritage places and objects.

5.2. Design, Layout and Construction

Objective

To ensure the design and construction of the feedpad minimises the risk of adverse amenity and environmental impacts, and supports a cost-effective farming system.

Standard – Effective farming system

The design and layout of the dairy farm provides environmental and amenity protection while maximising the efficiency of farm operations, including:

- integrating with existing farm infrastructure while also considering the needs of possible future expansions
- providing an adequate supply of feed and water
- efficient placement of feed storages
- collection, handling and treatment of all manure, carcasses and spoilt feed
- efficient energy and water use.

Recommended Measures

- New developments or expansions are well integrated with existing infrastructure (e.g. milking shed, farm laneways, power or water supply) and the site allows efficient access for feed and stock delivery, milk pick-up and staff movements.
- New developments are located to minimise the risk of odour, dust and noise impacts on nearby sensitive uses. Physical separation, topographical features (vegetation or earthen mounds) and prevailing winds can be used to minimise odour impacts on nearby sensitive uses.
- Feedpad orientation considers the effects of exposure to climatic elements such as prevailing winds, radiation from the sun and rainfall. Extreme weather conditions can affect all feedpad operations from time to time, regardless of geographic location (see Section 10.6).
- A continuous water supply is available to the site (e.g. reticulated town water supply, channel, dam or bore) for drinking, shed cooling and wash down (see Section 11).



- A back-up water supply or storage system is available to hold at least two day's peak requirement so that water demand can be continually met in case of a breakdown or loss of normal water supply.
- Feed storage and delivery systems are designed, constructed and operated to minimise feed spills (see Section 12).

Standard – Protecting the visual quality of the landscape

Buildings and works are designed and constructed to minimise their visual impact. Site topography, existing vegetation and proposed landscaping are used to best advantage to screen new buildings and works from public roads and surrounding properties.

Recommended Measures

- Buildings or works on flat land in the line of view of dwellings or roads are screened from view using either: existing or planted vegetation (see Section 5.5) or excess soil from earthworks.

Standard – Soil Management

Buildings and works are designed and constructed to minimise soil erosion and dust generation.

Recommended Measures

- Temporary control measures (e.g. capping of exposed soils and use of water trucks) are used during construction to prevent soil erosion from wind and rainfall runoff.
- Roadways are constructed and maintained to minimise soil erosion and subsequent dust generation.

Standard – Noise Management

The feedpad operation (development and use) meets the requirements of the Interim Guidelines for Control of Noise from Industry in Country Victoria N. 3/89 (or its most recent update). Noise nuisance is prevented by ensuring farm vehicles and equipment for farm operations do not cause adverse impacts on nearby sensitive uses. Appendix A provides information on typical noise criteria that apply to country Victoria.

Recommended Measures

- The design, siting and selection of all mechanical equipment (e.g. feed preparation and delivery equipment; manure handling equipment) minimises the generation of mechanical noise and the likelihood of off-site vibration.

Design Considerations

Orienting the long side of the feedpad perpendicular to the summer and autumn prevailing winds provides greater cooling (i.e. heat transfer) for all cattle. For earthen-floored feedpads it is important to consider pad drying when designing shade structures. Dry pad conditions are important as wet areas may predispose the cattle to mastitis. They also reduce the likelihood of nuisance odour generation.

A north-south shade orientation promotes pad drying because the shade moves across the pad during the day. However, this orientation provides less shade area than an east-west orientation because the shade moves across the pad, as the sun moves across the sky. Therefore a covered freestall should be orientated with the long axis running east-west, so that all cows are provided with sufficient shade throughout the whole day.

Water may be required for stock drinking supply, feedpad cleaning, cooling or diluting liquid manure prior to land application. It may also be needed for site construction. Legal access to a reliable supply of water with a suitable quality is imperative. The water supply system needs to allow for the pumping, storage and consistent delivery of the required volume of water. In areas where water usage is regulated this usually necessitates having an industrial or similar high-security water licence, allocation or entitlement.

Recycled effluent can be used for flood washing concrete feedpads. This significantly reduces the volume of freshwater required (see Section 8.2). Identifying opportunities to reduce freshwater use is important at the planning stage.

BUILDINGS AND WORKS ARE DESIGNED AND CONSTRUCTED TO MINIMISE SOIL EROSION AND DUST GENERATION



5.3. Traffic, Site Access and Farm Roadways

Objective

To ensure the location, design and construction of the farm access points; internal roadways and parking areas; and vehicles movements minimise adverse amenity impacts on nearby sensitive uses.

Standard 1 – Site Access

Vehicle access points are designed and constructed to allow safe, all-weather entry and exit for the anticipated numbers and types of vehicles, accounting for road and traffic conditions.

Recommended Measures

- Access points are constructed to a standard that minimises deterioration in the road pavement, avoids sharp turns, and provides sufficient road width for truck turning movements and viewing distance to see approaching traffic.

Standard 2 – Site Access

Farm vehicle access points from public roads are located to minimise noise and vehicle light impacts on nearby sensitive uses.

Recommended Measures

- Vehicle access points are well separated from sensitive uses not associated with the farm.
- All lighting is located, directed and baffled (if needed) to limit light beyond the farm boundaries.

Standard 1 – Internal roads and vehicle parking

Internal roads and parking areas are designed, constructed and maintained to operate in all weather conditions. Adequate provision is made for the parking and on-farm movement of the range of vehicles associated with the farms' operation.

Recommended Measures

- Internal roads and parking areas are constructed of a compacted sub-base with table drains, and a compacted gravel layer with a camber to shed rainwater to the drains.
- An area is provided for parking the number and range of vehicles involved in delivering feed, collecting milk and transporting stock, manure/compost.

Standard 2 – Internal roads and vehicle parking

Internal roads and parking areas are designed and sited to minimise noise and light impacts on surrounding sensitive uses.

Recommended Measures

- Internal roads and parking areas are designed to ensure efficient traffic flow and to reduce the need for vehicle reversing. The layout provides ease of access to the site, avoids the use of sharp turns, and allows vehicles to leave the farm travelling in a forward direction.
- Internal roads and parking areas are adequately separated from sensitive uses not associated with the farm.
- All lighting is located, directed and baffled to limit light beyond the farm boundaries.

Design Considerations

Council (local road) or Vic Roads (state road) can provide advice on the location of property access and any road works required to facilitate safe entry/access (e.g. turning lanes).

5.4. Manure and Carcass Management

Objective

To manage manure, recycled effluent and carcasses from feedpad operations to:

- avoid adverse amenity impacts from odour and dust on nearby sensitive uses
- prevent the pollution of ground and surface waters; and land
- avoid biosecurity risks.



Standard – Management of ponds, manure and compost stockpiles

Effluent ponds, manure and compost stockpiles are designed, constructed and managed to prevent movement of nutrients beyond the property boundaries and into surface waters and to minimise leaching into ground waters.

Recommended Measures

- Permanent manure or compost stockpiles are not visible or are well screened from surrounding sensitive uses.
- The base of ponds, manure and carcass compost stockpiles are constructed from low permeability materials (e.g. compacted clay, concrete, high density polyethylene) to minimise nutrient leaching (see Section 6.2).
- Earthen bunds and/or surface drains are used to prevent the entry of clean runoff in to the feedpad complex, effluent ponds, manure or compost stockpiles.
- Runoff and manure from within the feedpad complex, and from permanent manure or carcass compost stockpiles is contained and managed on the property (usually contained and managed via an effectively sited and designed manure management system) (see Section 8).
- Reuse sites are not on land subject to flooding, steep slopes (greater than 10 per cent), rocky, slaking or highly erodible land or highly impermeable soils where there is any risk of nutrient runoff to waterways, surrounding land or groundwater.

To protect sensitive land uses and natural resources, manure and recycled effluent should not be applied to land within:

- 20 metres of the property boundary
- 200 metres of a surrounding house
- 200 metres of a waterway, bore or spring.

Standard – Management of carcasses

The management and disposal of carcasses minimises odour and dust generation and the likelihood of disease transmission, and prevents nutrient runoff.

Recommended Measures

- If carcasses are to be taken off-site (e.g. to a rendering plant), they should be collected from an area away from public view.
- If carcasses are composted on-site this should occur in an area that is well separated from sensitive land uses. The base of the composting area should be compacted and the area bunded to contain runoff from the compost. The manure stockpile is often an appropriate location to compost carcasses (see Section 8.5)
- On-site burial of carcasses is undertaken only in an emergency situation (i.e. mass mortality or disease outbreak) and with the approval of the relevant authorities (the Chief Veterinary Officer of the Department of Primary Industries and EPA Victoria) (see Section 5.7).

Design and management considerations

Slope is necessary to promote good drainage within the feedpad complex. Gravity transfer of manure is preferred to mechanical pumping, as it is more reliable than a pumping system. Flat sites with a lower gradient can be more difficult to drain.

Manure management and reuse practices should prevent disease transfer across property boundaries (e.g. Johne’s Disease). For further information see Section 9.6.

5.5. Landscaping

Objective

To use landscaping to minimise the visual impact of the feedpad operation, further reduce the risk of adverse impacts from light and dust on nearby sensitive uses, and protect, manage and enhance on-farm native vegetation and biodiversity.

PONDS, MANURE AND COMPOST STOCKPILES ARE DESIGNED, CONSTRUCTED AND MANAGED TO PREVENT MOVEMENT OF NUTRIENTS BEYOND THE PROPERTY BOUNDARIES AND INTO SURFACE WATERS AND TO MINIMISE LEACHING INTO GROUND WATERS



LANDSCAPING

INCORPORATES A MIX

OF TREES AND LARGE

SHRUBS TO ENSURE

EFFECTIVE UPPER LEVEL

AND LOWER LEVEL

SCREENINGS OF THE

FARM.

Standard

The following standard is applicable if the site is not already screened by vegetation or topographical features.

Landscaping visually screens the feedpad complex from roads, public areas and nearby sensitive uses; integrates the feedpad complex into the surrounding landscape; and provides adequate access around the feedpad complex.

Recommended Measures

- Landscaping provides for dense vegetation and planting along frontages to public roads and other highly exposed site boundaries to provide screening of the farm buildings and the feedpad complex.
- Landscaping incorporates a mix of trees and large shrubs to ensure effective upper level and lower level screenings of the farm.
- As far as possible, the landscape plan retains existing trees, particularly native vegetation, and a mix of native and local indigenous plant species that blend into the landscape.
- Ground surfaces that are exposed to erosion are stabilised with ground cover planting or other means to minimise erosion.

5.6. Operation and Management

Effective operation and management of a feedpad significantly reduces the potential for environmental impacts. An environmental management plan (EMP) is an effective tool to recognise environmental risks and to provide clear strategies and measures to minimise those risks. An EMP includes strategies and measures to minimise environmental risks, and also contingency actions to manage environmental problems that may arise in the day-to-day operation and management of the farm.

For large scale development proposals (e.g. 1000 cow freestall) the responsible authority may require the applicant to develop an EMP to document the operation and management of the farm, especially if the proposed site is located close to sensitive uses, and natural resources. If an applicant is required to develop an EMP they should consult their milk company to check if there are any existing quality assurance standards, procedures or records that can be referenced to prevent duplication.

Objective

To apply best practice management of the feedpad operation to avoid or minimise the risk of adverse amenity and environmental impacts on the surrounding environment and nearby sensitive uses.

Standard – Environmental Management Plan framework

A site-specific EMP is developed that reflects how the site is to be managed and operated, which may vary from other farms. It should include strategies and measures to avoid or minimise environmental risks, as well as contingency actions to manage environmental problems that may arise.

Recommended Measures

An EMP may include the following components in an auditable format:

- overall objectives that addresses the following components with specific, measurable and time-bounded targets:
 - odour, dust and noise management
 - road and traffic management
 - landscaping management
 - effluent and manure system management
 - recycled effluent and nutrient management
 - carcass management and disposal
- day-to-day best practice management strategies that address the above objectives and avoid or minimise the site-specific risks of the property



- details of contingency plans to deal with accidents and emergencies. Contingency plans must identify the trigger points for their implementation, along with target response times for critical incidents. Consider contingency plans for:
 - power failure
 - water and feed supply failures
 - extreme weather events (heat and cold stress on animals and employees)
 - shed and equipment malfunctions
 - higher than average mortalities
 - emergency disease outbreaks or catastrophic mortalities
 - chemical or fuel spills
 - fire
 - large feed spillages
 - odour or dust events
 - flooding
 - manure management system breakdown
 - raw manure or recycled effluent spills
 - drain blockage
- details of monitoring systems to assess environmental performance, and procedures to ensure the regular and accurate recording of data. Monitoring records are to be available to responsible authorities on request.
- procedures to respond to complaints
- procedures to investigate causes after an environmental incident, review emergency actions, and to report to the responsible authority, if requested.
- document control for new or updated practices, procedures, records.

Contingency planning is discussed in Section 5.7.

Design considerations

Agricultural and environmental engineering consultants can assist in developing site specific EMPs, contingency plans or standard operating procedures.

Recommended Measures

Contingency plans for the following events should be considered at all dairy farms.

Manure or recycled effluent discharge in to a waterway

Action:

- stop the discharge (e.g. turn the pump off, use bunding to contain the manure / recycled effluent on your property)
- contact your local Council and water authority to notify them of the discharge (e.g. Goulburn-Murray Water, Southern Rural Water, Lower Murray Urban and Rural Water, Grampians Wimmera Mallee Water, Melbourne Water).

Mass mortality

Action:

- contact your vet immediately to discuss what, if any, immediate treatment and other action is required
- contact the Chief Veterinary Officer Unit from the Department of Primary Industries and also EPA Victoria if on-site burial is being considered.

Manure management system breakdown

Systems that use pumps or other mechanical equipment will most likely breakdown at some stage.

Action:

Use routine maintenance, contingency plans, and / or back-up equipment to reduce the impact of a manure system breakdown. The DPI Agnote 1324 – ‘Effluent: Maintenance Schedules and Contingency Planning’ will assist farms with developing site specific plans and maintenance schedules for containment sumps, solids separation equipment, ponds, pumps, recycled effluent reuse equipment.



5.7. Contingency Planning

Key objectives

To ensure that up-to-date procedures and management practices are developed and maintained to:

- prevent the feedpad from causing adverse impacts to the surrounding amenity; the environment; cattle; staff and contractors as a result of an unexpected events (e.g. power failure, mass mortality, fire)
- quickly address unexpected events or system breakdowns.

Procedures Manual

A procedures manual should be developed that:

- recognises potential unexpected events
- provides strategies and practices to minimise the likelihood of such events occurring
- provides clear procedures to respond to the unexpected events and to minimise impacts that they could cause
- identifies responses to problems that may arise in the day-to-day operation and management of the farm.

Contingency Planning

Contingency plans assist in responding to and managing accidents and unexpected events. They should identify the trigger points for their implementation and target response times for critical incidents. Section 5.6 outlines a series of events and contingency plans that should be considered.

References

2009, Agnote 1374, Dairy Effluent:

Maintenance Schedules and Contingency Planning, Department of Primary Industries, Melbourne.

2009, Victorian Code for Broiler Farms, Department of Primary Industries, Melbourne.

DairyGains 2008, Management of Dairy Effluent – 2008 DairyGains Victorian Guidelines, Department of Primary Industries on behalf of DairyGains, Victoria.



5.8. Checklist for Local Council Planners

The checklist in Table 5.1 can assist the responsible authority to determine if the planning permit application contains sufficient information for the assessment process to start.

Note: Appendix B lists information that may be typically sought to assess a feedpad permit application. This can be used by prospective applicants and design consultants when preparing documentation for a planning permit application.

Table 5.1 – Planners Checklist

	Section Reference	
Element 1: Location, size and environment protection	Section 5.1	Yes / No
A typical feedpad planning permit application will usually make reference to the following features: dairy; feedpad; feed storage and preparation area; manure management system; manure / compost stockpile; and manure reuse area). Does the proposed size and location of the features above provide adequate separation to:		
• minimise the risk of adverse amenity impacts on nearby existing, planned and potential future sensitive uses as a result of odour, dust and noise?		
• minimise affects to the use and development of nearby land?		
• avoid or offset the removal of native vegetation		
• avoid pollution of ground and surface waters?		
• avoid adverse impacts on the visual quality of the landscape?		
Element 2: Design, layout and construction	Section 5.2	Yes / No
Is the proposed development designed to minimise the risk of adverse off-site impacts and support a cost effective farming system?		
Element 3: Traffic, site access and property roadways	Section 5.3	Yes / No
Will the location and design of farm access points, roadways and parking areas:		
• provide safe and efficient entry / exit to the site?		
• allow for safe and efficient movements around the farm?		
• minimise noise, dust and lighting impacts on surrounding sensitive uses?		
Element 4: Manure and carcass management	Section 5.4	Yes / No
Have measures been proposed to manage manure, recycled effluent and carcasses from the farm operations to minimise odour and dust generation and to prevent the pollution of ground and surface waters; and land?		



Element 5: Landscaping	Section 5.5	Yes / No
Will landscaping:		
<ul style="list-style-type: none"> • minimise the visual impact of the dairy (if a Greenfield site), feedpad; feed storage and preparation areas; manure management system; manure / compost stockpiles? 		
<ul style="list-style-type: none"> • reduce the risk of light and dust impacts on nearby sensitive uses? 		
<ul style="list-style-type: none"> • protect, manage and enhance on-farm native vegetation and biodiversity? 		

Element 6: Farm operation and management	Section 5.6	Yes / No
Is an EMP required? If so:		
<ul style="list-style-type: none"> • are measures in place to ensure best practice management of the farm to avoid or minimise the risk of adverse impacts on the surrounding environment and surrounding sensitive uses? 		
<ul style="list-style-type: none"> • does the EMP adequately describe the day-to-day operation and management of the farm, including contingency plans? 		
<ul style="list-style-type: none"> • does the EMP provide an auditable checklist? (if required by the Local Council or other statutory authority) 		

References

DCFWG 2002, *Dairy cattle feedpad guidelines for the Goulburn Broken Catchment*, Goulburn Broken Catchment Management Authority, Shepparton, <http://www.gbcma.vic.gov.au/downloads/DairyFeedPadGuidelinesMay2002/FrontSection.pdf> (Accessed on 10/07/2009).

Department of Planning and Community Development – Aboriginal Affairs Victoria, <http://www.aboriginalaffairs.vic.gov.au/web7/AAVMain.nsf/allDocs/RWP80471A1E0128763BCA2574DA0017CD4C?OpenDocument> (Accessed on 30/09/2009).

Department of Sustainability and Environment – Interactive Maps, <http://www.dse.vic.gov.au/dse/index.htm> (Accessed on 30/09/2009).

2009, *Draft National Guidelines for Beef Cattle Feedlots* – 3rd Edition.

2009, *Victorian Code for Broiler Farms*, Department of Primary Industries, Melbourne.

Davison, T. and Andrews J 1997, *Feed Pads Down Under*. Queensland Department of Primary Industries, Brisbane.

2009, Agnote 0424, *Dairy Effluent: Pond Site Selection*, Department of Primary Industries, Melbourne.



6. SITE PREPARATION AND EARTHWORKS

Key objectives

Feedpad site selection and preparation should ensure that:

- site and soil attributes are assessed before any earthworks are undertaken
- the soil and imported materials are suitable for the proposed development
- adequate engineering standards are used to prepare the base of the feedpad
- runoff and soil erosion are managed during the construction phase.

6.1. Site Investigation

If a development proposes to alter the existing landscape (i.e. earthworks for drainage or construction) then certain procedures need to be considered to ensure that public services are not adversely affected. Determine if any services exist in the vicinity of the proposed development. Contact 'Dial before you dig' (Phone no. 1100) to find out if any of the following exist on the site:

- telecommunications (e.g. phone lines, fibre optics)
- water reticulation systems (urban and rural)
- electrical or gas transmission conduits.

Site investigation should also consider existing infrastructure and features. Existing vegetation and drains may require removal and relocating. Designers should take into consideration the proximity of such features as they may modify the position, design and orientation of the proposed development (e.g. existing moisture conditions, influence of tree roots on footings and foundations, stormwater runoff).

6.2. Soil Assessment

Different soil types are needed for different purposes. For example, soils that can be compacted to a low permeability are required for construction of the pad area, any earthen manure collection systems and any areas used to store manure prior to spreading. It may be possible to use soil materials available on the site, or materials imported from sites close by, for construction purposes. For some sites clay materials will need to be imported to line (seal) manure systems, alternatively these can be lined using synthetic materials (e.g. high density polyethylene).

