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National Environmental Management System for the Meat Chicken Industry – Version 2

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Version 2

by Eugene McGahan, Naomi Bielefeld, Stephen Wiedemann and Orla Keane, FSA Consulting

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Foreword

The Australian Meat Chicken industry is rapidly expanding and constantly changing. To keep up with the growth and adoption of new technologies and practices, environmental management practices need to be regularly reviewed. In the last ten years the industry has rapidly grown and there has been a shift to larger farms and in recent years the free range component of the industry has expanded in response to consumer demands. There has also been increasing pressure for agricultural industries to quantify their greenhouse gas emissions and water use efficiency.

The first version of the National Environmental Management System for the Meat Chicken Industry (Meat Chicken EMS), published in 2003, was developed and funded by the Rural Industries Research and Development Corporation (RIRDC) to enable a co-ordinated approach to environmental standards within the industry. This was achieved by delivering the program to growers through a successful series of workshops at which growers produced their own Environmental Management Plan (EMP) for their farm, while being educated about the best recommended environmental practices for different aspects of their production system. This second version of the Meat Chicken EMS builds upon the earlier work, and addresses new issues that the industry faces, including improving energy and water use efficiency and providing recommendations for free range production systems. Other potential environmental issues identified in the original EMS have been updated to reflect new research and industry practices.

Environmental management plans are now often required for existing and new developments by regulatory bodies. The content included in the National EMS is also a useful source of information for regulatory departments, consultants to the industry or other members of the public who want a practical overview of how the Australian meat chicken industry operates.

In reviewing and updating the Meat Chicken EMS, it is clear that to date there has been very little research into benchmarking energy and water consumption on meat chicken farms. This is the first step in improving efficiency in this area. There is also a need to investigate the potential environmental impact of free range farms in Australia, especially in terms of nutrient management within free range areas.

This project was funded from industry revenue which is matched by funds provided by the Australian Government.

This report is an addition to RIRDC's diverse range of over 2000 research publications and it forms part of our Chicken Meat R&D program, which aims to stimulate and promote R&D that will deliver a profitable, productive and sustainable Australian chicken meat industry that provides quality wholesome food to the nation.

Most of RIRDC's publications are available for viewing, free downloading or purchasing online at www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

Craig Burns
Managing Director
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Overview

Introduction

The Australian meat chicken industry has expanded significantly over the past 30 – 40 years. At the same time, community interest in environmental issues has heightened. To ensure the long-term sustainability of the industry and of individual farms, it is important that environmental concerns are carefully managed.

In 2002 FSA Consulting developed a National Environmental Management System for the Meat Chicken Industry (Meat Chicken EMS) with funding from the Rural Industries Research and Development Corporation (RIRDC) Chicken Meat Program. This Meat Chicken EMS was then developed into a training package for growers and was rolled out in 2003-2004. The training package was designed to assist facilitators conducting workshops for meat chicken growers. The workshops were designed to equip meat chicken farm managers with the skills to develop and implement an EMS based on risk assessment principles. The Environmental Management Plans (EMP) developed as part of the workshop should meet the minimum requirements in states where an EMP is compulsory for licensed or approved meat chicken farms.

Since the first version of the Meat Chicken EMS was developed, the meat chicken industry in Australia has undergone some changes including:

- An increase in the number of free range meat chicken farms, driven largely by consumer demands. The adoption of free range systems imposes new environmental challenges for the industry in terms of biosecurity, production efficiencies and nutrient management.

- An increase in pressure from the government, consumers and the general public for agricultural industries to quantify their environmental impacts including their greenhouse gas emissions, energy use and, more recently, their water use.

A literature review and rapid lifecycle assessment of meat chicken production in Australia (Wiedemann *et al.* 2012) recommended that more research should be undertaken on and more data collected to quantify the energy usage of chicken grow-out farms. It also noted that there is currently little information available on water usage for chicken meat production. Improved farm monitoring of these two resources will enable researchers to better quantify the impact meat chicken farms have on the environment, and with electricity, gas and water prices increasing, there is also an increasing economic incentive for growers to make efficiency gains in these areas.

The health of Australia's water resources is also coming under increasing scrutiny from the government and the general public. Agricultural industries, especially intensive livestock, will be increasingly targeted to reduce potential nutrient losses into these waterways. Nutrient losses into waterways can occur from the mismanagement of stored by-products (i.e. spent litter) and the nutrient overloading of soils from excessive litter applications.

The updated version of the Meat Chicken EMS – Version 2 addresses all of the issues raised above as well as being updated with new research and information. The updated Meat Chicken EMS includes:

- Information that addresses the additional challengers free range production systems face in terms of site layout and design, nutrient management, biosecurity and pest and vermin management.