The suitability of soil for earthworks is assessed on the basis of its geotechnical qualities. These qualities are assessed by testing in a laboratory or in the field (less common). Soil tests must be undertaken in accordance with published standards (e.g. Australian Standard AS 1289 – Methods for testing soils for engineering purposes).

Developments may utilise the existing soil as 'cut and fill' for the pad base or sub-base for a concrete pad. The in-situ soils should be assessed by a suitability qualified person to determine if they can be used, or what modifications are required to make them suitable.

Some proposed sites will not have access to suitable soils (e.g. clay), thus alternate materials will need to be imported (e.g. gravels, crushed local rock products, or clay) or the in-situ soil stabilised.

6.2.1. Preferred Soil Types

Water Retaining Structures

Well graded, impervious clays are preferred for manure management system construction (i.e. moisture retaining structures), such as:

- CL, CI, CH, SC, GC (refer to AS 1726 – Geotechnical site investigations)

IF A DEVELOPMENT PROPOSES TO ALTER THE EXISTING LANDSCAPE (I.E. EARTHWORKS FOR DRAINAGE OR CONSTRUCTION) THEN CERTAIN PROCEDURES NEED TO BE CONSIDERED TO ENSURE THAT PUBLIC SERVICES ARE NOT ADVERSELY AFFECTED



Gravels, sands; silty and clayey gravels; inorganic silts and clays are the preferred materials for pad and road sub-grade construction. They include:

- GW, GP, GM, GC, SW, SP, SM, C, ML, CL (refer to AS 1726 – Geotechnical site investigations).

If the development proposes to install ponds, then the constructed liner needs to achieve a permeability of less than $1.0 \times 10^{-9} \text{ m}\cdot\text{s}^{-1}$. Permeability needs to be determined by a recognised geotechnical laboratory (i.e. a laboratory that is recognised by the National Association of Testing Authorities).

6.3. Construction

6.3.1. Topsoil removal

- To achieve adequate compaction topsoil should be removed and stockpiled. Items such as tree roots and rock should be separated from the stockpiled topsoil, so the topsoil can be reused later in the development for landscaping or covering exposed soils.
- Proof rolling the existing surface will indicate the current stability of the site. Areas that fail should be ripped, worked, compacted and backfilled with suitable material.

MOISTURE CONTENT CONTROL SHOULD BE APPLIED TO ALL LAYERS TO ENSURE THAT THE MAXIMUM DRY DENSITY OF MATERIALS IS BEING OBTAINED.

6.4. General Earthworks Considerations

6.4.1. Design Details

Not all projects will require geotechnical design elements and construction reports. This will depend on the scale and scope of the development, however some details should be made available for the earthmoving contractors. These may include:

- Basic specifications that allow proper execution of the works. Other details such as testing requirements, compaction limits, spoil sites and drainage lines will assist in achieving a satisfactory outcome.
- List of suitable and unsuitable materials for use in earthworks. Unsuitable materials will mainly be organic soils, gypsums, contaminated soil and solid objects (e.g. tree trunks, concrete etc).
- The optimum moisture content for specific materials, as determined by laboratory methods. This can only be used as a guide for construction.

Disregarding the investigation and soil assessment stages (i.e. not completing a soil assessment, as per Section 6.2) may expose the owner to a greater risk of cost over-run. A design stage will identify any site constraints and allow detailed estimates to be determined prior to commencing earthworks. Site investigation and design may reduce the overall cost of a project, in comparison to a project that does not complete an investigation and design element.

6.4.2. Cut and Fill Material

- Fill material should be placed in near horizontal layers of uniform thickness in a systematic process across the site. This may not be possible when clay lining water retaining structures such as ponds.
- Fill thickness should be appropriate to the equipment being used to spread and compact the material.



- Moisture content control should be applied to all layers to ensure that the maximum dry density of materials is being obtained.
- Clays of high plasticity (i.e. ability of material to shrink/swell) may require strict moisture, placement and compaction controls.
- Materials with large size particles may cause concern for future excavations (i.e. post holes and foundations).
- Compaction requirements may vary depending on the project. As a guide, the minimum relative compaction should be 95% and 65% for cohesive and cohesionless soils, respectively (refer to AS 3798).
- Cohesionless soils used for fill may require a cohesive soil covering to reduce erosion by wind and water.
- Some projects may require daily geotechnical advice and reports to substantiate the earthworks specifications outlined in the design.
- Some specifications will provide generic compaction information with the number of passes with a given size compactor, maximum layer thickness, moisture conditioning etc. This information should be checked once the specific use of the earthworks and the specific nature of the material being placed are known.
- As a minimum all fill areas should be compacted to withstand test rolling and loadings from construction equipment.
- A recommended safe bearing pressure of 200 kilopascals (kPa) should be achieved for all soil types.
- If rain is imminent then the site should be left in a self draining state by crowning and sealing the upper surface to prevent any ponding.
- Stockpiled topsoil can be placed over exposed earthworks (minimum layer of 100 mm) to protect and stabilise the area from erosion.

Further information

- For guidance regarding topsoil removal recommendations, see <http://www2.dpi.qld.gov.au/environment/13764.html> (Skerman, Redding and McLean 2006).
- For guidance regarding clay lining and compaction to achieve a design permeability of $1.0 \times 10^{-9} \text{ m}\cdot\text{s}^{-1}$, see <http://www2.dpi.qld.gov.au/environment/8841.html> (Skerman *et al.* 2005).
- Refer to *Manure Database* (Element 2.4 – Pond site investigation) to see other soil assessment criteria and recommended design standards.

References

AS3798 – Guidelines on Earthworks for Commercial and Residential Developments.
AS1289 – Methods for Testing Soils for Engineering Purposes.

Dairy Australia 2008, *Effluent and manure management database for the Australian dairy industry*. Dairy Australia, Melbourne, <http://www.dairyingfortomorrow.com/index.php?id=48> (Accessed 23/08/2009).

Skerman, A. G., Redding, M.R. and McLean, D. 2005, *Clay Lining and Compaction of Effluent Ponds Areas*, Department of Employment, Economic Development and Innovation, Brisbane Queensland, http://www.dpi.qld.gov.au/4789_14274.htm (Accessed 17/08/2009).

Skerman, A.G. 2006, *Earth Pad Preparation Requirements for Deep Litter Pig Production Systems and Solid Waste Stockpile and Composting Areas*, Department of Employment, Economic Development and Innovation, Brisbane Queensland, <http://www2.dpi.qld.gov.au/environment/13764.html> (Accessed 17/08/2009).



7. FEEDPAD AND FREESTALL DESIGN

Key objectives

To ensure the design and construction of feedpads:

- minimises the risk of adverse amenity and environmental impacts
- supports the operational efficiency of the farm
- facilitates farm productivity
- provides a safe working environment for farm staff.

To ensure appropriate standards of animal health and welfare; and hygiene are maintained by:

- providing sufficient room for resting and standing
- providing comfortable, hygienic lying surfaces
- providing clean, dry surfaces for standing and feed placement
- providing a safe environment to minimise injury
- encouraging smooth, quiet stock movement.

Permanent Feedpad: usually consists of a concrete pad located adjacent to the dairy or the main farm laneway. The pad generally consists of a concrete feed alley that is used by vehicles for delivering feed (drive alley) and a separate alley that cattle stand on whilst feeding (feed alley) (see Figure 1.3). The pad usually has a longitudinal slope of 0.5–3% (i.e. along the entire pad length). Accumulated manure can either be scraped or vacuumed from the alleys; or flood washed in to a containment sump or pond.

Freestall: a type of permanent feedpad that also includes a bedding area for cattle to lie down. It is generally covered (roofed) and may also include a loafing area for cattle to stand, ruminate or idle. Planning with future expansion in mind will allow an effectively sited permanent feedpad to be retrofitted into a freestall using a process of staged development (see Figure 1.4).

The stalls are often referred to as the bedding area, which provide each animal with a specifically designed space to lie down. Freestalls can be classified by the number of 'stall' rows they contain. Figure 7.4 shows a typical 4-row covered freestall.

Loose housing: a permanent feedpad with a bedded area for the cattle to lie down in an unrestricted space (see Figure 7.6). The bedded area may be deep bedded straw or compost bedded pack.

FEEDPADS CAN BE CLASSIFIED ACCORDING TO THEIR PERMANENCY (E.G. SEMI-PERMANENT OR PERMANENT), AND THE MANURE MANAGEMENT METHOD (E.G. SCRAPING OR FLOOD WASHING) AS DESCRIBED IN SECTION 1 OF THE GUIDELINES

7.1. Feedpad Classifications

Feedpads can be classified according to their permanency (e.g. semi-permanent or permanent), and the manure management method (e.g. scraping or flood washing) as described in Section 1 of the guidelines.

Semi-permanent Feedpad: usually consists of a formed earthen or rubble pad located adjacent to the dairy or the main farm laneway. Feed can be placed directly on to the ground or rubber matting, or in modular steel or concrete troughs (see Figure 1.1, Figure 1.2 and Figure 7.1). Accumulated manure is scraped away from the pad. Earthen and rubble pads cannot be flood washed to remove manure.



This section outlines the design recommendations and dimensions for feedpads and freestalls. Cleaning and manure management are described in more detail in Section 8.

7.2. Typical Freestall Layout

The typical features of a feedpad and freestall are shown in Figure 7.7, Figure 7.8 and Figure 7.9.

7.3. Key Features and Terminology used to describe Feedpads and Freestalls

Feeding table: where feed is placed for cattle on a feedpad. For example feed can be placed:

- directly on to the ground (see Figure 1.1)
- in to troughs (see Figure 1.2, Figure 7.1 and Figure 7.2)
- on to rubber matting or a concrete surface (see Figure 1.3 and Figure 7.3).

Feed alley: the alleys occupied by cattle when they are accessing feed. These alleys are located parallel to the feeding table (see Figure 7.3 and Figure 7.7).

Drive alley: the area adjacent the feeding table. In a freestall (see Figure 7.3) the drive alley does not allow any cattle access, as its intended purpose is to only allow machinery to enter and deliver or push-up feed along the feeding table. Semi-permanent feedpads usually require feed-out machinery to drive in the feed alley (see Figure 7.1).

Stall: Resting cubicles or 'beds' in a freestall which dairy cows are free to enter and leave, as opposed to being confined in pens (see Figure 1.4).

Cow alley: these alleys are only applicable to freestalls. They provide a walkway for cattle to access the stalls (see Figure 7.4 and Figure 7.7).

Cow barrier: structures used to prevent cattle from standing in/on the feeding table or contain stock on a feedpad. Common structures include elevated troughs, fences, hot wires, steel cables, stanchions. (Stanchions are straight head stalls – see Figure 7.3)

Nib wall: a small concrete wall constructed along the perimeter of alleys to prevent manure from leaving the feedpad and/or entering the feeding table (see Figure 7.7).

Side slope: the slope in the feed alley that directs manure and runoff away from the feeding table. The slope direction runs perpendicular to the feeding table. This is usually only associated with earthen feedpads (see Figure 7.2).

Longitudinal slope: the slope along the pad length (see Figure 7.7).

Stall kerb: Barrier at the back of a freestall used to prevent slurry manure from the alley contaminating the bedding (see Figure 7.8).

Brisket boards: A board at the front of stalls that prevents cows from lying too far inside the stall (see Figure 7.8).

Neck rail: A rail to assist the position cows so they have enough forward lunging space when they lie down in a stall (see Figure 7.8). They are also referred to as a 'training rail'.

7.4. Overview of Design and Management

The design of feedpads and freestalls must be guided by design principles which consider the *environment and production* outcomes outlined in Section 1.

**THIS SECTION
OUTLINES THE DESIGN
RECOMMENDATIONS
AND DIMENSIONS
FOR FEEDPADS AND
FREESTALLS. CLEANING
AND MANURE
MANAGEMENT ARE
DESCRIBED IN MORE
DETAIL IN SECTION 8**



7.4.1. Semi-permanent Feedpads

Feedpad design should:

- allow for easy cow movements around the system (i.e. resting, eating, drinking, exercising and milking)
- allow for regular manure removal
- provide adequate feeding table space
- provide easy access to the drive and feed alleys for vehicles.

There are several types of semi-permanent feedpads. The main differences relate to the type of feeding table that is provided on the feedpad. Precast concrete troughs and modular steel troughs are commonly used as they provide a robust, sturdy feeding table that can be relocated if required. The feeding table should be raised so that manure and runoff drains away from the feed, and where cattle stand whilst feeding.

Precast concrete troughs (see Figure 7.1) can be constructed with footings that allow the troughs to sit above ground level. The trough volume is relatively small, therefore feed is delivered at least daily. Raised troughs prevent cattle from having to strain to reach the feed and they can also reduce the ability of cattle to flick/toss feed out of the troughs. A cow barrier such as a hot wire should be installed above the centre line of the troughs to prevent cattle from standing in the troughs.

The internal profile of a concrete trough can be an oval, semi-circle or square shape. A square internal profile may allow feed to accumulate in the front and back corners of the trough.

Modular steel troughs (see Figure 7.2) sit on the ground. The modules provide a large volume to store feed, which allows large round or square hay bales to be placed directly in to the

troughs. Fresh feed is usually added 2–3 times per week. Due to the large module size cattle may not be able to reach the feed at the base, therefore spoiled feed will need to be removed periodically. Cleaning requires the modules to be partly dismantled to allow access for a front-end or skid-steer loader.

Most semi-permanent feedpads require the feed-out machinery to drive in the feed alleys to distribute feed. This will restrict machinery access to when cattle are not on the feed alleys.

If cows are to be left on feedpads for extended periods (more than 8 hours) (BAW, 2001) they should be provided with a loafing area. This should provide a well-drained, comfortable surface for them to lie down on. A wood chip-bedded stand-off pad can be designed for this purpose.

7.4.2. Permanent Feedpads

Permanent feedpads will usually have separate drive and feed alleys. The advantage of individual alleys is that there is no direct interaction between machinery and cattle. This allows feed to be delivered or feed to be pushed-up at any time during the day (cattle will push feed away from the feeding table as they eat – see Figure 7.3). Skid-steer or front-end loaders with implements can be used to push the feed back towards the cattle or remove spoiled feed.

The feeding table and feed alley are separated by a permanent cow barrier such as a post and cable system (the posts are concreted in to the nib wall) or individual head stanchions. For a post and cable system cattle place their head between the nib wall and cable to access the feeding table.

The feeding table should be raised above the feed alleys to prevent cattle from having to strain to reach the feed and it can also reduce the ability of cattle to flick/toss feed, which can result in feed wastage.

**PRECAST CONCRETE
TROUGHS (SEE
FIGURE 7.1) CAN BE
CONSTRUCTED WITH
FOOTINGS THAT
ALLOW THE TROUGHS
TO SIT ABOVE
GROUND LEVEL**



Freestall or loose housing design should:

- allow for easy cow movements around the system (i.e. resting, eating, drinking, exercising and milking)
- allow for regular manure removal
- provide adequate feeding table and bedding spaces
- provide easy access to the alleys for vehicles
- provide a comfortable and clean bedding area
- allow for multiple routes between bedding and feeding areas to minimise 'boss' cows restricting the movement of less dominant cows
- be modular (i.e. organise alleys, feeding spaces and watering points in to modules).

In freestalls it can be easier to control cow flow and keep cows clean. Bedding costs are lower than other loose housing systems. However, it should be noted that freestalls tend to compromise cow comfort with the potential for poorer health outcomes than other loose housing systems, therefore requiring more stringent management for success. If a freestall is selected it is essential to consider cow comfort when designing stalls, flooring and space allowance.

Loose housing alternatives, such as straw yards or compost bedded pack, offer excellent cow comfort and fewer injuries than freestall housing although the cows can be dirtier, and there may be a higher incidence of mastitis and some forms of lameness. Bedding and labour costs are higher in loose housing systems, compared with freestalls and these bedding systems may compromise cows' ability to reduce their heat load in hot weather.

Adequate space allowance should be provided, with multiple access points for feed and water. Water and feed should be well separated to minimise feed contamination of water. The bedding (usually straw or rice hulls) may be topped up daily and completely removed after a long period (e.g. annually).

Good management is the key to the success of compost dairy systems. They require excellent pack and ventilation management; appropriate stocking rates and bedding use; and excellent cow preparation procedures at milking time. The bedded pack needs to be aerated twice daily to refresh the surface and enhance microbial activity in the pack (Endres, 2009).

Appendix C lists practical operational and management considerations (advantages/disadvantages) for semi-permanent and permanent feedpads.



Figure 7.1 – Earthen Feedpad with modular concrete troughs separated by a hot wire, combined feed and drive alleys



Figure 7.2 – Concrete Feedpad with modular steel troughs, combined feed and drive alleys



Figure 7.3 – Covered Concrete Feedpad with central drive alley, 2 feed alleys and stanchions



Figure 7.4 – 4-Row Covered Freestall with sand bedding, central drive alley and 2 cow alleys



Figure 7.5 – 6-Row Uncovered Freestall with rubber matting, central drive alley, 2 feed alleys and 2 cow alleys



Figure 7.6 – Covered Compost Barn with sawdust bedding (raised bedding area on the left; feed alley on the right)



7.5. Design Considerations

Table 7.1 – Feedpad and Freestall Design Considerations

Key features of feedpads and freestalls		
Feature	Recommended Specifications	Additional Design / Management Considerations
Drainage	<ul style="list-style-type: none"> • catch drain design (see Section 8.3) • alley slopes (see Feed alley in this table) 	<p>Natural or engineered slopes will assist in transporting manure and runoff away from alleys, loafing and bedding areas. Effective drainage will provide a clean, dry environment for the cattle. The efficacy of the drainage system will rely on slope; cleaning method and frequency and rainfall intensity.</p>
Manure management system	<ul style="list-style-type: none"> • see Section 8 	<p>All feedpads must contain and manage manure and runoff to prevent adverse impacts on amenity and the surrounding environment (i.e. natural resources such as soil, water and air).</p>
Feed alley	<p>Feeding space per cow</p> <ul style="list-style-type: none"> • recommended width of 0.60–0.76 m per cow (to accommodate both young and mature cows) (NFACC, 2009) • feedpad and freestall systems may tolerate 10% overstocking <p>Alley width</p> <ul style="list-style-type: none"> • 4.5–6 m, enough space for 1 cow to feed and 2 cows to pass behind <p>Alley slope for semi-permanent feedpads</p> <ul style="list-style-type: none"> • 3–5% side slope away from the feeding table <p>Alley side slope for permanent feedpads that are flood washed</p> <ul style="list-style-type: none"> • concrete pads with individual alleys should have no side slope. A side slope will reduce the effectiveness of alley flood washing <p>Flooring overlays</p> <ul style="list-style-type: none"> • resilient flooring overlays can be placed on top of hard surfaces that are occupied/trafficked by cattle to reduce wear on cows' hooves and provide cushioning. Overlay materials include rubber belting, rubber mats, EVA mats etc 	<p>Soft flooring in the feeding alley appears to be preferred by cows over concrete and should only be provided if freestalls are well designed. Otherwise cows may choose to lie in the feed alley instead of the stalls, if the alley floor is comfortable and stalls are not (Tucker <i>et al</i>, 2006).</p>



Key features of feedpads and freestalls		
Feature	Recommended Specifications	Additional Design / Management Considerations
Drive alley	<p>Alley width</p> <ul style="list-style-type: none"> • minimum of 4.4 m if delivering feed in to troughs • minimum of 6.0 m if delivering feed on to the ground, rubber matting or a concrete floor 	
Alley surface texture	<p>Concrete alleys</p> <ul style="list-style-type: none"> • grooves should be constructed parallel with alley length and not have any ridges • pad surfacing texture must be durable to withstand wear from hooves • typical grooving shapes used have a rectangular or triangular profile • typical 'groove' is 12–25 mm deep, 20–25 mm wide and spaced at 100–125 mm intervals <p>Earthen alleys</p> <ul style="list-style-type: none"> • should provide a firm, non-slip surface for both cattle and machinery 	<p>Surfaces should be grooved to improve traction and broomed to remove sharp edges and protruding aggregate which could cause hoof injury. Newer patterns have small grooves between the larger grooves, to provide additional traction.</p>
Nib wall	<p>Wall height in the drive alley</p> <ul style="list-style-type: none"> • height dependent on type of cow barrier and cattle size • 300–550 mm above cow feet level (425 mm for 300 kg cow; 525 mm for 600 kg cow) (DPC <i>et al</i>, 2009) • for feedpads proposing stanchions deduct 100 mm from the recommended wall height <p>Nib wall height on feed and cow alleys</p> <ul style="list-style-type: none"> • minimum of 200 mm higher than the alley floor 	<p>Walls should be constructed so that alleys can be effectively cleaned. For example cow barriers such as posts and rails should be housed in the concrete nib wall, so that alleys can be easily scraped or flood washed to remove manure or spoilt feed.</p>
Feeding table	<p>Distributing feed on the ground, rubber matting or concrete</p> <ul style="list-style-type: none"> • provide a 0.9 m wide smooth surface • elevate the feeding table 75–100 mm above cow feet level (i.e. above the feed alley surface level) <p>Distributing feed in to concrete troughs</p> <ul style="list-style-type: none"> • the base of the trough should be elevated 100–600 mm above cow feet level 	<p>Concrete surfaces for the feeding table should be covered with epoxy resin. The resin will reduce corrosion attack on the concrete surface. (American feeding tables are commonly tiled to reduce the effects of corrosion).</p> <p>Hay tossing and water flinging may be related to the feeding table and water points being too high (1.2 m is too high).</p>



Key features of feedpads and freestalls		
Feature	Recommended Specifications	Additional Design / Management Considerations
Cow barrier	<ul style="list-style-type: none"> • neck rail or self-locking stanchions (head stalls) may be used • barrier design should allow one space per cow • increasing space allowance at the feeding table to 1000 mm improves feeding behaviour and reduces fighting when fresh feed is delivered (Huzzey <i>et al</i>, 2006) • post and rail specifications are outlined in Section 7.6 	<p>Self-locking stanchions result in improved feeding behaviour with less competition than post and rail barriers because they provide a physical barrier between adjacent cows. Their main use is for cow maintenance.</p> <p>Over-crowding results in reduced intakes.</p>
Stocking density	<ul style="list-style-type: none"> • feedpads where cows will only be eating supplementary feed before moving onto pasture – 3.5 m² per cow is sufficient (Dexcel, 2005) • if the cows will spend extended periods on the feedpad (e.g. 12 hours per day) with access to a loafing area, 9–12 m² per cow is recommended (Dexcel, 2005, O’Driscoll <i>et al</i>, 2008) • if cows will be permanently housed: <ul style="list-style-type: none"> • in loose housing they require at least 11 m² per mature cow (NFACC, 2009) • in a freestall one stall and one feeding spacing per cow should be provided (Dowman 2008) 	<p>Insufficient space allowance on feedpads may result in cows not being able to lie down when they need to, resulting in tired, stressed cows and potential lameness problems.</p> <p>Overcrowding of freestalls may result in reduced intakes and cows lying in the alleys.</p>
Water supply	<ul style="list-style-type: none"> • there should be two water points for every group with at least 600 mm of watering space per every 10–15 cows (NFACC, 2009) • water points should be easily accessible as soon as cows leave the dairy and also within 15 m of the feeding table • See Section 11 	<p>Water and feed should be well separated to minimise feed contamination of the drinking water.</p>
Personnel access points	<ul style="list-style-type: none"> • provide strategic locations to allow personnel access • minimum access width of 310 mm (wider access points may require small gates to remove the temptation of small cows trying to exit the feedpad) 	<p>Reduces the amount of opening/closing of gates to access areas. This may improve feedpad and cow maintenance, as staff do not have to jump fences or open/close multiple gates to carry out tasks.</p>



Design principles specific to freestalls		
Feature	Recommended Specifications	Additional Design / Management Considerations
Modular design	<ul style="list-style-type: none"> no more than 60 stalls per module 	<p>Modules can be manipulated to match site constraints.</p>
Stall sizing	<ul style="list-style-type: none"> stalls should be well designed to allow cows to enter, lie down and stand easily and safely, and urinate and defecate outside the stall (to maintain a dry bedding area) stalls need to provide adequate lying and lunging space (forward and side lunging) dependent on cow size (i.e. weight, body dimensions) Figure 7.8 shows the typical dimension descriptors for a stall Table 7.2 shows stall dimensions for various cow weights ranging from 400–770 kilograms 	<p>Stalls should be sized based on the largest 25% of cows in the group (genetic improvement of the herd should also be considered when designing stalls).</p> <p>Forward lunging space can be shared where two rows of stalls face head-to-head.</p>
Stall kerb	<ul style="list-style-type: none"> minimum of 200 mm higher than the alley floor 	
Stall divisions	<ul style="list-style-type: none"> for dimensions see Table 7.2 and Figure 7.8 the lower rail of stall divisions (dividers) should be located above the stall base to prevent cows from crawling over the lower bar and getting stuck, particularly when side lunging (Nordlund and Cook, 2003) there should be a gap between the end of the divider and the kerb (Nordlund and Cook, 2003) 	<p>Stall design should allow forward lunging when the cow lies down and allow the cow to extend her legs when lying. Suspended stall divisions which hang from the front rail are preferred. Stall divisions which allow side lunging (where the cow puts its head through the side division to carry out the forward lunging part of the lying down movement) compromise cow welfare. If the gap between the end of the division and the kerb is too large cows will walk along the edge of the lying platform or try to occupy other cows' stalls. This can lead to dirtier bedding through manure being tracked into the stall. If the gap is too small, cows may hurt themselves when entering the stall.</p>
Neck rail	<ul style="list-style-type: none"> for dimensions see Table 7.2 and Figure 7.8 the neck rail should be positioned close to or over the brisket board 	



Design principles specific to freestalls		
Feature	Recommended Specifications	Additional Design / Management Considerations
Brisket boards	<ul style="list-style-type: none"> for dimensions see Table 7.2 and Figure 7.8 an alternative to the traditional wooden brisket board is PVC pipe, concrete kerb and the Poly Pillow™ (Promat 2009) 	Brisket boards may be used to prevent cows from lying too far inside the stall. They should allow cows to extend their front legs when lying and rising.
Cow alley	<ul style="list-style-type: none"> recommended 3.0–3.6 m wide to promote smooth cow flow, avoid sharp turns in alleys all walking surfaces should be grooved to minimise slips and falls and encourage oestrus activity 	
Crossovers	<ul style="list-style-type: none"> locate every 20–25 stalls (approximately 24–30 m) width between 4.5–4.8 m (4.5 m provides enough space for 1 cow to drink, and 2 cow to pass – see Figure 7.9)) crossovers should be slightly higher than the stall kerb to allow manure/spilt water to drain in to the alleys 	Crossovers should be located at the end of alleys to prevent ‘dead-ends’, so that younger or smaller cows are able to access feed, water and stalls without confronting more dominant cows. This can be achieved by having at least two crossovers at opposite ends of the freestall.
Bedding surface	<ul style="list-style-type: none"> if organic bedding is to be used the stall base is usually constructed of concrete if inorganic bedding is to be used the stall base is usually constructed using compacted fill or sand to improve comfort, the concrete base may also be covered by rubber mats or mattresses mattresses should be designed with ‘cells’ to prevent the filling from piling up at one end, or should allow the cover to be lifted and re-filled after a period of time 	The ideal lying surface is soft, absorbs moisture and does not promote the growth of bacteria. Cows that must lie down on hard surfaces do not lie down as long, are more unsettled, may lie in alleys, or may develop knee and hock lesions and swelling. Instruments and practical tests are available to compare the compressibility of different surfaces (see Section 9.11).



Design principles specific to freestalls

Feature	Recommended Specifications	Additional Design/Management Considerations
<p>Bedding material</p>	<ul style="list-style-type: none"> • a concrete base and some of the harder rubber mats will need deep bedding to be placed on top of the surface. At least 100 mm of rice hulls, sawdust shavings or sand should be provided • mattresses may use a layer of bedding to keep them dry and clean 	<p>When choosing a bedding material consider hygiene, degree of compression when the cow lies down, performance over time and how it will interact with manure handling systems.</p> <p>In general bedding materials can be described as either:</p> <ul style="list-style-type: none"> • inorganic (e.g. sand, rubber); or • organic (e.g. sawdust, straw, hay, composted manure, rice hulls) <p>Inorganic bedding materials (e.g. sand and ground limestone) are drier and do not support the growth of mastitis pathogens. However, sand needs to be free of dirt or clay. It offers little insulation in cold weather, but may be beneficial in hot weather. Sand can become hard when packed down. It can interfere with manure handling systems, but these can be adapted to include sand traps. Traps can reduce the amount of sand contacting pumps and sand can also be recovered from manure and recycled (60 days drying time is needed before re-use). Any stall surface with bedding should be free of 'potholes'.</p> <p>Organic bedding materials may support the growth of mastitis bacteria, so beds should be kept as clean and dry as possible. These materials are also more insulating and could reduce cows ability to cool down in hot weather.</p> <p>There is a considerable body of research on cows preferences for different stall base and bedding materials and the consequent effects on lying behaviour, udder health, lameness and hock injury. In general sand-bedded stalls and mattresses are preferred over other types, but the results vary across trials. In hot climates, cows appear to show a preference for bedding which promotes conductive heat loss, such as ground limestone (Cummins, 1998). Unfortunately, there has been little research on the most appropriate bedding types for different climates (Rushen <i>et al</i>, 2007).</p>



Other design considerations		
Feature	Recommended Specifications	Additional Design / Management Considerations
Loafing areas	<ul style="list-style-type: none"> • these can be located adjacent to feedpads and freestalls. Runoff from these areas should be factored in to the design of the manure management system • see Stocking density in this table 	
Gateways	<ul style="list-style-type: none"> • gates can be muffled by attaching rubber strips to prevent excessive banging • there should be no projections, such as broken boards or rails, or protruding nails on which cows might injure or bruise themselves 	Loud noises are as stressful to cows as being hit.
Rails	<ul style="list-style-type: none"> • rails should be strong enough to not break when cows lean on them, or else have a designed weak point which will break first, reducing the risk of injury 	
Crush	<ul style="list-style-type: none"> • crush design must ensure that the animal is capable of being examined without fear of injury • head gates should have full length openings so that the animal can be released quickly if necessary • side access is preferred in an emergency, and it also allows safe vet access • walk-through bails are preferred; guillotine head bails are not recommended (BAW 2001) • a tipping crush is very useful for trimming and lameness treatment in large herds 	
Building design	<ul style="list-style-type: none"> • building design (e.g. covered feedpad or freestall) should be performed by a registered building practitioner – refer to Building Commission of Victoria 	



Other design considerations		
Feature	Recommended Specifications	Additional Design/Management Considerations
Roof	<p>Roof pitch</p> <ul style="list-style-type: none"> • lower roof pitch results in slower air movement (e.g. 1 : 4 pitch or less) • steeper roof pitch results in greater air movement (e.g. 1 : 3 pitch is suggested for warmer climates) <p>Ridge opening</p> <ul style="list-style-type: none"> • provide a continuous open ridge to promote air movement (i.e. convective heat dissipation) • open ridge space : 50–75 mm per 3.0 m of shed width (DPC <i>et al</i>, 2009) • open ridge space : 300 mm + 50 mm per 3 m width for sheds greater than 6 m wide for northern Australia (Davison <i>et al</i> 1996) • eave overhang of 900 mm (recommended for open sided sheds). Eave overhang is dependent on feedpad/barn configuration; and on eave height and degree of protection required <p>Guttering and downpipe design</p> <ul style="list-style-type: none"> • as per state plumbing code (engage a qualified design engineer) <p>Ventilation and shading</p> <ul style="list-style-type: none"> • passive ventilation is economical (more common in Australia) • cross ventilation provides air more readily to the whole building 	<p>Steel roofing systems are more economic in Australia.</p> <p>Eave overhang is not required on a 4 row freestall barn, as the cow alley is located on the perimeter of the shed. The roof area over the cow alley provides protection from sunshine and rain for cattle lying in the stalls.</p> <p>Ventilation should provide clean, dry air to the cows, pad and bedding areas.</p>
	<p>Machinery access</p> <ul style="list-style-type: none"> • minimum 3.6 m at the lowest roof height; and minimum of 4.5 m at the shed centre (for entry/exit) • minimum 7.0 m internal ridge height (to operate front-end and skid-steer loaders) • turn around areas to be a minimum 15–18 m radius from edge of shed 	<p>Check individual operating heights for equipment in the design phase.</p> <p>Check individual turning circles of feed-out carts, this radius will vary with tractor and cart type).</p>