- Greenhouse gas emission reporting requirements.

- Energy and water use efficiency.

- Risk assessment and management options available for better monitoring and increasing the efficiency of energy and water usage on-farm.

- A review and updated information on on-farm composting.

- More detailed information on monitoring farm water quality (surface and bore water) and soils in reuse areas with the aim of increasing an awareness of these issues and suggesting management options to reduce the risk of nutrient losses off-site.

The changes made to the Meat Chicken EMS Manual of Good Environmental Practice have then been incorporated into the updated training materials to enable the new Meat Chicken EMS to be rolled out to growers.

This second version of the National EMS comprises:

- Part A – Manual of Good Practice for the Meat Chicken Industry

- Part B – Example Environmental Management Plan, and explanatory notes

- Part C – Generic Environmental Management Plan

- Part D – Environmental Risk Assessment Workbook for the Meat Chicken Industry, so individuals can self-assess their individual enterprises and identify any environmental improvement or monitoring that is required

- Recommendations for training industry participants in environmental awareness and environmental management.

These are described in more detail below.

Manual of good environmental practice

The environmental practice manual details operating and management practices to ensure meat chicken production is environmentally sustainable. Potential environmental impacts of meat chicken production (community amenity, water and soil) have been identified, along with measures to minimise the potential for these impacts.

Environmental management plans

The development of an ***environmental management plan*** (EMP) for an individual enterprise is a formal commitment that all reasonable and practical efforts will be made to operate the meat chicken farm in an environmentally sustainable manner. *The meat chicken farm includes all operations involving the production of chickens on either a meat chicken farm or a breeder farm. This includes road access; sheds; manure storage areas; carcass storage or treatment; used litter storage, treatment or use.* An EMP provides a system for documenting:

- The environmental risks of the meat chicken farm.

- How these risks will be minimised by design and management.

- Measurement of the effectiveness of these strategies by monitoring.

- Reporting of monitoring results.

Growers are encouraged to develop an EMP for their enterprise to demonstrate that the farm is managing potential environmental impacts. It also allows for improved management of the farm. In

some instances the development of an EMP is now also a requirement for the licensing, approval or planning of a meat chicken farm.

The key components of an EMP are:

- Identification and contact details, with a brief description of the meat chicken farm and a commitment that the farm will operate in an environmentally sustainable manner.
- Legal requirements of the farm, including applicable consents, approvals and/or licences to operate the enterprise.
- Information on the natural resources and amenity issues of the property and surrounding area.
- Description of all the design and management facets of the meat chicken farm.
- Identification of any environmentally vulnerable areas by examining how the location, design and management of the meat chicken farm interact with the environment. Identification of a risk may mean regular monitoring or a change in design and management to minimise the risk.
- Monitoring to measure any environmental impacts, including subjective monitoring of odour, dust and noise, in addition to soil sampling if spent litter is spread on-farm or chemical analysis of spent litter sold off-farm.
- Contingency plans for emergency situations.
- Any environmental training undertaken by staff.
- Periodic review of the EMP to update changes in regulatory requirements, operation, environment, design or management.

As part of the Meat Chicken EMS, an example Environmental Management Plan with explanatory notes and a Generic Environmental Management Plan (blank document) have been developed.

Environmental risk assessment workbook

The risk of a meat chicken farm impacting upon the environment depends upon the vulnerability of the natural resources and amenity issues and on the standard of design and management of the operation. For instance, if a resource is vulnerable, good design and management can prevent impacts. However, unless design and management are appropriate, environmental impact is likely. The environmental risk assessment workbook enables individuals to self-assess their meat chicken farm in order to identify areas that require environmental improvement or monitoring, to reduce the risk of causing unacceptable environmental impact.

The first step is to assess the vulnerability on each of the major natural resources and amenity issues associated with the meat chicken farm, including:

- Surface water quality
- Groundwater quality
- Community amenity – odour, noise, dust and light
- Soils (if re-using litter on-farm)

The second step is to assess the risk of each of the major design and operation features of the meat chicken farm, including:

- Road, traffic and machinery management
- Siting and design
- Shed management
- Spent litter clean-out and removal
- On-site spent litter spreading and management of nutrients in free-range areas
- Dead bird management
- Chemical storage and use
- Contingency measures
- Subjective monitoring and community liaison

To evaluate the likelihood of an environmental impact it is necessary to assess each of the design and operation ratings against each of the natural and social vulnerabilities. This is done via a two dimensional matrix to give an overall assessment of risk. If action were required in a particular area, it would take the form of an Environmental Improvement Program or Monitoring.