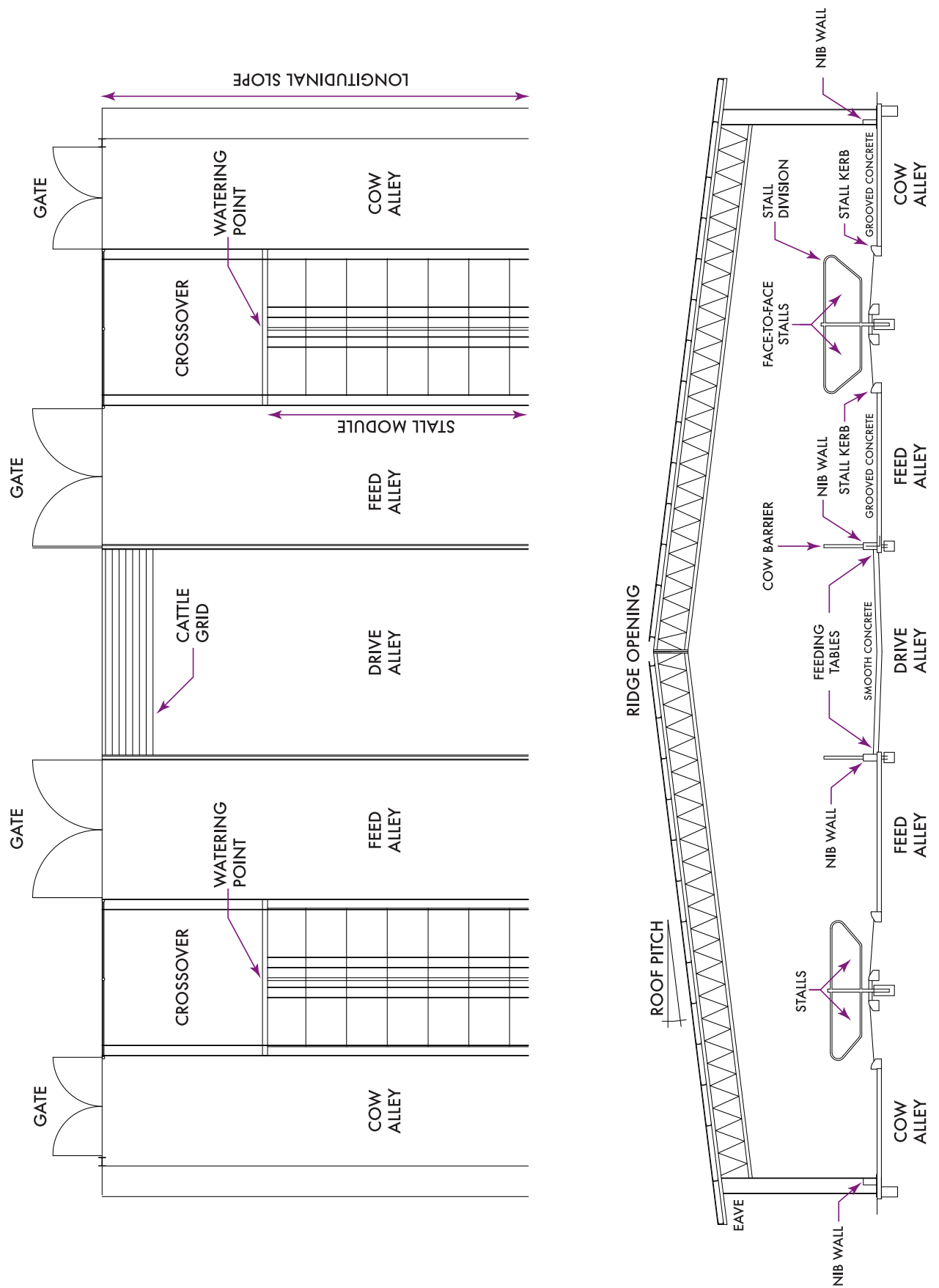


Figure 7.7 – Plan and Cross Section View of a Typical 4-row Freestall

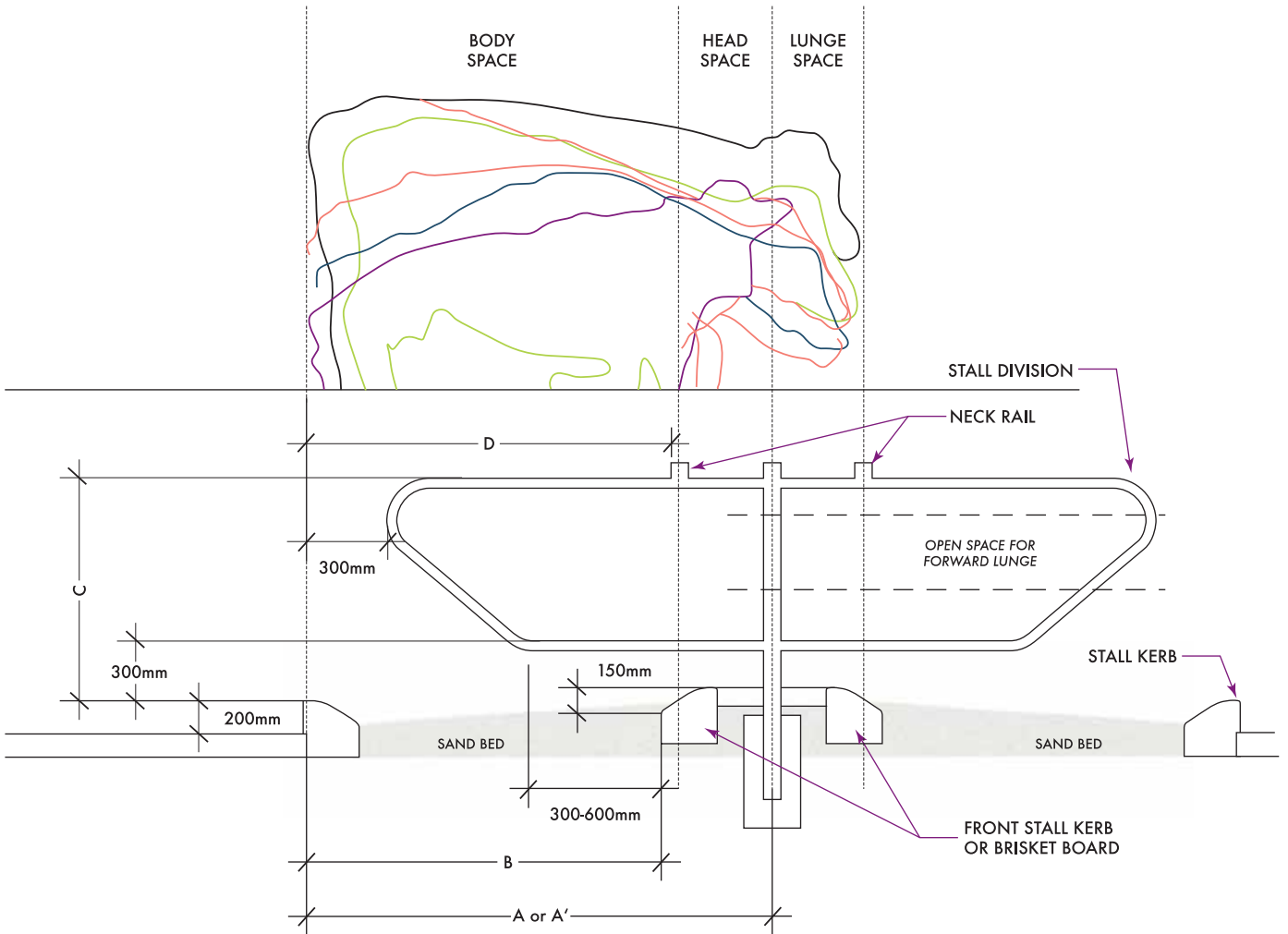


Figure 7.8 – Side View of a Typical Stall



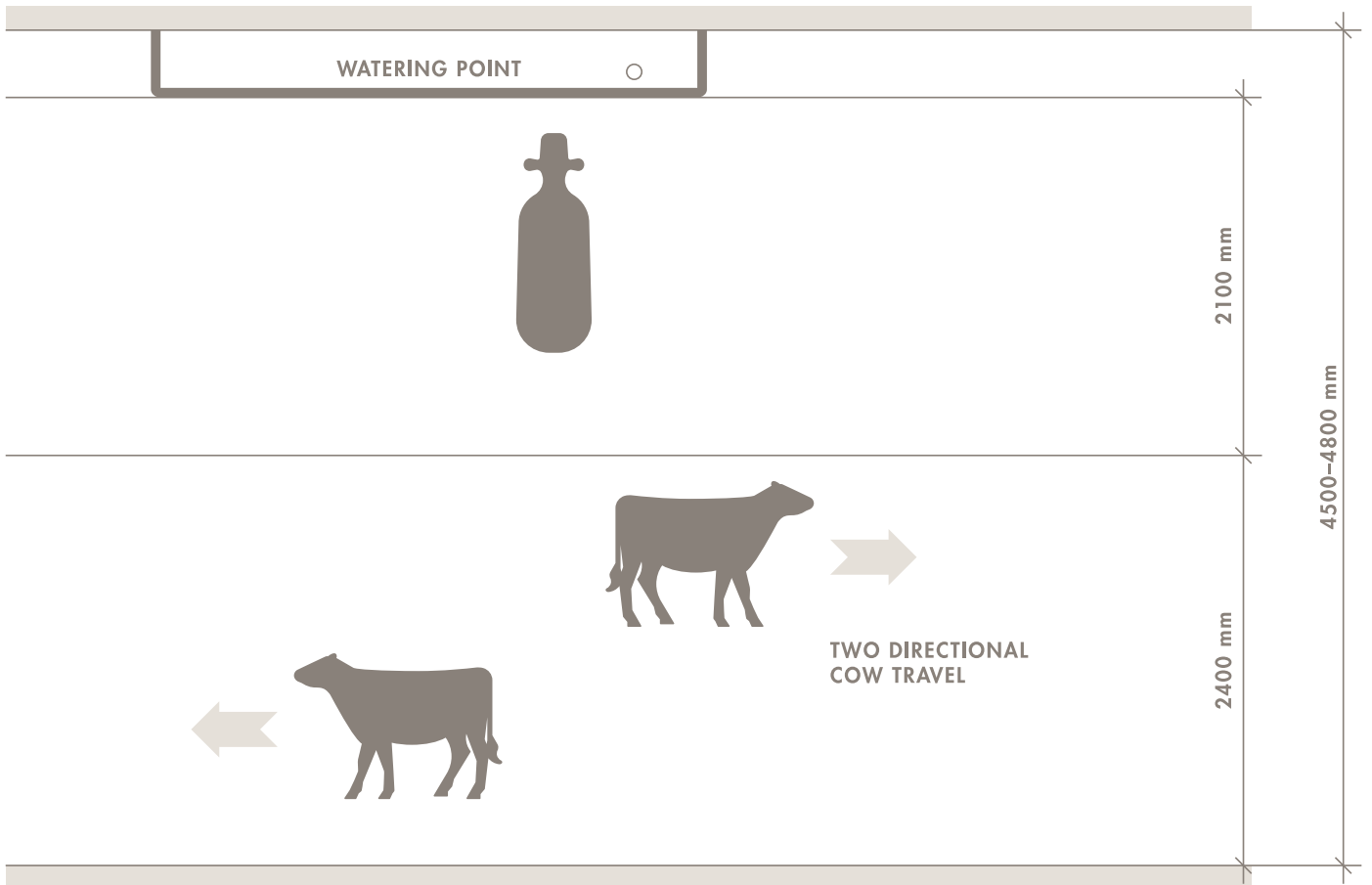
Table 7.2 provides a range of stall dimensions for different cow body weights. The descriptors for the individual stall dimensions (e.g. height to neck rail) can be seen in Figure 7.8 (e.g. 'height to neck rail' then refer to descriptor C).

Table 7.2 – Stall Dimensions Based on Body Weight

	Reference to Figure 7.8	Body weight (kg)	400–500	500–590	590–680	680–770
	Refer to A	** Total stall length – open front (face-to-face)	1980–2080	2080–2180	2290–2440	2440–2590
	Refer to A'	Total stall length – closed front (facing a wall)	2280–2440	2440–2590	2590–2740	2740–2900
	Refer to B	Distance from rear curb to front stall kerb	1620–1670	1670–1730	1730–1780	1780–1830
	Refer to C	Height to neck rail	1070–1120	1120–1170	1170–1220	1220–1320
	Refer to D	Stall length to neck rail	1570–1630	1630–1680	1680–1730	1730–1780
Stall Dimensions (mm)	Not shown	Centre – Centre stall divider placement (stall width)	1040–1090	1090–1140	1140–1220	1220–1320

Source: Graves *et al*, 2005

Note: **The open front stalls in Figure 7.8 require a smaller stall length, as they share forward lunging space.



Source: DPC *et al*, 2009

Figure 7.9 – Crossover Layout and Dimensions



7.6. Construction Materials

Material suppliers should be able to provide certification of materials being used for a project. The materials should meet the applicable Australian Standards or Australia and New Zealand Standards.

7.6.1. Concrete

Companies supplying concrete (greater than 50 cubic metres) should use plant production testing to guarantee the product meets the required parameters (refer to AS1379 – Specification and Supply of Concrete).

Recommended concrete strengths:*

- Footings N20 concrete
- Pedestrian traffic N25 concrete
- Cow and vehicle traffic N32 concrete

Recommended concrete thickness for alleys:*

- Feed and cow alley
100–125mm
(with SL82 reinforcing mesh in the top layer)
- Drive alley
150 mm
(with SL82 reinforcing mesh in the top layer)

*The actual concrete strength and thickness required will depend on the type and strength of the sub-base and base materials; and the proposed animal and vehicle loadings.

7.6.2. Construction Joints

Alley design should incorporate construction, expansion and contraction joints. Generally they should be placed in regular grids approximately matching the widths of the sections, but no more than 4 metres apart.

Construction joints should be designed in advance of construction and placed at the end of each day’s concrete pour. These joints:

- should be used for unplanned breaks in concrete pours, where the concrete has hardened
- should be relatively free to move in a horizontal direction only.

Many proprietary systems are available to form construction joints such as dowel bars; and plate or key joint systems.

Expansion and contraction joints should be designed in advance and placed to suit the overall layout. They should be used for any points that may move, shrink or expand as a result of thermal and other loadings on the concrete. These joints should be relatively free to move in a horizontal direction only.

7.6.3. Steel

Tube steel products used for structural applications should be fully compliant to AS1163 – Structural Steel Hollow Sections.

All other structural steel should meet AS/NZS 3679 – Hot Rolled Bars and Sections. Some basic specifications for dairy construction include:

- Tube steel: 250/350 (L0 – pronounced “L Zero”, is the lowest ambient temperature to which these products have been tested as per the standards (refer to AS1163))
- Plate steel: 250 grade
- Beams, channels, columns and angle: 300 grade.

The steel market has non-structural steel sections available for non-structural, general purpose and light duty applications. These products may not meet the above required standards for dairy constructions.

**TUBE STEEL PRODUCTS
USED FOR STRUCTURAL
APPLICATIONS
SHOULD BE FULLY
COMPLIANT TO
AS1163 – STRUCTURAL
STEEL HOLLOW
SECTIONS**



7.6.4. Post, Rail and Cable Specifications

Drive alley, stall or gate posts

80 NB medium galvanised pipe at 3.6 m spacings (maximum); nominally 2.2–3.6 m spacings.

Other posts (e.g. intermediate posts on general fences)

65 NB medium galvanised pipe at 2.2 m spacings.

Posts should be placed in concrete footings. Footing size: 300 mm diameter x 600 mm deep.

Top rails

50 NB medium galvanised pipe.

Intermediate rails

25–32 NB medium galvanised pipe at 300 mm centres.

Cables

12–15 mm galvanised cable (either fibre or steel core).

Note: NB is 'nominal bore', which refers to the wall thickness of the pipe.

7.6.1. Reinforcement

All reinforcement products should comply with AS/NZS 4671 – Steel Reinforcing Materials. Products should be class 500N or 500L, and be certified by the Australian Certification Authority for Reinforcing Steels Ltd.

Further Information

Dairy Practices Council (DPC)
<http://www.dairypc.org/index.htm> (Accessed on 15/10/2009)

Midwest Plan Service – Dairy freestall housing and equipment, Seventh Edition
<http://www.mwps.org/> (Accessed on 15/10/2009)

ALL REINFORCEMENT

PRODUCTS SHOULD

COMPLY WITH

AS/NZS 4671 –

STEEL REINFORCING

MATERIALS. PRODUCTS

SHOULD BE CLASS

500N OR 500L,

AND BE CERTIFIED

BY THE AUSTRALIAN

CERTIFICATION

AUTHORITY FOR

REINFORCING STEELS

LTD



References

- Davison T, McGowan M, Mayer D, Young B, Jonsson N, Hall A, Matschoss A, Goodwin P, Goughan J, and Lake M 1996, *Managing hot cows in Australia*, Queensland Department of Primary Industries, Brisbane.
- Dexcel 2005, *Minimising muck, maximizing money: stand-off and feed pads, design and management guidelines*, Dexcel, Hamilton, NZ.
- Dowman T 2008, *Feed pads, feedlots, freestall barns, loafing areas and sacrifice paddocks*, Dairy News , Issue4, March 2008, p4–5.
- DPC and NRAES 2009, *Guideline 1 planning dairy freestall barns (revised edition)*, <http://www.dairypc.org/index.htm> (Accessed on 15/10/2009).
- Graves, McFarland, Tyson, and Wilson 2005, *Cow Freestall (Cubicle), Types and Details*, PennState Agricultural and Biological Engineering, Publication DIP No. 82, <http://www.abe.psu.edu/> (Accessed on 19/10/2009).
- Huzzey JM, De Vries, TJ, Valois P and Von Keyserlingk MAG 2006, *Stocking density and feed barrier design affect the feeding and social behavior of dairy cattle*, Journal of Dairy Science 89, 126–133.
- McDonald, S., Spry, J. and Janssen, M. 2008, *Developing and managing dairy cattle feedpads*. Technical Information Notes, Victorian Department of Primary Industries, Kyabram.
- MWPS 2000, *Housing and Equipment, MWPS-7, Seventh Edition*. Ames, Iowa, Midwest Plan Service, Iowa State University.
- 1995, *Guidelines for Planning Dairy Freestall Barns*, Dairy Practices Council, Pennsylvania.
- NFACC 2009, *Code of Practice for the Care and Handling of Dairy Cattle*, National Farm Animal Care Council and Dairy Farmers of Canada, Ontario, Canada.
- O'Driscoll, K., Boyle, L., French, P., Meaney, B., Hanlon, A. 2008, *The effect of out-wintering pad somatic cell score and mastitis design on dirtiness score, incidence in dairy cows*. Animal 2, 912–920.
- Tucker C, Weary DM, de Passillé AM, Campbell B and Rushen J 2006, *Flooring in front of the feed bunk affects feeding behavior and use of freestalls by dairy cows*. Journal of Dairy Science 89, 2065–207.
- United States Environment Protection Agency – Dairy Glossary, <http://www.epa.gov/oecaagct/ag101/dairyglossary.html> (Accessed on 09/10/2007).



8. MANURE MANAGEMENT

Key objectives

To manage manure and recycled effluent from dairy farm operations to:

- avoid adverse amenity impacts from odour and dust on nearby sensitive uses
- prevent the pollution of ground and surface waters; and land
- to provide a safe working environment for farm staff and contractors.

8.1. What is Manure?

Manure is the faecal and urinary excretion of livestock. It may also contain bedding, spilled feed, water or soil. It may also include components not associated with livestock excreta, such as dairy shed wash down water, contaminated milk or hair.

Manure may be classified in different ways depending on its solids and moisture content which affect its handling and storage properties. These guidelines use the following terms to describe manure, with respect to total solids (TS) content.

- liquid manure (<5% TS)
- slurry manure (5–10% TS)
- semi-solid manure (10–20% TS)
- solid manure (>20% TS)

The term recycled effluent refers to liquid manure that is reused for yard or alley washing, or applied to land after being treated to remove solids (i.e. in a pond or ponds).

8.2. Feedpad Cleaning Methods

Accumulated manure can be dry-scraped from the pad surface using a scraper, scraper and vacuum, front-end loader or it can be washed off. The design principles for cleaning a feedpad by flood washing are similar to those used for cleaning a dairy yard. Runoff contaminated with manure is usually directed to containment systems, and then in to storages before land application. Scraped manure is usually stockpiled or composted within or near the feedpad complex and allowed to air-dry, then either applied to land or exported off site (Dairy Australia, 2008).

Scraping is the most practical method to clean earthen and concrete pads with external earthen drainage systems. The slope of the feed alleys and local climate will influence the efficacy of scraping and the ability to maintain a suitable area to feed dairy cattle. Manure from the pad surface can be scraped on to a compacted area nearby (ideally within the controlled drainage area of the feedpad since seepage from the stockpiled manure needs to be contained and managed).

Scraping works well in the drier months of the year, when the deposited manure has an opportunity to air-dry. However, during the wetter months of the year the feedpad surface can become hard to scrap. The deposited manure can become very sloppy (similar TS content of slurry manure), making it difficult to physically scrape and stack. Adequate feed alley slope will assist in draining semi-permanent pads during the wetter months.

Skid-steer and front-end loaders with purpose built attachments can be used to scrape feedpads. Attachments should be fitted with a sacrificial 'edge' (i.e. the part of the attachment that contacts with the pad) to reduce wear on the pad surface.

**SCRAPING IS THE
MOST PRACTICAL
METHOD TO CLEAN
EARTHEN AND
CONCRETE PADS WITH
EXTERNAL EARTHEN
DRAINAGE SYSTEMS**



Automated blade and vacuum scrapers can be used to clean alleys. Automated systems are commonly used in American freestalls that have concrete cow and feed alleys.

Although dry scraping is laborious, it is relatively cheap in terms of capital outlay as most properties will have a front-end loader.

Flood washing is suited to permanent feedpads with concrete alleys and properties that have a sufficient volume of freshwater and/or recycled effluent to supply the flood wash system. The volume and subsequent flow rate required to effectively wash an alley is influenced by: alley slope, width, length and surface texture; and the type, consistency and amount of manure that needs to be washed from the surface. Fresh manure ‘paddies’ and sand will require more energy to be broken up and then entrained in the wash fluid in comparison with spilt hay or straw bedding. Scraping or pre-wetting the

alley surface prior to flood washing reduces the energy required to break-up and entrain manure within the wash fluid.

Flood washing systems can consist of tanks at the highest end of the alley mounted at ground level or on stands to generate sufficient head. The tanks can apply the wash volume directly on to the pad surface through large diameter piping or piping can ‘rise’ through the alley surface (e.g. buried main and risers). Alternatively, large volume irrigation pumps can be used to pump freshwater or recycled effluent directly on to the alley or through risers, negating the need for a tank.

Buried main and riser systems are suited to wide alleys/yards. They are more expensive than tank systems.

The washing frequency is determined by the length of time that cattle spend in the feed and

Table 8.1 – Typical Flood Wash Volumes

	1000-cow Freestall	500-cow Feedpad
Time cattle in alleys	24 hours per day	6 hours per day
Alley length	390 metres	190 metres
Alley washing frequency	3 times per day	2 times per day
Feed alleys	2 (500 cows per alley) 4.6 m alley width	2 (250 cows per alley) 4.6 m alley width
Cow alleys	2 3.6 m alley width	Not applicable
Longitudinal slope	2.5%	1.5%
Flood wash velocity	1.5 metres per second	1.0 metres per second
Depth of flow	75 millimetres	50 millimetres
Alley surface roughness coefficient	0.018	0.018
Feed alley wash volume	44,850 litres per wash	17,330 litres per wash
Cow alley wash volume	35,100 litres per wash	Not applicable
Total wash volume per day	479,700 litres	69,320 litres



cow alleys, and subsequently the amount of manure that is deposited. For a freestall that houses cattle for 24 hours per day the feed and cow alleys should be washed at least three times per day. Washing can occur whilst cattle are standing in the alleys, alternatively it can be conducted whilst they are being milked. Feedpads that are used to provide a portion of the cattle's daily diet are usually washed twice per day, after the cattle have returned to the grazing paddocks or loafing area.

A 1000 cow freestall could use up to 480,000 litres of fluid (e.g. freshwater or recycled effluent) per day to maintain clean feed and cow alleys. A 500 cow feedpad could use up to 70,000 litres of fluid (e.g. freshwater or recycled effluent) per day to maintain clean feed alleys (flood wash calculation assumptions are shown in Table 8.1). Refer to Manure Database (Element 1.4 – Flood wash systems) for flood wash design specifications.

The overall quantities of water required to operate the facility needs to be carefully considered and addressed in the planning stages to alleviate any community concerns regarding water consumption and groundwater extractions.

8.3. Runoff Collection

A typical feedpad complex will have a substantial catchment area. They have the potential to capture large volumes of runoff during high intensity rainfall events. Thus direct application manure systems are not recommended for feedpads, due to the size of the sump required to contain and manage the runoff from the feedpad complex. Direct application requires manure to be applied even when conditions do not suit irrigation (e.g. during periods of rainfall and minimal pasture/crop growth). Hence, runoff from within the catchment is usually captured by 'catch drains', which direct runoff in to sedimentation basins or holding ponds. Catch

drains should have a minimum slope of 0.5% to transport runoff and manure. The sedimentation basin and/or pond usually removes a percentage of solids, which then enables the effluent to be recycled either for pad cleaning or land application.

Design of feedpad complex drains: they should be able to manage a 1 in 20 year design storm using a runoff coefficient of 0.8 (as per Draft National Guidelines for Beef Cattle Feedlots in Australia – 3rd Edition).

Design of sedimentation basins: they should be able to manage a 1 in 20 year design storm using a runoff coefficient of 0.8 (as per Draft National Guidelines for Beef Cattle Feedlots in Australia – 3rd Edition).

8.4. Solid-Liquid Separation Systems

Solids separation systems are becoming an increasingly common component of manure management systems, particularly where cattle receive a large percentage of their daily feed intake on the pad. Solids separation is used to remove large particles and organic matter from the manure stream.

Solids separation systems can be divided in to two categories:

- those that rely on gravity (e.g. trafficable solids traps, sedimentation basins and ponds)
- mechanical systems using screening (e.g. inclined stationary screens, elevating stationary screens, vibrating screens, rotating screens), centrifugation (e.g. centrifuges, hydrocyclones) or pressing (e.g. roller press, belt press, screw press).

**A 1000 COW
FREESTALL COULD USE
UP TO 480,000 LITRES
OF FLUID PER DAY TO
MAINTAIN CLEAN FEED
AND COW ALLEYS
AND A 500 COW
FEEDPAD COULD USE
UP TO 70,000 LITRES
OF FLUID PER DAY TO
MAINTAIN CLEAN FEED
ALLEYS**



8.4.1. Why Install a Solids Separation System?

Solids separation systems offer the following advantages:

- they minimise the need for agitation in sumps and reduce the likelihood of blockages in pumps and pipes
- they reduce the rate of sludge accumulation in ponds. Together with the reduction in volatile solids (VS) loading to the pond, this allows smaller ponds to be built or extends the life of existing ponds
- they allow the use of conventional irrigation equipment for distribution of liquid manure from adequately sized single ponds (although high salinity levels are not reduced, and some equipment, for example centre pivots, may require additional protection)
- they concentrate organic matter (and nutrients to a limited extent) for direct application to pasture, composting or cost-effective transportation off-site.

However, installing a solids separator may also introduce some additional requirements:

- a solids handling system (i.e. separator, impermeable storage pad, front-end loader, spreader etc.) introduces additional energy, labour, repair and maintenance costs
- separated solids will generally have a TS content of 10–30 % and will need to be managed separately (Dairy Australia, 2008).

8.5. Optional Components of a Manure Management System

Other components of a manure management system can include containment sumps, solids separation systems and manure/compost stockpiles.

8.5.1. Containment Sumps

Containment sumps are usually located within or at the end of the concreted surface of dairy yards or feedpads. Their purpose is to contain wash down water and rainfall runoff prior to direct application or further treatment. Sump design and siting needs to consider:

- maximum wash volumes for flood wash systems
- catchment areas contributing to the sump
- runoff potential from the catchment areas
- access for maintenance and repairs.

8.5.2. Gravity Sedimentation Systems

Settling or sedimentation of solids by gravity is the most effective method for separating low TS manure streams such as dairy shed wash down, loafing pad or feedpad runoff, and manure flushed from freestalls. Sedimentation systems can consistently remove more solids and nutrients from liquid manure than mechanical methods when the TS content is low. It remains the favoured approach for dilute manure slurries.

Sedimentation basins are typically shallow structures designed to achieve a low through-flow velocity and accommodate the accumulated settled material between periodic clean-outs.

Trafficable solids traps, now common on many dairy farms, are a form of sedimentation basin using a concrete base for regular clean-out by front-end loader.

Earthen sedimentation basins are a more suitable option where the catchment area (i.e. feedpad complex) will generate a significant volume of runoff during a rainfall event.

Sedimentation ponds are deeper structures that do not drain before clean-out (Dairy Australia, 2008)

SEDIMENTATION BASINS ARE TYPICALLY SHALLOW STRUCTURES DESIGNED TO ACHIEVE A LOW THROUGH-FLOW VELOCITY AND ACCOMMODATE THE ACCUMULATED SETTLED MATERIAL BETWEEN PERIODIC CLEAN-OUTS



**THE RANGE IN
DIFFERENT TYPES OF
SOLIDS SEPARATION
SYSTEMS AVAILABLE,
NOT TO MENTION
SUPPLIERS, MEANS
THAT SEPARATION
EFFICIENCY IS A
KEY CRITERIA FOR
COMPARING THE
PERFORMANCE
OFFERED BY DIFFERENT
TYPES OF SEPARATION
SYSTEMS**

8.5.3. Mechanical Separation Systems

Inclined stationary screens have a header tank at the top edge of an inclined screen; as the liquid manure overflows the tank and runs down over the full width of the screen, liquid passes through the screen openings, leaving solids behind on the screen. The solids are washed downwards and drop onto a storage or draining pad. The lack of moving parts means maintenance and power requirements are low.

Inclined stationary screens are suited to a higher-solids content liquid manure than sedimentation basins are suited to. However, they are limited to a TS inflow content of less than 5% (Zhang and Westerman 1997).

Screw press separators use a straight or tapered screw (auger) to compress solids within a perforated or slotted cylinder. Liquid is forced out through the screen openings by pump pressure and the rotating screw. Solids are pushed out the end of the barrel through an adjustable retainer.

Presses can operate at a higher TS content than stationary inclined screens. Separation efficiency can be poor for dilute liquid manure but increases with solids concentration.

8.5.4. Performance of Separation Systems

The range in different types of solids separation systems available, not to mention suppliers, means that separation efficiency is a key criteria for comparing the performance offered by different types of separation systems. However, before doing so, it is important to note the following:

- variability in particle size distribution (with manure type), TS content and flow rate make it difficult to draw anything other than general conclusions about the suitability of separator types for a particular property. Results can vary greatly for any given device, thus care should be taken when extrapolating results from published studies to individual farms
- there is currently no standard for testing and reporting separator performance, reported results must be scrutinised carefully to determine the method used to calculate efficiency, and whether the characteristics of the tested liquid manure are relevant
- published results come mainly from the USA, where rations are fed to housed or lot-fed cows and slurry manure may include readily separable organic bedding and waste feed (Dairy Australia, 2008).

Burcham, Gill and Moore (1997) showed that settling basins are much more effective at removing sand from flushed dairy manure than inclined screens.

8.5.5. Anaerobic, Facultative and Aerobic Ponds

Ponds may be designed to reduce organic, nutrient and pathogen loadings in liquid manure, thus converting raw manure to a more suitable product for reuse. Ponds do not provide a means for disposal of liquid manure, as the pollution potential of the recycled effluent leaving the pond is still too high for discharge to waters. More importantly, well managed ponds provide a means of storing effluent produced during periods when direct application may result in runoff.



The most important function that a pond provides is containment. A pond or multiple ponds should provide sufficient storage to avoid having to distribute effluent during wet weather. Pond(s) may allow the feedpad operator to:

- reduce odour during and after land application
- use recycled effluent for cleaning alleys
- reduce the likelihood of blockages in conventional irrigation systems
- reduce nutrient and pathogen loads in recycled effluent
- produce biogas.

Anaerobic ponds can receive raw manure from the feedpad or treated liquid manure (i.e. post solids separation).

Solid separation systems (e.g. sedimentation basins) usually precede anaerobic and facultative ponds.

True aerobic ponds are rare in agricultural manure treatment systems, as many so called 'aerobic' ponds have anaerobic conditions below the top 200 mm (Sukias *et al.* 2001).

Pond design: a trained consultant should be engaged to assist with the selection and siting of the most appropriate pond system, as well as system design. A storage pond should be designed to manage the wettest year in ten without overtopping (ARMCANZ & ANZECC 1996).

8.5.6. Manure Stockpile

Manure removed from solids separation systems should be placed on a compacted pad that prevents contaminated runoff from adversely affecting ground and surface waters. Contaminated runoff from the pad should be:

- directed in to the manure management system, or
- contained on the pad using earthen bunding.

The pad surface should be durable so that it can be trafficked all year round.

The pad is also a suitable area to compost carcasses (refer to the Draft National Guidelines for Beef Cattle Feedlots in Australia (3rd Edition) – Appendix D: Manure and Carcass Composting).

8.6. Land Application Systems

An effective land application system should:

- ensure that manure and recycled effluent does not leave the property boundaries or adversely affect ground and surface waters
- allow the property to apply the manure and recycled effluent to actively growing crops to avoid losses and maximise nutrient uptake
- prevent adverse impacts to the reuse area soils (e.g. nutrient imbalances, acidification, salinity, sodicity, decline of soil structure, erosion, and weed growth)
- ensure the reuse area available is sufficient to allow the manure and recycled effluent to be applied at sustainable rates. Reuse application rates should be calculated using site-specific analysis results for effluent and/or manure solids.

**ANAEROBIC PONDS
CAN RECEIVE RAW
MANURE FROM THE
FEEDPAD OR TREATED
LIQUID MANURE
(I.E. POST SOLIDS
SEPARATION)**



Recycled effluent can be applied via surface irrigation systems (e.g. border-check, furrow, contour bank, contour ditch); fixed or moving sprinklers (e.g. lateral-move, centre-pivot, boom, drip); or pipe and risers.

Solid manure can be applied using conventional fertiliser spreaders (e.g. belt driven) or purpose built manure spreaders with vertical/horizontal beaters that macerate and spread the manure.

8.7. Key Design and Management References for Victoria

8.7.1. Manure Database

The Effluent and Manure Management Database for the Australian Dairy Industry is a repository of reliable and scientifically validated technical information on dairy manure management adaptable to all dairying regions in Australia. The database outlines the principles for effective manure management, performance based design criteria for components of manure containment and reuse systems, and appropriate management principles for optimal operation of each design. The database not only provides the technical information required for on-farm manure management designs but also the technical base to support National, State and Regional regulations on dairy manure management, technical and farmer based extension programs, and educational material on dairy manure management.

8.7.2. DairyGains

DairyGains (Dairy, Government and Industry Nutrient Strategy) was an industry project with the key aims of improving the management of manure, sustaining management into the long term, minimising environmental impacts and improving nutrient management. The project produced the 'Management of Dairy Effluent – Victorian Guidelines', which complement the use of these guidelines.

The purpose of 'Management of Dairy Effluent – Victorian Guidelines' is to:

- assist dairy farmers to make informed and practical decisions in relation to dairy manure management while taking into consideration farm productivity and environmental requirements
- inform and raise awareness of industry expectations and obligations for dairy manure management
- establish clear standards and procedures for industry operators and service providers
- demonstrate that the dairy industry has an ongoing commitment to the environment.

Further Information

South Australian Dairy Industry website – Posters (including photos) showcasing manure management infrastructure at South Australian Dairying properties.
http://www.dairyindustrysa.com.au/for_farmers/effluent_management (Accessed on 25/08/2009)

Department of Primary Industries – Information notes regarding Effluent Management

- Dairy Effluent: Pond Site Selection (AG0424)
- Dairy Effluent: Maintenance Schedules and Contingency Planning (AG1374)

<http://www.dpi.vic.gov.au/DPI/nreninf.nsf/LinkView/BBB90E3F477DOB74CA256BC700811C92> (Accessed on 07/10/09)

**SOLID MANURE CAN
BE APPLIED USING
CONVENTIONAL
FERTILISER SPREADERS
(E.G. BELT DRIVEN)
OR PURPOSE
BUILT MANURE
SPREADERS WITH
VERTICAL/HORIZONTAL
BEATERS THAT
MACERATE AND
SPREAD THE MANURE**



References

ARMCANZ & ANZECC 1996, *Effluent management guidelines for dairy sheds*, National Water Quality Management Strategy, No. 16a, Agriculture and Resource Management Council of Australia and New Zealand, Australian and New Zealand Environment and Conservation Council.

Burcham, T.N., S.K. Gill and R.B. Moore. 1997, *Comparison of dairy manure separation technologies*. ASAE Paper No 974050, American Society of Agricultural Engineers, St. Joseph, MI.

Dairy Australia 2008, *Effluent and manure management database for the Australian dairy industry*. Dairy Australia, Melbourne, <http://www.dairyingfortomorrow.com/index.php?id=48> (Accessed 23/08/2009).

DairyGains 2008, *Management of Dairy Effluent – 2008 DairyGains Victorian Guidelines*, Department of Primary Industries on behalf of DairyGains, Victoria.

2009, *Draft National Guidelines for Beef Cattle Feedlots in Australia (3rd Edition)*

Shilton, A. (ed.) 2005, *Pond treatment technology*, Integrated environmental technology series, IWA Publishing, London, UK.

Sukias, J.P.S., C. Tanner, R.J. Davies-Colley, J.W. Nagels & R. Wolters 2001, *Algal abundance, organic matter, and physico-chemical characteristics of dairy farm facultative ponds: implications for treatment pond performance*, New Zealand Journal of Agricultural Research, 44, 279–296.

Zhang, R.H. & P.W. Westerman 1997, *Solid-liquid separation of animal manure for odour control and nutrient management*, Applied Engineering in Agriculture, 13(5), 657–664.



9. ANIMAL HEALTH AND WELFARE

Key objectives

- To understand:
- risk factors that affect animal health and welfare outcomes
- practices to achieve accepted animal health/welfare outcomes.

9.1. Cow Comfort and Behaviour

Cows held in a comfortable environment produce more milk and generally live healthier, longer lives. This comfort state relies on the provision of:

- well ventilated air
- adequate clean water
- high quality feed
- a clean and dry resting surface
- non slippery, even walking surfaces
- adequate lying, walking, feed and watering spaces
- calm, quiet and non stressful handling.

Adequate comfort will be demonstrated by:

- cows ruminating well and producing milk
- cows in appropriate body condition for their stage of lactation
- cows standing, lying and walking easily
- a low incidence of disease and injury within the herd.

Welfare is determined by the health and behaviour of the cow, both of which are affected by housing systems. Once cows are confined to any degree, cow comfort becomes a factor of critical importance in ensuring good welfare. Management is the key to success in any system. If poorly managed, any system can result in significant health and welfare issues, such as: lesions on legs and joints, inappropriate behaviour and dirty cows, leading to lameness, mastitis and poorer reproductive efficiency.

Facilities need to be designed with cow behaviour in mind (Cook 2008), especially in relation to ease of cow flow. Adequate space to walk, lie, feed and water is necessary to minimise the effects of bullying of younger and less dominant cows. Bullied cows will often drink and eat insufficient quantities. Overcrowding will also increase bullying and reduce lying time. Cows that rest for insufficient periods often show higher levels of lameness (Krawczel *et al* 2008).

9.1.1. Bedding Management

Bedding management in a freestall is vital to maintaining a clean, dry lying surface. Manure and wet bedding should be removed from the stall and dry bedding replaced to keep cows as clean as possible. Cleaning should be frequent enough to keep the back of the stall clean, as this is where the cows' udder and teats will be in contact with the bedding when she lies down. Generously bedded stalls may need to be leveled (e.g. twice per week). The bedding in stalls may be topped up as needed (e.g. daily) and completely removed after a long period (e.g. annually). However, bedding renewal frequency can vary between farms and the season, and the need for addition of fresh bedding should be assessed by bed and cow cleanliness, rather than following a strict routine. Lime can be used to manage moisture in the bedding surface.

Compost dairy barns require good management in order to be successful: excellent pack and ventilation management; appropriate stocking rates and bedding use; and excellent cow preparation procedures at milking time. The bedded pack needs to be aerated regularly (e.g. twice daily) to refresh the surface and enhance microbial activity in the pack (Endres, 2009). Grouping cows of similar age and size may be an advantage to limit bullying.

**WELFARE IS
DETERMINED BY
THE HEALTH AND
BEHAVIOUR OF THE
COW, BOTH OF WHICH
ARE AFFECTED BY
HOUSING SYSTEMS**



9.1.2. Cow Handling

Stockpersons' attitudes and behaviors influence animal behavior and consequently welfare and production (Hemsworth *et al* 2000). People tend to use long-established behaviors, through force of habit, that may not be ideal.

Cows should be allowed to move at their own pace to avoid unnecessary hoof wear and damage. It is important that cows are not crowded or forced excessively whilst on gravel or concrete, as this reduces the cows' ability to place her feet safely and increases hoof wear, injury and lameness. This is especially the case following calving, as hoof horn is softer at this time. Cows should walk willingly and freely, place hind feet on the same spot as front feet, have their head up to see where they will place their feet, not bump walls or each other when walking and rise and turn easily. Handlers should use slow, deliberate movements at all times, without flapping their arms or shouting. When moving stock, 'slow is quicker'.

The use of goads and dogs for the handling and moving of cattle should be limited to a minimum. Dogs that bite cattle should be muzzled when working. Physical goads should be made of material unable to physically damage an animal. They should not be applied to cattle legs as this may cause the animal to kick. 'Flappers' (e.g. leather straps attached to a cane) are acceptable. Metal or wooden pickets, pipes, strikers and fencing wire are not. The use of unreasonable force in twisting an animal's tail to cause it to move is unacceptable (BAW 2001). Canes and electric cattle prods should only be used in emergencies (e.g. situations that may potentially cause harm to the handler or the animals).

Some important features of cow behaviour that need to be remembered, for the sake of calm animal handling and operator safety, are:

- Flight zone – outside the flight zone, cattle will turn and face the handler and maintain a safe distance; inside the flight zone, they will move away. By moving in and out of the flight zone at varying speeds, the handler can control stock movement and speed.
- Point of balance – cows have a point of balance between their shoulders and hips. Standing forwards of this point, inside the flight zone will cause the cow to move backwards. Conversely standing behind this point and inside the flight zone will cause the cow to move forwards.
- Blind spot – whilst cattle have good all round vision, they do have a blind spot directly behind them. Moving suddenly in the blind spot will alarm cows and could cause flighty behaviour.
- Relaxed behaviour – when approached, calm cattle will stand up (if they were lying down) and stretch, their tail will be hanging down and they may be chewing their cud. They will probably turn towards you or at least look in your direction to assess your behaviour.
- Threat behaviour – cattle are domesticated animals but still show behaviours that evolved when they were wild animals, such as the head-down threat posture. An animal standing facing the threat (you), with head lowered, tail swishing and possibly also bellowing is demonstrating a threat posture. This is a warning but can quickly be followed by full attack. It is not safe to turn your back on an animal showing this posture, but you should immediately start to back away slowly. In the event of an animal charging, you should put your arms out to make yourself look bigger and yell 'menacingly' to give yourself a split second advantage while the animal re-assesses the situation. Use this advantage to get out of there.



- Fight or flight response – an animal that is agitated, alarmed or which feels threatened has its ears up, eyes bulging and tail tucked under. An animal in this state will not want you close to it and will probably be looking for an escape route. It could either try to climb through or over apparently solid structures, or it may turn and threaten the handler. In particular, bulls with a group of cows, or cows with their calves are more likely to threaten than seek escape.

have sharp exposed gravel. Wood shavings or sawdust can be used on laneways to provide softer surfaces in frequently trafficked areas. Rubber matting may prove useful in reducing hoof wear in frequently trafficked areas, where cattle may jostle for position (e.g. from the dairy yard to the feedpad). Stones on concrete floors may cause bruising and efforts should be made to remove them on a regular basis. New concrete and grooving is often very abrasive and may need to be abraded and cleaned prior to use.

9.2. Hoof and Leg Health

Lameness is a painful and costly condition and prevention is always preferable to treatment. Facility design, as well as staff competency, attitude and actions, should reflect an understanding of the need for gentle and free cow flow. Normal cow walking behaviour will allow for appropriate cow resting, movement and husbandry, and assist in prevention, diagnosis and treatment of lameness.

Alleys and concrete yards need to be cleaned regularly enough, so that cows are not continuously walking in slurry manure (urine and faeces) and mud. This predisposes to excessive hoof hydration, heel horn erosion, wear, infection and lameness. It is preferable for hooves to be able to dry out on a daily basis (Borderas *et al* 2004). Cows hooves that are wet for extended periods of time become soft and more prone to wear and lameness (O'Driscoll *et al* 2008).

MOST LAMENESS

ARISES FROM

CONDITIONS

AFFECTING THE HOOF,

AND AN IMPORTANT

ASPECT OF LAMENESS

MANAGEMENT IS THE

TYPE OF SURFACE THE

COWS WALK ON

Most lameness arises from conditions affecting the hoof, and an important aspect of lameness management is the type of surface the cows walk on. Surfaces should not be excessively abrasive, slippery or continuously heavily contaminated with mud or manure (Cook 2004). Surfaces may be compacted earth, gravel, concrete or artificial compounds (e.g. rubber coated concrete). Feedpad and laneway surfaces should be designed to shed water and not become excessively muddy or

If cows are to spend a lot of time on concrete surfaces, animals with superior leg and feet conformation should be selected (Bergsten 2001). Selection should be based on hooves that are short, angled steeply, with high heels and even claws. The sole should be concave with the majority of the weight taken by the hoof wall. Poor conformation should be avoided where possible, including overly straight hocks, weak pasterns, sickle hocks, splay toes, or overlapping toes, as these conformations may increase the rate of lameness. Some hoof conformation may be restored by trimming.



A professionally developed hoof health plan including staff training, monitoring, recording, prevention, diagnosis and treatment is recommended. All hooves should be examined at least once per year, trimmed and treated as necessary. The incidence of lameness often increases with increased use of cement and pressure to walk. Professional advice should be sought if there is a sudden increase in lame cow numbers, or if more than 7% of cows are diagnosed as being lame in one year (Chesterton *et al* 2008). Resources including Dairy Australia's 'CowTime' and 'OnTrack' and the training video 'Lameness Management in the Dairy Herd' will help to develop understanding of cow dominance, behaviour, social interaction and movement husbandry.

Conditions of the upper limb, such as hock lesions, knee lesions and adventitious bursa may also occur. These are often due to inappropriate bedding type or thickness. Hip and shoulder injuries are usually a sign of cattle being forced on to metal objects as a result of inappropriate handling or post/rail placement. Gateways and fencing should be maintained so there are no projections, such as broken boards or rails, or protruding nails on which cows might injure or bruise themselves.

Nutrition, especially when a high percentage of the diet is mixed rations, needs to be professionally formulated and monitored. High quality silage-based diets, especially in heifers, may also predispose to clinical and sub-clinical laminitis (Stone *et al* 2004).

9.3. Udder Health

Good udder health depends on a number of factors, including a good udder, teat and teat-end conformation; environmental conditions; cow behaviour and milking management.

Cows with a genetically superior udder and teat conformation should be selected. They should preferably have compact/non-pendulous udders, short teats with healthy skin and good teat sphincters that allow free milking, but close quickly following milking. There may also be an advantage in selecting replacement heifers from cows with a low occurrence of clinical mastitis and bulls with a history of offspring with a low incidence of clinical mastitis.

A professionally produced mastitis prevention, monitoring and treatment plan is recommended to prevent new infections and control current infections with contagious or environmental organisms that includes staff training. The 'Countdown Downunder' extension program is recommended. It is important that cows do not lie down in alleys, laneways or other muddy areas, as this predisposes them to mastitis. Bedding or mattresses may provide a medium for bacterial growth and may need to be treated with acid, alkaline, ash or lime if a mastitis problem is evident in freestall and loose housing systems. Bedding management is important to limit bacterial growth and teat contamination. In freestalls keep bedding dry and limit urine and faecal contamination, and in loose housing maintain correct aeration and composting practices.

**A PROFESSIONALLY
PRODUCED MASTITIS
PREVENTION,
MONITORING AND
TREATMENT PLAN
IS RECOMMENDED
TO PREVENT NEW
INFECTIONS AND
CONTROL CURRENT
INFECTIONS WITH
CONTAGIOUS OR
ENVIRONMENTAL
ORGANISMS THAT
INCLUDES STAFF
TRAINING**



9.4. Injury

Facility design must ensure that cow flow is maintained and obstructions are avoided. Cows must be able to see where they will place their feet to allow normal movement. Cows should not be pushed from behind as a group, as dominance has a great effect on cow flow and gentle/slow handling is essential. Non-slip surfaces will reduce the incidence of upper leg and hip injuries, often related to oestrus or bull mating behaviour.

9.5. Nutrition

Cows require sufficient high quality nutrition to provide for growth (in heifers and cows under 3 years of age), maintenance, reproduction and production in different classes of stock.

Cows suffering from painful or debilitating conditions may not eat sufficient food and can lose weight quickly. Cows given diets with high levels of soluble carbohydrate are predisposed to acidosis and need close monitoring and management (Rustomo *et al* 2006). Different classes of stock may need to be run as separate herds, to allow for adequate, accurate and specific feed delivery. Inappropriate or unbalanced diets may lead to acidosis, laminitis, milk fever, ketosis, retained placenta, fat cow disease and other conditions.

Staff members need adequate training or experience to be able to monitor feeding behaviour, manure scoring and recognise herd or individual cow issues. Botulism vaccination should be considered if processing mixed rations on farm. Professional nutritional advice is highly recommended, especially in large herds (greater than 300 cows), and when mixed rations supply a high percentage of the diet.

It is recommended that genuine vendor declarations accompany incoming feedstuffs, to reduce the possibility of receiving contaminated feedstuffs (e.g. salmonella, fungus, chemicals).

9.6. Manure Management and Reuse

Feedpads, laneways, alleys and other walking surfaces need to be cleaned of manure and mud as often as needed to maintain relatively clean and dry walking surfaces (see Section 8.2). Manure may be reused as bedding following suitable composting processes.

The organisms responsible for conditions like Johne's Disease, salmonellosis, leptospirosis, mastitis, internal parasite infestations, coccidiosis, clostridial and Enzootic Bovine Leucosis may be present in raw manure and recycled effluent. Extended manure residence time and dilution with water will reduce the risk of these organisms remaining viable after land application. To reduce the risk of spreading disease from manure and recycled effluent to animals:

- do not graze young stock (under 12 months of age) on pasture that has received raw manure or recycled effluent
- do not graze older cattle (over 12 months of age) for three weeks after spreading manure or effluent or until the pasture has received at least a week's strong sunshine (DPI Vic AgNote 0419)
- consider botulism vaccination if fertilising pastures/crops with chicken manure
- consider a north – south orientation for covered feedpads to allow sunlight in the morning and afternoon to help dry cow standing areas.

**COWS SUFFERING
FROM PAINFUL
OR DEBILITATING
CONDITIONS MAY
NOT EAT SUFFICIENT
FOOD AND CAN LOSE
WEIGHT QUICKLY**



9.7. Shelter and Environment

Shelter should be available to help protect animals from extremes in environmental conditions, including cold wind, heat, prolonged rain and flood. Protection from heat and rain is important at certain times of the year (see Section 10). It may be necessary to utilise feedpads and yards as temporary refuge areas in times of flood.

Freestalls and loose housing systems must be well ventilated, especially in front of the stalls. Overstocking will promote a build-up of dust, humidity and ammonia which may reduce lying time and predispose cows to respiratory conditions. Respiratory disease vaccination may need to be considered if this is an issue for the farm.

Discarded and spoilt feed around feed storage areas and the feedpad may attract unwanted pests and should not be left exposed. Fly control may be necessary, as a build up of flies may irritate cows, reducing lying time and production, and also predisposing them to mastitis. Vermin control may also be necessary, as rats may introduce diseases into a freestall or loose housing systems.

9.8. Behavioural Enrichment

Behavioural enrichment is the practice of providing animals under managed care with environmental stimuli to improve quality of life. Generally cows need little behavioural enrichment as feeding, ruminating and resting occupy most of their time and other cows in the herd provide social stimulation. However, cow brushes may be provided to allow cows to groom and scratch themselves. It may also reduce frustration and stress due to boredom. Cows can be very vigorous in their use of brushes so these need to be robust. Some brushes automatically start to rotate when an approaching cow is detected, which may encourage their use. Cows particularly use brushes to scratch their backs, rather than their heads, so brushes which allow this behaviour are preferred.

9.9. Health Plan

A professionally developed and managed health plan for the specific enterprise is essential. Staff should understand the content of the plan and know where to locate it. It should include:

- the relevant Codes of Practice
- necessary staff resources and training procedures
- vaccination and parasite control procedures and records
- animal husbandry and management practices
- euthanasia procedure
- specific sections on lameness, mastitis control and eye conditions
- biosecurity procedures and disease outbreak contingency plans.

To avoid unnecessary injury to animals and personnel, all cattle should be dehorned, preferably as calves, using approved methods. Routine tail docking is discouraged.

Cows that can not stand or walk unaided following calving, hip or leg injury or other disease or injury must be treated as a medical emergency. They should receive immediate treatment, including adequate bedding, shelter from climatic extremes, nursing, rolling and humane assistance with standing, preferably with multi-strap slings at least twice daily (Stull *et al* 2007). Veterinary attention/advice should be sought if the animal is not responding to treatment or if a number of cases are occurring. Consider humane destruction immediately, especially for animals that have been down for more than 24 hours (Green *et al* 2008). Appropriate carcass disposal systems need to be in place.

TO AVOID

UNNECESSARY

INJURY TO ANIMALS

AND PERSONNEL,

ALL CATTLE SHOULD

BE DEHORNED,

PREFERABLY AS

CALVES, USING

APPROVED METHODS



**MANAGEMENT IS
CRITICAL TO THE
SUCCESS OF ALL
HOUSING SYSTEMS
AND IT IS IMPORTANT
TO MONITOR THE
COWS' HEALTH AND
WELL-BEING TO
ASSESS THE SUCCESS
OF MANAGEMENT
STRATEGIES**

9.10. Reproduction and Calving

It is important to have appropriate facilities and procedures for mating and calving. They should promote efficient herd reproduction rates and reduce the incidence of disease and injury at mating and calving (Dairy Australia 'InCalf' extension program, Mee 2004). Accurate records of oestrus and mating are essential to predict calving date and observe cows prior to calving. Bull mating should occur on non-slippery surfaces and bulls of appropriate size should be used to minimise damage to heifers at mating. Slippery floor surfaces are often associated with leg and pelvic injury, especially in cows showing oestrus behaviour or calving.

To reduce the incidence of dystocia, peri-parturient disease and calf loss:

- calving heifers should not be over fat
- avoid sires with known calving difficulty with heifers and small cows
- feed appropriate rations during lactation and the dry period
- avoid routine calving induction
- calving should take place in a clean and dry environment.

9.11. Monitoring

Management is critical to the success of all housing systems and it is important to monitor the cows' health and well-being to assess the success of management strategies. It is recommended that all staff members be well trained in observing normal behaviour and recognising and reporting abnormal or unusual behaviour, and other signs that may indicate emerging health and welfare issues (the ProHand Dairy Cows CD-based stock handling training packages are available from the Animal Welfare Science Centre).

The following observations can be used to monitor and identify emerging issues in freestall and loose housing systems.

1. Do cows appear comfortable when standing or lying?
2. Do cows lie backward in stalls or in alleys?
3. Do cows stand half-in or half-out of stalls? (This can occur when stalls are too short, when the neck rail is too far back, or when stalls are otherwise uncomfortable)
4. Do cows stand in stalls in an angular fashion? (This could indicate that stalls are too wide)
5. Are all stalls used equally?
6. When cows normally rest (between 10 pm and 4 am) is more than 20–30% of the herd standing in the stalls?
7. Are cow udders, tail switches or hindquarters dirty? (This could indicate dirty bedding, but could also be due to insufficient fibre in the diet)
8. Are there patches of rubbed-off hair or visible injuries to hocks and knees? (These are signs that cows rub excessively on stall partitions or neck rails when rising or lying down).
9. Are cows walking very slowly, or timidly, with rear feet spread wide? (This could be a sign of poor traction or laminitis).

The following tests may give an indication of bedding comfort.

'Wet knee test' – kneel in the stall for 10 seconds. If your knee is wet, then your stall bedding is not dry enough.

'Drop knee test' – crouch and then drop to your knees in the stall. This will quickly tell you how truly comfortable your stalls are for the cows.



A **Clegg Impact Soil Tester** (Lafayette Instruments: model 95051,) with a 20 kg hammer can be used to compare the compressibility of different surfaces which correlates well with cow preferences. It can also be used to test for changes in compressibility over time (Fulwider and Palmer, 2004).

The following may be indicators that all is not well:

- cows bellowing or calling vocalisation (This may be an indicator of inappropriate facility/handling issues)
- abnormal locomotion or cow movement behavior
- some cows slipping or falling. This may indicate inappropriate walking surfaces or management of surfaces.
- more than 20% of the cows defecate in the milking facility (this could be a sign of discomfort or uneasiness).

Further Information

National Model Codes of Practice for the Welfare of Animals (SCARM) Australia and New Zealand Codes

Animal Welfare Standards and Guidelines – Land Transport of Livestock (2009) (DAFF) <http://www.animalwelfarestandards.net.au/landtransport.pdf>

Farm Animal Management and Welfare Guidelines Qld Dairyfarmers' Org

National Animal Welfare Strategy (DAFF) <http://www.daff.gov.au/animal-plant-health/welfare/aaws>

Code of accepted farming practice for the welfare of cattle (Vic DPI) <http://www.dpi.vic.gov.au/DPI/nreninf.nsf/LinkView/B49A42716C4DB484CA256BC70081154C>

RSPCA Australia <http://kb.rspca.org.au/?View=entry&EntryID=207>

DeLaval Dairy Knowledge http://www.delaval.com/Dairy_Knowledge

Dairy Australia Publications/Resources:

- Countdown Downunder <http://www.countdown.org.au>
- InCalf; <http://www.incalf.com.au>
- CowTime <http://www.cowtime.com.au>
- On Track <http://dairyinfo.biz/default.asp?PageID=111&n=Lameness+Guidelines>
- Cool Cows <http://www.coolcows.com.au>
- People in Dairy <http://www.thepeoplein.dairy.org.au>

Lameness Management in the Dairy Herd a DVD set by Neil Chesterton B V Sc <http://www.lamecow.co.nz>

Australian Animal Welfare Standards and Guidelines <http://www.animalwelfarestandards.net.au/index.htm>

ProHand Dairy Cows – CD-based stock handling training package <http://www.animalwelfare.net.au/>

The Healthy Feet Project – The University of Bristol <http://www.cattle-lameness.org.uk/>



References

- Amory JR, Kloosterman P, Barker ZE, Wright JL, Blowey RW, Green LE, 2006, *Risk Factors for Reduced Locomotion in Dairy Cattle on Nineteen Farms in The Netherlands*, J. Dairy Sci. 89:1509-1515.
- Barberg AE, Endres MI, Salfer JA, Reneau JK, 2007, *Performance and Welfare of Dairy Cows in an Alternative Housing System in Minnesota*, J. Dairy Sci. 90:1575-1583.
- Bergsten C, 2001, *Effects of conformation and management system on hoof and leg diseases and lameness in dairy cows*, Vet Clin North Am Food Anim Pract. Mar;17(1):1-23.
- Borderas TF, Pawluczuk B. de Passillé AM, Rushen J, 2004, *Claw Hardness of Dairy Cows: Relationship to Water Content and Claw Lesions*, J. Dairy Sci. 87:2085-2093.
- Chesterton RN, Lawrence KE, Laven RA, 2008, *A descriptive analysis of foot lesions identified during veterinary treatment for lameness on dairy farms in north Taranaki*, NZ Vet. J. Jun;56(3):130-8.
- Cook NB, Marin MJ, Mentink RL, Bennett TB, Schaefer MJ, 2008, *Comfort zone design free stalls: do they influence the stall use behavior of lame cows?* J. Dairy Sci. 91(12):4673-8.
- Cook NB, Bennett TB, Nordlund KV. 2004, *Effect of Free Stall Surface on Daily Activity Patterns in Dairy Cows with Relevance to Lameness Prevalence*, J. Dairy Sci. 87:2912-2922.
- Fulwider WK and Palmer RW, 2004, *Use of impact testing to predict softness, cow preference, and hardening over time of stall bases*, Journal of Dairy Science 87, 3080-3088.
- Hopkins D, 1999, AgNote 0419 *Dairy Effluent: Application to Pastures*, Department of Primary Industries, Victoria.



10. DAIRY CATTLE COOLING

Key objectives

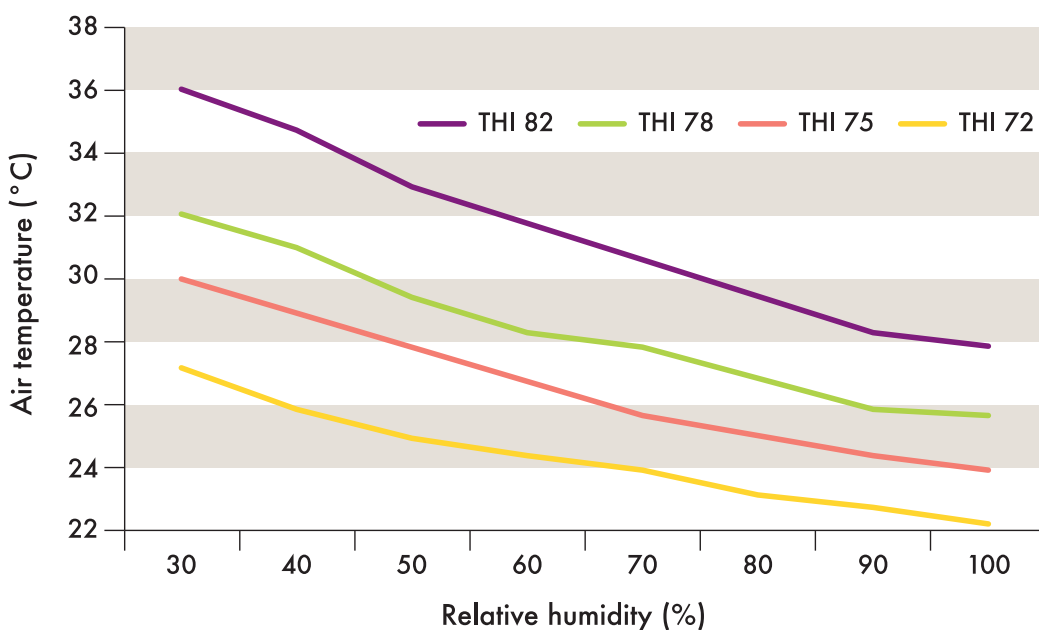
To ensure appropriate standards of animal health and welfare are maintained by:

- providing practical methods for assessing and managing heat load
- analysing and monitoring potential milk yield losses resulting from heat load
- adopting practical design features to minimise the impact of heat load.

10.1. Measuring Heat Load

Keeping cows cool is critical to maintaining high feed intakes and high milk production. Feedpad design can have a major influence on the way in which cows are kept cool. The best way to measure the impact of heat load on the biological performance of dairy cattle is through the Temperature Humidity Index (THI) – see Figure 10.1. This index uses the combined impact of temperature and relative humidity, to assess the risk of heat stress. For example:

- when THI exceeds 72 cows begin to reduce intake in response to heat load
- when THI exceeds 82 large losses in milk yield occur and if not treated the cow can die.



Source: Dairy Australia, 2008

Figure 10.1 – THI for Different Combinations of Temperature and Humidity



10.2. Symptoms of Heat Load

Heat load and subsequent stress on dairy cattle can affect cow health and welfare and impact on the following productive traits of dairy cattle:

- reduced milk yield
- reduced fat and protein concentration in milk
- increased incidence of mastitis
- reduced fertility
- reduced calf birth weight.

10.3. Economic Impact of Heat Load

Table 10.1 shows the likely loss in milk yield and associated income loss for a 300 cow herd at Shepparton in Northern Victoria under heat load conditions. The THI break point is the point at which yield starts to decline for different cooling systems. For example, if cows are under a solid roofed shed with sprinklers then the environmental THI at which milk yield starts to decline is higher than if they were in unshaded paddocks and grazing. The economic loss shown below is only for milk yield so other potential losses from reproduction, milk components, increased mastitis and reduced calf birth weight, are not included. Therefore the losses quoted are an underestimate of the total losses due to heat load. The financial loss in Table 10.1 is a guide to allow producers to calculate the investment needed in cooling systems to minimise productivity losses.

Table 10.1 – Effect of Heat Load and Cooling Systems on Milk Production

	No Shade	Tree shade in paddocks	Corrugated iron over feedpad	Corrugated iron and sprinklers
THI break point	72	74	76	78
Lost milk (Litres/cow/year)	430	273	161	87
Dollars lost per year (\$)	\$36,120	\$22,932	\$13,524	\$7,308

Source: Mayer *et al* (1999)

Table 10.1 assumptions: Shepparton region, cows producing greater than 20 litres per day; a summer milk price of 28 cents per litre; maximum loss per unit of THI.



10.4. Practical Ways to Observe Heat Load in Cows

Cows use a variety of behavioural mechanisms to deal with increasing heat load and they provide a guide to the severity of stress. Symptoms of increasing heat stress are as follows:

- seeking shade
- increased respiration rate
- decreased feed intake
- crowding over watering points
- body splashing
- reduced or no rumination
- open mouthed breathing and salivation
- collapse, convulsions, or coma
- death.

10.4.1. Observing Respiration Rate

The most practical way for a farmer to assess the impact of heat stress on a herd at any point in time is by monitoring cow respiration rates. Respiration rate is measured by counting the flank movements of a small sample of cows in the herd over 20 seconds, and multiplying the value by 3. It is important to measure cows of different ages and lactation number, as heifers are generally more resistant to heat stress due to a lower body mass and skin surface area.

Sick animals often have higher respiration rates and should not be included in the sample.

- The ideal respiration rate for a cow is 60 breaths per minute or lower.
- When the respiration rate is above 60 breaths per minute, intake will start to decrease.
- Respiration rates increase with increasing heat load and have been observed as high as 130 breaths per minute.

10.5. Whole Farm Strategies to Deal with Heat Stress

It is recommended that an integrated whole of farm and whole of year approach is considered to manage heat load. There is a range of options available depending on the severity of heat load for individual farms. (This is beyond the scope of these guidelines)

Refer to 'Cool Cows – Dealing with Heat Stress in Australian Dairy Herds' by Dairy Australia. It is the most up to date reference and it outlines practical strategies to deal with heat load on farms (see www.coolcows.com.au).

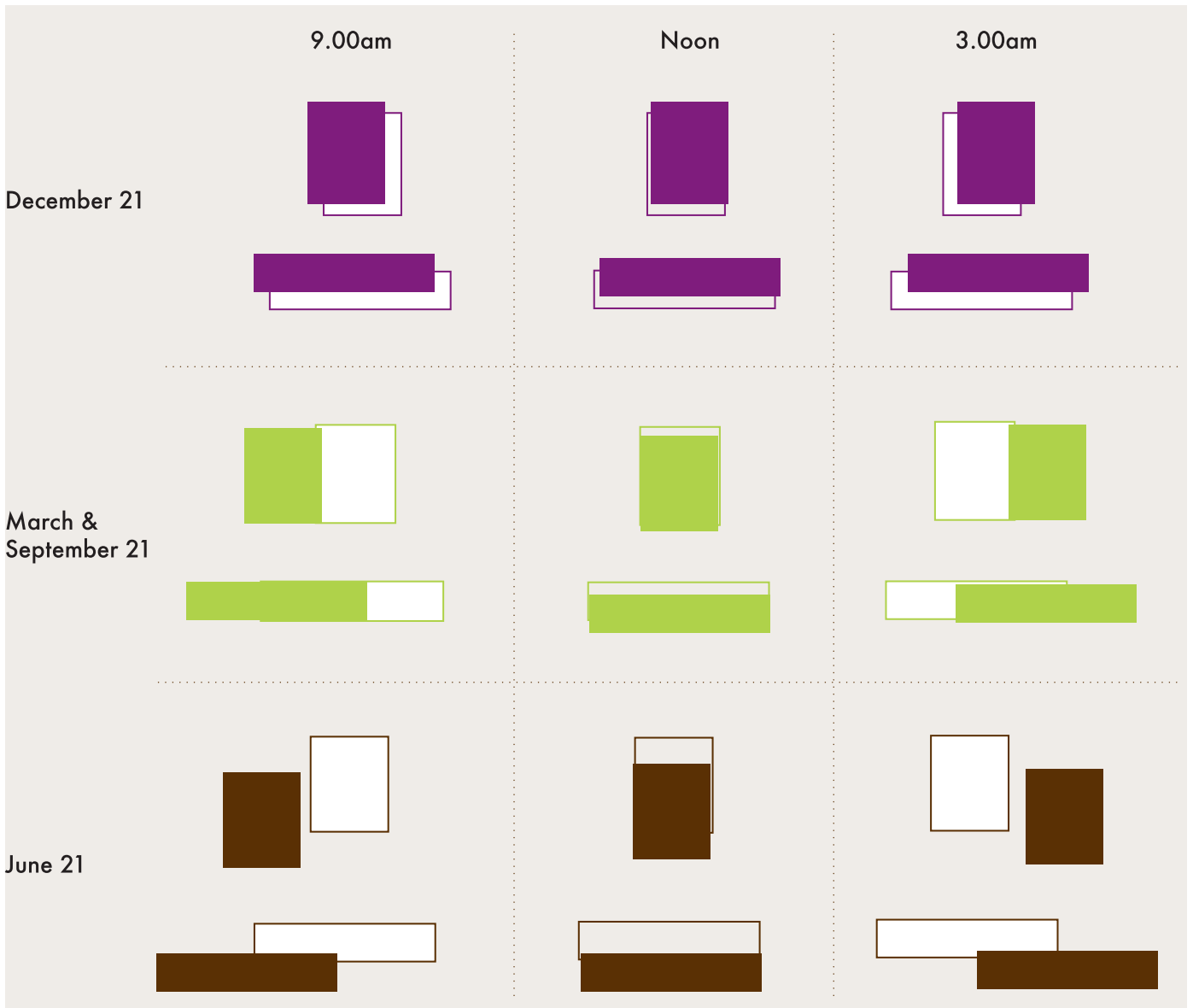
10.6. Practical Feedpad Design

Feedpad design principles that assist with cooling cows are detailed in Section 7. The most important issues are:

- interception of radiation (see Figure 10.2)
- orientation (e.g. north-south or east-west)
- roof pitch
- use of a ridge opening in the roof
- roofing material
- passive or mechanical ventilation
- use of sprinkling systems
- the area of shade available per cow (3.5–5 m² per cow is preferred).

Figure 10.2 demonstrates the effect of a north-south or an east-west orientation on shade for different seasons of the year.

THE MOST PRACTICAL WAY FOR A FARMER TO ASSESS THE IMPACT OF HEAT STRESS ON A HERD AT ANY POINT IN TIME IS BY MONITORING COW RESPIRATION RATES



Source: Dairy Australia, 2008

Figure 10.2 – Seasonal Shading Effect



10.7. Using Sprinkler Systems and Fans

If sprinkler systems and/or fans are installed, the following design features should be considered.

- Locate them so that water does not excessively wet the feeding table or where cows can interfere with their operation.
- Timers activated by temperature settings will assist in reducing water wastage.
- A common system uses a 2 minute on; 12 minute off cycle of cow wetting.
- Evaporative cooling will occur if large water droplets wet the cow's skin (this is essential in higher humidity environments).
- Consider feedpad orientation to promote passive cooling before installing fans.
- High ventilation fans are needed to force air over cows and are only effective when designed in combination with sprinkling systems.
- Fans have a lower impact on cooling where adequate air movement exists either due to feedpad siting, wind movement, farm topography or the shed design.

References

Dairy Australia 2008, *Cool cows, Dealing with heat stress in Australian dairy herds*, Dairy Australia, Melbourne, <http://www.coolcows.com.au> (Accessed on 10/07/2009).

Davison T and Andrews J 1997, *Feed Pads Down Under*, Queensland Department of Primary Industries, Brisbane.

Davison T, McGowan M, Mayer D, Young B, Jonsson N, Hall A, Matschoss A, Goodwin P, Goughan J, and Lake M 1996 *Managing hot cows in Australia*, Queensland Department of Primary Industries, Brisbane.

Davison TM, Silver BA, Lisle AT and Orr WN. 1988, *The influence of shade on milk production of Holstein-Friesian cows in a tropical upland environment*, *Australian Journal of Experimental Agriculture* 28:149-154.

Johnson HD, Ragsdale AC, Berry IL and Shanklin MD. 1962, *Effect of various temperature-humidity combinations on milk production of Holstein cattle*, *University of Missouri Research Bulletin* 791:1-39.

Mayer D.G., Davison T.M., McGowan M.R. 1999, *Extent and economic effect of heat loads on dairy production in Australia*, *Australian Veterinary Journal* 77:804-808.

Moran J, McDonald S and Spry J 2010, *Feedpads for Grazing Dairy Cows*, Department of Primary Industries, Victoria.



11. WATER SUPPLY

Key objectives

To ensure appropriate standards of animal health and welfare; and hygiene are maintained by:

- providing a sufficient volume of good quality water
- designing the system so it can manage increased demand
- designing and locating watering points so that water is not contaminated by feed
- designing and installing watering points that are easy to clean.

Salts can be imported in to the manure management system from:

- wash down water (consider testing new bores before use)
- feeds (e.g. concentrate by-products or supplements)
- cleaning agents used at the dairy or on alleys.

Refer to Manure Database (Element 3.6 – Salinity).

11.2. Volume and Space Requirements

Lactating cows tend to drink after milking and they can consume up to 20 litres of water per minute. Each watering point should be able to hold 200–300 litres of water, with a minimum flow rate of 10 litres per minute. The volume can be reduced to approximately 100 litres if the flow rate is increased to 20 litres per minute. At least 50 mm of water point space should be provided per cow in systems where cattle are confined for 24 hours per day. The optimal water point height is between 600–900 mm (cow feet level to top of water point). A depth of 150–200 mm is recommended to maintain cool water temperature and reduce debris accumulation.

11.1. Water Quantity and Quality Requirements

DCFWG (2002) suggests water reticulation systems should supply at least 20 litres per cow per hour. The optimal drinking water temperature is 15–17 degrees Celsius.

Watering points should be cleaned at least weekly to remove any feed material or other contaminants.

Salinity is the presence of high levels of soluble salts in soils and waters (Dairy Australia, 2008). Saline water can affect animal health and impact on the manure management system. Hence, stock and wash down water supplies should be analysed regularly to check salinity levels. If recycled effluent is used for yard or alley washing, salts will accumulate in the system. Salinity can accumulate in ponds, especially where evaporation rates are high and there is minimal freshwater (low salinity) entering the system.

**SALINE WATER CAN
AFFECT ANIMAL
HEALTH AND IMPACT
ON THE MANURE
MANAGEMENT SYSTEM**



11.3. Water Point Location

Water points should be:

- surrounded by plenty of passage space and preferably on the outside of the traffic curve
- easily accessible as soon as cows leave the dairy and also within 15 m of the feeding table
- easily accessible for cleaning. A bung should be provided to drain the system completely (for earthen pads the drainage water should be piped directly from the water point to the manure management system).

Preferred location on concrete feedpad:

- away from the feed alley to prevent feed contaminating the water
- within the feedpad complex, so that spillage and water point flushing can be directed in to the manure management system.

Preferred location in a freestall:

- at the crossovers to prevent feed contaminating the water and to reduce the incidence of cattle blocking each other in the alleys.

Preferred location on an earthen feedpad:

- away from the feed source on the down-slope side of the pad, so that water can drain directly in to the manure management system. This helps to minimise the formation of wet patches throughout the feedpad.

References

Moran J, McDonald S and Spry J 2010, *Feedpads for Grazing Dairy Cows*, Department of Primary Industries, Victoria.

DCFVG 2002, *Dairy cattle feedpad guidelines for the Goulburn Broken Catchment*, Goulburn Broken Catchment Management Authority, Shepparton, <http://www.gbcma.vic.gov.au/downloads/DairyFeedPadGuidelinesMay2002/FrontSection.pdf> (Accessed on 10/07/2009).

Delaval website, http://www.delaval.com/Dairy_Knowledge/EfficientCowComfort/Drinking.htm (Accessed on 14/08/09).



12. FEED STORAGE AND MANAGEMENT

Key objectives

To ensure appropriate standards of animal health and welfare; and hygiene are maintained by:

- ensuring there is adequate feed supply on farm at all times
- designing feed storages that enable efficient preparation and delivery of feed to the cattle
- establishing feed handling and delivery procedures that enable efficient preparation and supply of feed to the cattle.

12.1. Overview

Feed management includes four main functions: storage, handling, mixing and delivery. Storage can have a big impact on preserving feed quality and minimising losses, while feedpad design can influence cow intake and maintenance. The layout of feed storage and mixing areas can influence operating times and labour costs substantially.

Feed sourced from forage, concentrates, by-products or minerals can be supplied to cows either individually or as a mixed ration in a feedpad operation. A feedpad can reduce wastage, thus improving utilisation of feed sources. Estimates suggest that if supplements are fed on the ground to cows in a paddock then losses of up to 30% may occur and this has a direct impact on farm costs.

**FEED SOURCED
FROM FORAGE,
CONCENTRATES,
BY-PRODUCTS OR
MINERALS CAN BE
SUPPLIED TO COWS
EITHER INDIVIDUALLY
OR AS A MIXED
RATION IN A FEEDPAD
OPERATION**

12.2. Storage Types

- Above or below-ground **bunkers** with removable covers (e.g. tarp, silage wrap or earthen covers). Feed from the 'face' of the bunker is removed daily. Materials range from earthen floors and walls to bunkers with concrete floors and walls.
- Steel or concrete vertical **silos** mainly used for grains or protein meals. Capacities range from 8 to in excess of 1000 tonne storage. Silos can be arranged in a semi circle to create a single load-in point.
- **Bales** can be individually wrapped or wrapped in groups. Bales are a good long term storage method, however they need to be kept tightly closed especially if they contain silage. They need to be protected from birds, vermin and cattle. Ruptures to bales will cause spoilage of the stored material.
- **Sheds** can be used to store feeds in bulk, or individual bays within the shed. They typically have concrete floors with timber, steel or concrete used to construct bays. Hay is typically stored under sheds or under large plastic tarps.
- **Tanks** can be used to store liquid commodities (e.g. molasses). Consult with the tank manufacture to determine the most applicable tank (i.e. some liquid commodities may corrode metallic tanks.)

12.3. Storage and Handling

- Feeds should be stored to minimise spoilage from soil, manure, wind, rain and attack by vermin.
- Concrete bunkers and surfaces, and dedicated feed sheds will minimise losses of expensive feeds and prevent contamination by stones or soil.
- Storage bunkers or commodity sheds need to be close to the feedpad to minimise time and labour taken for mixing and delivery.



- Storage sizing for imported commodities should be calculated on truck volumes that allow for the existing quantities in storage.
- Storage needs to be located so there is adequate room for machinery to operate in a safe manner.
- Feed ingredients change with time due to individual preference, market prices and quality. Therefore storage and handling equipment needs to be adaptable, or able to accommodate change with minimal impact on the operation.

12.4. Feed Delivery

12.4.1. Feeding Table

- Seepage from wet rations (defined as below 50% dry matter) such as brewers grains or citrus pulp should be directed in to the manure management system. If troughs are used the accumulated seepage needs to be managed to prevent spoilage of other feeds.
- If acidic feeds are used for extended periods then epoxy resin can be applied to the feeding table to prevent corrosion. Tiles are another way to seal concrete from feed based acids, which can be high in silages, molasses and other high moisture feedstuffs (see Table 7.1).
- Feeds with low bulk densities, such as hay, will require a larger feeding table volume to be supplied.

12.4.2. Feed Out

The key issues to consider are:

- feed needs to be fresh and palatable – a well managed feeding table is often a good indicator of overall farm management
- prevent feed contamination by soil, manure, or other contaminants – use of dirt alleys next to cement feeding tables often allows mixing of soil and rainfall runoff with feed over time
- feed out chutes and speed of delivery from mixer wagons needs to be calibrated to minimise wastage (this is particularly important if narrow troughs are used)
- frequency of feed out – should be proportional to the time spent on feedpads or freestalls. Where cows spend 6–8 hours between milkings on a feedpad, then one feed out is adequate. An American study of cows on total mixed rations indicated that four feed-outs per day was more effective than one or two, in terms of milk production (Gibson 1984).

Further Information

Dairy Australia website – Flexible Feeding Systems Fact Sheets

The fact sheets provide information for dairy farmers facing reduced fodder availability and relying on alternative feeds. It also examines new feeding systems that are more flexible and resilient to the effects of climate change and drought.

<http://www.dairyaustralia.com.au/Farm/Feeding-Cows/Feeding-Systems/Flexible-Feeding-Systems.aspx>

Refer to *Manure Database* (Element 4.3 – Feed storage and wastage).



References

Gibson, J.P. 1984, *The effects of frequency of feeding on milk production of dairy cattle: an analysis of published results*, *Animal Production* 38: 181–188.

Dairy Australia 2007, *Flexible Feeding Systems – Mixing and Delivering Feed (Fact Sheet 6)*, <http://www.dairyaustralia.com.au/Farm/Feeding-Cows/Feeding-Systems/Flexible-Feeding-Systems.aspx>
Accessed on (22/08/2009).

McFarland DF 2003, *Nutritional interactions related to dairy shelter design & management*, Proceedings of the 28th Western Canadian Dairy Seminar, 9–12 March.

Moran J, McDonald S and Spry J 2010, *Feedpads for Grazing Dairy Cows*, Department of Primary Industries, Victoria.

MWPS 2000, *Housing and Equipment, MWPS-7, Seventh Edition*. Ames, Iowa, Midwest Plan Service, Iowa State University.

Davison T and Andrews J 1997, *Feed Pads Down Under*, Queensland Department of Primary Industries, Brisbane.



13. OCCUPATIONAL HEALTH AND SAFETY

Key objectives

To ensure that dairy farms:

- provide a safe working environment for all staff, contractors and visitors
- provide appropriate training and/or induction for all staff, contractors and visitors
- address regulatory obligations from the state *Occupational Health and Safety Act (2004)*.

13.1. Dairy Property OH&S Considerations

13.1.1. Farm Scale

At a farm scale, it is important to:

- regularly maintain all equipment and machinery
- provide adequate lighting around high use areas, especially if these areas are frequented before sunrise/after sundown
- implement a training program for staff, contractors and visitors to inform them of potential dangers and ways to minimise exposure to any dangers
- train staff in interacting with animals in confined spaces (e.g. dairy shed, yard or feedpad)
- ensure staff are trained and skilled to undertake the farm activities and responsibilities required of them.

13.1.2. Equipment and Machinery

Implement regular inspection and maintenance scheduling. Appropriately trained personnel should ensure all equipment maintains operational performance. This should involve:

- regularly inspecting all equipment and machinery; promptly rectifying defective equipment and machinery failures; and implementing repair and maintenance programs
- ensuring all guards and safety systems are in place on all machinery and equipment.

13.1.3. Pad/Flooring Surfaces

Provide non-slip floor surfaces for both animals and staff.

13.1.4. Confined Spaces

Adhere to confined space regulations when entering manure containment sumps or tanks. Information is available from WorkSafe Victoria.

**IMPLEMENT REGULAR
INSPECTION AND
MAINTENANCE
SCHEDULING.
APPROPRIATELY
TRAINED PERSONNEL
SHOULD ENSURE
ALL EQUIPMENT
MAINTAINS
OPERATIONAL
PERFORMANCE**



13.1.5. Ponds

To minimise risks around ponds:

- control weeds and vegetative growth around the manure management system (especially ponds), so that the extent of the system is clearly visible
 - locate and clearly mark pond surfaces before moving machinery for desludging and maintenance activities
 - use wheel chocks or railing barriers with pond agitation machinery to prevent vehicle movement
 - consider topography when using slurry tankers and solid spreaders, as they are not suited to steep sloping embankments
 - ensure appropriate fencing and warning signage is in place around ponds.
- make sure staff are up to date with any relevant vaccination (e.g. Q fever, leptospirosis)
 - avoid unnecessary handling of manure
 - minimise spray drift when using recycled effluent
 - avoid using recycled effluent inside milking sheds or vat rooms due to potential contamination by bacteria, sediment, minerals and salts.

Further Information

Dairy Safety: A Practical Guide (WorkSafe Victoria 2006) www.worksafe.vic.gov.au
Manure Database (Element 6 – Occupational Health and Safety)
DairyGains (Part 2 – Occupational Health and Safety)

13.1.6. Human Health

To minimise risks to human health:

- ensure staff wear appropriate personal protective equipment for activities that involve direct contact with manure, chemicals and veterinary products

References

Dairy Australia 2008, *Effluent and manure management database for the Australian dairy industry*. Dairy Australia, Melbourne, <http://www.dairyingfortomorrow.com/index.php?id=48> (Accessed 23/08/2009).

DairyGains 2008, *Management of Dairy Effluent – 2008 DairyGains Victorian Guidelines*, Department of Primary Industries on behalf of DairyGains, Victoria.



14. REFERENCES

Broom, D.M., 1986, *Indicators of poor welfare*.
Br. Vet. J. 142:524-526.

Endres, M., I and Janni, K., A, 2008, *Compost Bedded Pack Dairy Barns*, University of Minnesota, St. Paul, http://www.extension.org/pages/Compost_Bedded_Pack_Barns_for_Dairy_Cows (Accessed 26/08/2009).

2007, *Your dam, Your responsibility: A guide to managing safety of farm dams*, Department of Sustainability and Environment, Melbourne.

1994, *Uniform Terminology for Rural Waste Management – S292.5*, American Society of Agricultural Engineers.



15. APPENDICES

APPENDIX A – RELEVANT LEGISLATION

Environment Protection Act (1970)

EPA Victoria is jointly responsible for administering and enforcing the *Environment Protection Act 1970*, as well as other related policies and regulations.

State Environment Protection Policies

State environment protection policies (SEPPs) are subordinate legislation made under the provisions of the *Environment Protection Act (1970)* to provide more detailed requirements and guidance for the application of the Act to Victoria.

Subordinate legislation is law made by a body that has been delegated the power to create law by an Act of Parliament. It is used to implement the policies outlined in the primary legislation (or Act) and its powers cannot exceed those provided in the primary Act.

SEPPs aim to safeguard the environmental values and human activities (beneficial uses) that need protection in the State of Victoria from the effect of pollution and waste, such as:

- human health and well-being
- ecosystem protection
- visibility
- useful life and aesthetic appearance of buildings, structures, property and materials
- aesthetic enjoyment and
- local amenity.

SEPPs express in law the community's expectations, needs and priorities for using and protecting the environment. They establish the uses and values of the environment that the community wants to protect, define the environmental quality objectives and describe the attainment and management programs that will ensure the necessary environmental quality is maintained and improved.

http://www.epa.vic.gov.au/about_us/legislation/sepps.asp (Accessed on 31/07/2009)

Interim Guidelines for Control of Noise from Industry in Country Victoria

Outside the metropolitan region, the *Interim Guidelines for Control of Noise from Industry in Country Victoria* (EPA Victoria publication no. 3/89, or its most recent update) specify minimum recommended noise limits. These guidelines are currently being revised. Refer to the relevant guidelines.

Aboriginal Heritage Act (2006)

In 2006, the Victorian Government introduced the *Aboriginal Heritage Act 2006*. The Act links the protection of Aboriginal cultural heritage more directly with planning and land development processes. It does not seek to stop or delay development; rather, it establishes a process to protect and manage Aboriginal heritage, with the involvement of Aboriginal people, while allowing development to proceed. Further information is available at www.dvc.vic.gov.au/aav/heritage/index.htm

Occupational Health and Safety Act (2004)

The *Occupational Health and Safety Act 2004* and *Occupational Health and Safety Regulations 2007*, specify the key principles, duties and rights in relation to occupational health and safety in Victoria.

The Act and Regulations, which are administered by WorkSafe Victoria, aim to (a) secure the health, safety and welfare of employees and other persons at work; (b) eliminate, at the source, risks to the health, safety and welfare of employees and other persons at work; and (c) ensure that the health and safety of members of the public is not placed at risk by the conduct of undertakings by employers and self-employed persons.

STATE ENVIRONMENT

PROTECTION

POLICIES (SEPPS)

ARE SUBORDINATE

LEGISLATION

MADE UNDER THE

PROVISIONS OF

THE ENVIRONMENT

PROTECTION ACT

1970 TO PROVIDE

MORE DETAILED

REQUIREMENTS AND

GUIDANCE FOR THE

APPLICATION OF THE

ACT TO VICTORIA



Environment Protection and Biodiversity Act (1999)

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places — defined in the Act as matters of national environmental significance.

The EPBC Act enables the Australian Government to join with the states and territories in providing a truly national scheme of environment and heritage protection and biodiversity conservation. The EPBC Act focuses Australian Government interests on the protection of matters of national environmental significance, with the states and territories having responsibility for matters of state and local significance. <http://www.environment.gov.au/epbc/index.html> (Accessed on 13/08/2009)

Catchment and Land Protection Act (1994)

The *Catchment and Land Protection Act (1994)* has an objective of establishing a framework for the integrated and coordinated management of catchments which will:

- maintain and enhance long-term land productivity while also conserving the environment, and
- aim to ensure that the quality of the State's land and water resources and their associated plant and animal life are maintained and enhanced.

The Act established ten Catchment and Land Protection Boards, nine of which have since expanded their roles to become Catchment Management Authorities. The *Catchment and Land Protection Act (1994)* provides for the development of Regional Catchment Strategies which, among other things, must assess the nature, causes, extent and severity of land degradation of the catchments in the region and identify areas for priority

attention. Local Planning schemes must have regard for the Regional Catchment Strategies. http://www.dpi.vic.gov.au/dpi/vro/glenregn.nsf/pages/glenelg_vegetation_man_catch (Accessed on 31/07/2009)

Water Act (1989)

The purposes of the Act include the sustainable, equitable, efficient and adaptive management of water resources. The *Water Act* also includes a formal means for the protection and enhancement of the environmental qualities of waterways and their in-stream uses. Recent amendments to the *Water Act* that relate to the *Water (Irrigation Farm Dams) Act 2002* and the *Water (Resource Management) Act 2005*. http://www.melbournewater.com.au/content/library/rivers_and_creeks/waterway_diverters/melbourne_waterway_diverters_information_handbook.pdf (Accessed on 03/08/2009)

Take and Use Licences

Where water in a dam is to be used for irrigation or commercial purposes, a Take and Use licence is required whether the dam is on a waterway or not. Such a licence would be required for the time period in which water will be taken and prior to the construction of a new dam.

Dams used for domestic and stock purposes built on your property do not require a take and use licence.

Construction Licences

In all cases where you wish to build a dam on a waterway you will need a once-off construction licence.

If you wish to build a dam off a waterway you will need a construction licence if the dam is:

- (a) 5 metres or higher and 50 megalitres capacity or larger or
- (b) 10 metres or higher and 20 megalitres capacity or larger or
- (c) 15 metres or higher, regardless of capacity.

Local Planning Authorities may require a permit to construct a dam.

WHERE WATER IN A DAM IS TO BE USED FOR IRRIGATION OR COMMERCIAL PURPOSES, A TAKE AND USE LICENCE IS REQUIRED WHETHER THE DAM IS ON A WATERWAY OR NOT



Licensing Authorities

Licensing Authorities are responsible for regulating the construction of dams and the use of water. In particular they:

- issue take and use licences;
- issue construction licences for new dams;
- issue operating licences for existing dams;
- determine licence conditions relating to safety of existing dams;
- investigate complaints regarding safety threats or dams with known deficiencies and take necessary action;
- ensure licence conditions are complied with; and
- take action where people illegally take water or illegally construct dams.

Licensing authorities include Goulburn-Murray Water, Southern Rural Water, Lower Murray Urban and Rural Water, Grampians Wimmera Mallee Water, Melbourne Water.

Flora and Fauna Guarantee Act (1988)

The *Flora and Fauna Guarantee Act (1988)* provides a legal and administrative structure to promote flora and fauna conservation. The objectives of the Act are:

- To provide a program of community education in the conservation of flora and fauna;
- To encourage cooperative management of flora and fauna through, amongst other things, entering into land management cooperative agreements under the *Conservation Forests and Lands Act (1987)*.

To assist and provide incentives to people, including landholders, to enable flora and fauna to be conserved.

http://www.dpi.vic.gov.au/dpi/vro/glenreg.nsf/pages/glenelg_vegetation_man_flora (Accessed on 03/08/2009)

Clause 52.17 of the *Victoria Planning Provisions* and all planning schemes regulate the removal of native vegetation, and a planning permit may be required to remove, destroy or lop any native vegetation.

Where native vegetation is removed as part of a development, the applicant will have obligations to off-set this removal. The responsible authority or the Department of Planning and Community Development can provide information on obligations regarding the protection, retainment or replacement of native vegetation www.dse.vic.gov.au/planning.

Planning and Environment Act (1987)

The *Planning and Environment Act 1987*, along with the *Planning and Environment Regulations 2005* and the *Planning and Environment (Fees) Regulations 2000* establish the legal framework for the planning system in Victoria. It includes provisions regarding the Victorian Planning Provisions, preparation and amendment of planning schemes, and the planning permit application process.



APPENDIX B – PLANNING PERMIT APPLICATION SUBMISSION – INFORMATION TO BE INCLUDED

Note: There is a standard planning permit application form that must be used when applying for a permit. A copy of the application form can be obtained from your local Council. The following information may assist the responsible authority and referral authorities to assess feedpad planning permit applications.

Feedpad submission checklist		
	Section Reference	Provided Yes / No
Planning permit application form		
Planning application fee		
Copy of certificate of title, including any restrictive covenants		
General overview of proposed operation and management		
Response to the zone objectives and planning overlays	Section 2	
Show how the proposed development supports the state and local planning policy, relevant Catchment Management Authority strategies or local policies.	Section 2	
Show that the development proposed addresses the requirements and any relevant decision guidelines of the zone objectives and planning overlays applying to the land.	Section 2	
Overview of Farm Design and Operation		
Has all the required information listed in 'Table 5.1 – Planners Checklist' been supplied?	Section 5	



APPENDIX C – FEEDPAD ADVANTAGES / DISADVANTAGES

Feedpad type	Advantages	Disadvantages
SEMI-PERMANENT Formed earthen pad	<ul style="list-style-type: none"> • Solid stable foundations • Lower maintenance • Low cost to install • Gentle slope to diver rainfall runoff • Capacity to handle larger herds 	<ul style="list-style-type: none"> • Potential for surface water pooling • Necessity to constantly dry scrape • Potential to become slippery for cows and machinery • Feed wastage • Potential herd health issues
SEMI-PERMANENT Formed earthen pad with troughs	<ul style="list-style-type: none"> • Contains feed and reduces spillage • Relatively cheap to set up • Layout can be doubled up to suit the designated area • Opportunity to feed a wider range of supplements • Opportunity to fence section off to cater for other herds 	<ul style="list-style-type: none"> • Spoilt feed may get trapped underneath creating odour, which hinders feeding • Potential for cattle injury or death as cows can fall in troughs • Difficulties in cleaning in and under troughs • Trough height may not be compatible with feed out machinery • Tendency to hold water during rain events damaging feed
PERMANENT Concrete pad	<ul style="list-style-type: none"> • Solid stable foundations capable of handling large herds and machinery • Cleaner environment for cows to spend longer periods of time • Feed wastage significantly reduced • Opportunity to reuse recycled effluent for alley washing • Multipurpose facility to cater for needs of different herds • Permanent high value farm asset 	<ul style="list-style-type: none"> • Usually require large volumes of water for washing • Extended period may cause feet problems • Alleys may require re-grooving due to constant wear and slippage • Cows may push feed out of reach • Increased effluent loading requiring management • Contingency plans required when pumps fail



Feedpad type	Advantages	Disadvantages
PERMANENT Freestall	<ul style="list-style-type: none"> • All weather facility to control herd comfort • Reduces costs associated with managing pastures • Reduced farm capital infrastructure such as laneways, fencing and stock troughs • Opportunity to closely monitor the herd • Opportunity to increase feed imports to match seasonal variations • Minimal feed wastage • Reduced walking distance to the dairy • Clean and dry environment for herd • Opportunity to increase herd size above the carrying capacity of a pasture based operation 	<ul style="list-style-type: none"> • Significant capital investment • Extreme water usage in cleaning requires a recycling option or large water right • Potential for other environment issues such as noise and odour • Labour intensive • Difficulties in retaining bedding material from the manure stream • Advanced manure system needed with constant maintenance • Difficulties accessing sick or injured stock • Specialist machinery and equipment in cleaning and feeding • Necessity to deal with many agencies and authorities

Source: McDonald *et al* (2008)



16. GLOSSARY

Agriculture	Land used to: propagate, cultivate or harvest plants, including cereals, flowers, fruit, seeds, trees, turf, and vegetables; keep, breed, board, or train animals, including livestock, and birds; or propagate, cultivate, rear, or harvest living resources of the sea or inland waters. Source: VPP
Amenity	The comfortable enjoyment of life and property, particularly with regard to visual appearance, odour, dust, noise and lighting.
Anaerobic pond	A lined pond (e.g. clay or HDPE) in which anaerobic conditions prevail (minimal or no oxygen). These ponds are usually deep to minimise surface area, which reduces temperature fluctuation and enhances anaerobic decomposition.
Animal husbandry	Land used to keep, breed, board, or train animals, including birds. Source: VPP
Animal welfare	The welfare of an individual is its state as regards its attempts to cope with its environment.
Best practice	The adoption of management practices and technologies that use the most current and recommended information, science and technologies available. Best practices continually change, as new information and research demonstrates improved methods. Best practices encourages continuous improvement.
Brisket board	A board at the front of stalls that prevents cows from lying too far inside the stall.
Buffer distance	A distance between the feedpad complex and surrounding environmental features (e.g. waterway, surface or ground waters, significant native vegetation).
Calving pad	A calving pad is a bedding area for young calves, often provided because it provides a warmer, dryer option to the paddock to facilitate round the clock access for the care of new born and young calves. The pad usually has an earthen base and it can incorporate subsurface drainage, which is typically covered with an adsorbent organic form of bedding (e.g. straw, sawdust, woodchips or rice hulls).
Catch drain	A drain to capture runoff from smaller areas within a controlled drainage area, such as the manure stockpile. It conveys the captured runoff to the manure management system.



Cattle feedlot	<p>Land used to keep and fatten cattle which are restrained by pens or enclosures and intensively fed.</p> <p>Note: This definition refers to beef cattle for meat production only, as it directs compliance with the Victorian Code for Cattle Feedlots (beef cattle).</p> <p>Source: VPP</p>
Compost bedded pack system	<p>Generally known as a compost dairy barn. They are a loose housing system for dairy cows. Compost barns are similar in many respects to a freestall. The key difference is that the stalls and stall alleys are replaced with a bedded pack that is aerated at least twice daily. (The bedded pack consists of a mixture of solid manure and adsorbent organic bedding.)</p>
Controlled drainage area	<p>A controlled drainage area is a self-contained catchment surrounding the feedpad complex. It is typically established using:</p> <ul style="list-style-type: none"> • a series of catch drains to capture runoff from the feedpad and all other surfaces within the feedpad complex, and ultimately convey that runoff to a holding pond • a series of diversion banks or drains placed immediately upslope of the feedpad complex, which are designed to divert 'clean' upslope runoff around the feedpad complex.
Cow alley	<p>These alleys are only applicable to freestalls. They provide a walkway for cattle to access the stalls.</p>
Cow barrier	<p>Structures used to prevent cattle from standing in/on the feeding table or contain stock on a feedpad. Common structures include elevated troughs, fences, hot wires, steel cables, stanchions.</p>
Dairy cattle	<p>Cattle bred, kept and/or raised for the primary purpose of milk production. Dairy cattle includes all the dairy farm stock including calves, heifers, dry cows and lactating cows.</p>
Development	<p>Development of land includes the construction of a building, carrying out works (e.g. clearing vegetation), subdividing land or buildings, or displaying signs.</p> <p>Source: VPP</p>
Drive alley	<p>The area adjacent the feeding table. In a freestall the drive alley does not allow any cattle access, as its intended purpose is to only allow machinery to enter and deliver or push-up feed along the feeding table. Semi-permanent feedpads usually require feed-out machinery to drive in the feed alley.</p>



<p>Emergency and supplementary feeding</p>	<p>This refers to additional feed provided to cattle to make up for a deficiency in the vegetation or feed that can be obtained on the site and /or farm. It does not include regular supplementary feeding for the purpose of production, growth or finishing.</p>
<p>Environment</p>	<p>The site and surrounding natural resources (i.e. air, soil and water).</p>
<p>Extensive animal husbandry</p>	<p>Land use to keep or breed farm animals, including birds, at an intensity where the animals’ main food source is obtained by grazing, browsing, or foraging on plants grown on the land. It precludes:</p> <ul style="list-style-type: none"> • emergency and supplementary feeding; and • the incidental penning and housing of animals, including birds, for brooding, weaning, dipping, or other husbandry purposes. <p>Source: VPP</p>
<p>Feed alley</p>	<p>The alleys occupied by cattle when they are accessing feed. These alleys are located parallel to the feeding table.</p>
<p>Feeding table</p>	<p>Where feed is placed for cattle on a feedpad (e.g. in troughs, on concrete alleys, on the ground).</p>
<p>Feedpad</p>	<p>A feedpad is defined as that part of a farm that is used for regular supplementary feeding of cattle on an area of land that is either formed, surfaced or stocked at a rate that precludes vegetation.</p> <p>It is generally a confined area in which feed and/or water are provided. Cattle are held and fed for all or part of the year for the purpose of production and/or growth of young cattle, and for protection from adverse environmental impacts such as wet, cold or hot conditions.</p>
<p>Feedpad complex</p>	<p>The feedpad complex may include:</p> <ul style="list-style-type: none"> • feed area including drive and feed alleys, feeding table (e.g. concrete alley, troughs, hay rings) and watering points • alleys, internal laneways and loafing areas • bedding areas • feed storage and preparation areas • drains and ponds • manure/compost stockpile. <p>The feedpad complex does not include manure and recycled effluent utilisation areas.</p>
<p>Freeboard</p>	<p>The height of the pond embankment crest above the designed full-storage level. The freeboard prevents overtopping of the pond embankment during spill events, and includes allowances for wave action and construction inaccuracies.</p>



Freestall	These can be open-air, partially or fully enclosed structures in which dairy cattle are housed and provided with feed and water. They can be used to house dairy cattle for extended periods and include a bedding area for cattle to lie down, and possibly a loafing area for cattle to stand. The term 'freestall' refers to the bedding area where cattle are allocated specific cubicles (stalls), which they may enter to lie down. Feed and cow alleys, and bedding areas are cleaned regularly (usually daily) to maintain cow comfort and health.
Ground water	All water below the land surface that is free to move under the influence of gravity.
Hot wire	Electrified wire used to contain stock in an area.
Intensive animal husbandry	Land used to keep or breed farm animals, including birds, by importing most food from outside the enclosures. It does not include: an abattoir or sale yard; emergency and supplementary feeding if incidental to the use of land for extensive animal husbandry; or the penning and housing of animals, including birds, for brooding, weaning, dipping or other husbandry purposes if incidental to the use of land for extensive animal husbandry. Source: VPP
Leaching	Process where soluble nutrients (e.g. nitrogen) are carried by water down through the soil profile.
Liquid manure (thin slurry)	Manure that by its nature, or after being diluted by water, can be pumped easily. Normally fibrous material such as chopped straw or waste hay is not present.
Loafing area	The loafing area is a formed surface adjacent to the feedpad complex, or alleys on the feedpad. Its primary purpose is to provide a separate section away from the feeding table for cattle to stand, lie, ruminate or idle.
Longitudinal slope	The slope along the pad length.
Loose housing	A permanent feedpad with a bedded area for the cattle to lie down in an unrestricted space. The bedded area may be deep bedded straw or compost bedded pack.
Manure	The faecal and urinary excretion of livestock. This material may also contain bedding, spilled feed, water or soil. It may also include components not associated with livestock excreta, such as dairy shed wash down water, contaminated milk or hair.
Neck rail	A rail to assist the position cows so they have enough forward lunging space when they lie down in a stall. They are also referred to as a 'training rail'.



Nib wall	A small concrete wall constructed along the perimeter of alleys to prevent manure from leaving the feedpad and/or entering the feeding table.
Nutrients	Elements such as phosphorus, potassium and nitrogen found in manure and recycled effluent. The nutrient content of recycled effluent and manure solids means that these products are useful to agricultural production if applied to land, as part of a managed nutrient program. A well managed nutrient program should prevent nutrient runoff and/or leaching to surface and ground waters.
Pond	Used to store or treat liquid manure or recycled effluent. Treatment ponds are outlined in the Glossary – see anaerobic and sedimentation ponds.
Recycled effluent	Liquid manure from a holding pond that is used to clean dairy yards, feedpad alleys or applied to pastures/crops.
Referral authority	Another authority that the responsible authority consults for advice on a permit application.
Responsible authority	The body that administers and enforces the planning scheme. It is usually the local council, unless specified otherwise in the Victoria Planning Provisions or planning scheme.
Reuse	The application of manure and recycled effluent on to crops. The application rate is based on a calculated nutrient budget for the specific crop and soil type.
Runoff	Surface water flow, both over the ground surface as overland flow and in streams as channel flow. It may originate from excess precipitation that can't infiltrate the soil or as the outflow of groundwater along lines where the watertable intersects the earth's surface.
Sedimentation pond	A lined pond that is usually shallow and narrow to enhance manure drying and removal.
Semi-solid manure	Manure that has had some bedding or spilled feed added, or has received sufficient air-drying to raise the solids content so the manure can be stacked (it will have a lower physical profile than solid manure). Seepage may appear around the outer edge of the manure. It may be pumped with positive displacement pumps or handled with a front-end loader.



Sensitive use (also known as Sensitive land use)	A use that involves the presence of people, causing the use to be sensitive to amenity considerations such as odour, dust and noise. Sensitive uses (also referred in other documents as sensitive land uses) include a dwelling, a dependant persons unit, a residential building, a hospital, a school, a day care centre, a caravan park and other uses involving the presence of people for an extended period. Sensitive use does not include recreational areas such as parks and sporting facilities.
Separation distance	The distance separating a possible source of an emission (e.g. dust, odour or noise) from potential sensitive receptors, such as nearby houses. Maintaining an appropriate separation distance is a key tool to minimise the risk of odour and dust adversely impacting on surrounding neighbours and community. Separation distances are measured from the nearest physical part of the feedpad complex (not including the manure and recycled effluent reuse areas) to the nearest point of the prospective receptor (e.g. sensitive use).
Side slope	The slope in the feed alley that directs manure and runoff away from the feeding table. The slope direction runs perpendicular to the feeding table. This is usually only associated with earthen feedpads.
Slurry manure	Manure in which the percent total solids approximates that of excreted manure. The total solids content could vary by a few percent depending on whether water is added or minor air drying occurs. It can be handled with conventional and centrifugal manure pumps.
Solid manure	Manure that has had sufficient bedding or soil added, or has received sufficient air drying to raise the solids content to where it will stack with little or no seepage. It is best handled with a front-end loader.
Solids separation	Separation of the solid and liquid fractions of manure so they can be managed and/or utilised individually.
Stall	Resting cubicles or 'beds' in a freestall which dairy cows are free to enter and leave, as opposed to being confined in pens.
Stall kerb	Barrier at the back of a stall used to prevent slurry manure from the alley contaminating the bedding.



Stand-off pad	A type of loafing area (refer to loafing area definition).
Stockpile	An area where manure, feed wastage or used bedding is stored before being applied to crops/pastures. Carcasses may also be composted in the same area.
Surface water	Water on the land and includes dams, impoundments, rivers, creeks and all waterways where rainfall is likely to collect. It excludes groundwater and waters within tanks, artificial waste treatment systems, reticulated water supply distribution systems, off-stream private dams, and piped and underground drains. Source: <i>Environment Protection Act (1970)</i>
Victoria Planning Provisions	The Victoria Planning Provisions (VPP) is a document containing a comprehensive set of planning provisions for Victoria. It is not a planning scheme and does not apply to any land but it is a State wide reference, used as required, to construct planning schemes.
Waterway	Defined in the <i>Water Act 1989 (Vic.)</i> as: <ul style="list-style-type: none"> (a) a river, creek, stream or watercourse, or (b) a natural channel in which water regularly flows, whether or not the flow is continuous, or (c) a channel formed wholly or partly by the alteration or relocation of a waterway as described in paragraph (a) or (b); (d) a lake, lagoon, swamp or marsh, being: <ul style="list-style-type: none"> (i) a natural collection of water (other than water collected and contained in a private dam or a natural depression on private land) into or through or out of which a current that forms the whole or part of the flow of a river, creek, stream or watercourse passes, whether or not the flow is continuous, or (ii) a collection of water (other than water collected and contained in a private dam or a natural depression on private land) that the Governor in Council declares under section 4(1) to be a lake, lagoon, swamp or marsh; or (e) land on which, as a result of works constructed on a waterway as described in paragraph (a), (b) or (c), water collects regularly, whether or not the collection is continuous, or (f) land which is regularly covered by water from a waterway as described in paragraph (a), (b), (c), (d) or (e) but does not include any artificial channel or work which diverts water away from such a waterway, or (g) if any land described in paragraph (f) forms part of a slope rising from the waterway to a definite lip, the land up to that lip.