Additional technical information

The original version of the National EMS included a series of factsheets on:

- Litter Clean-out
- Manure Production and Spent Litter Composition
- Composting and Pasteurising Spent Litter
- Land Application of Spent Litter
- Composting Chicken Carcasses

Much of this information has been incorporated into Version 2 of the National EMS or will be more comprehensively covered in a series of technical guides that are being produced as part of a separate RIRDC project being conducted by FSA Consulting for the chicken meat industry. These guides will cover the broad topics of:

1. Land Application of Poultry Litter
2. Reuse of Poultry Litter
3. Energy Generation from Poultry Litter

Theses guides are also available on the RIRDC website.

Implementation of the meat chicken EMS

The best way to implement the Meat Chicken EMS will be through whole-farm Quality Assurance (QA) systems.

The Environmental Management Plan that each farmer develops can be used as a stand-alone document in a QA system, or can be incorporated into an over-arching QA Manual. If used as a stand-alone document, some cross-referencing to other procedures may be beneficial.

It is essential to include environmental management in any whole-farm QA systems. This is a good way to ensure that the system is effectively implemented and has an ongoing place in farm management. Fortunately, good environmental management relates closely to good production practices, so it fits neatly into a whole-of-farm QA system.

If a farmer develops a QA Manual, the Environmental Management Plan should be included in the body of this Manual, rather than as an appendix. This will identify environmental management as an integral part of the whole-farm QA system, rather than as an 'add-on'. The procedures developed in the Operational Design and Management; Monitoring, Recording and Reviewing; and Training sections should complement the format of the QA Manual. Appropriate cross-referencing to other sections of the QA Manual will help to integrate the information.

If the EMS will be part of the QA system, any auditing arrangements for the QA system will be used in the EMS. The EMS should be regularly audited, like any other part of the QA system. It is suggested that the whole QA system should be audited annually, with each major section independently audited at some other time throughout the year. External auditing is more expensive than internal auditing, since a consultant needs to be engaged. However, it may be more thorough and may provide greater credibility.

Training

To support the implementation of this program, a participants training manual and a facilitators training manual have been prepared. These are available to industry trainers and chicken companies and growers upon application to the Research Manager of the RIRDC Chicken Meat Program.

References

Wiedemann, S, McGahan, E & Poad, G 2012, *Using Life Cycle Assessment to Quantify the Environmental Impact of Chicken Meat Production*, Final Report, RIRDC Project No PRJ-004596 & PRJ-007445, RIRDC Publication No 12/029, Rural Industries Research and Development Corporation., Barton, ACT.

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Glossary

Aerobic – contains dissolved or free oxygen

Anaerobic – no dissolved or free oxygen

Bunding – making an embankment to exclude run-on and run-off

Community amenity – anything that is agreeable to the community

Contaminant – can be a gas, liquid or solid, an odour, an organism (whether dead or alive)

Conventional meat chicken farming – Conventionally farmed meat chickens are housed in environmentally controlled sheds on litter, feed mainly consist of grains, and may be given antibiotics for prophylactic and/or therapeutic use. Most chickens are grown under a contract to processors and farms are supervised by the processor (ACMF 2014).

Effluent – liquid or slurry containing chicken manure or it components, spent litter or its components

Electrical conductivity – a measure of the conduction of electricity through water, or a water extract of soil. The amount can reflect the amount of soluble salts in an extract and therefore provide an indication of soil salinity.

Erosion – the detachment and transport of soil particles

Free range meat chicken farming – "Free range meat chickens are produced using similar management, housing and feeding practices as conventional meat chickens. The major differences are that free range chickens are allowed access to an outside run for part of each day (at least post the brooding period) and often have lower target stocking densities. Depending on the accreditation program adhered to, use of antibiotics to treat sick birds may proclude the meat from these birds being sold as free range". Free range farms are monitored by industry associations that accredit farms (ACMF 2014).

Groundwater – subsurface water contained in a saturated zone of soil or a geological stratum (layer)

Groundwater recharge area – areas where water infiltrates readily to the water table

Intensive meat chicken farming – farming of meat chicken birds in a confined area (roofed structure)

Leaching – movement through the soil of a material in solution

Natural ventilation – Sides of poultry sheds are open to fresh air. The amount of air circulating inside the shed is controlled by raising or lowering curtains or panels along the side of the shed. Sheds are usually fitted with ceiling fans to help circulate air and with evaporative cooling systems.

Organic matter – chemical substances of animal or plant matter

Organic meat chicken farming – Certified organic meat chickens have two additional requirements to free range production systems. The birds must be fed predominantly certified organic ingredients and birds cannot be treated with routine vaccination. There are exceptions, such as where treatment is required by law or disease cannot be controlled with organic management practices. Certified organic chicken meat bears a certification logo from an approved organisation, and producers must comply with *The National Standard for Organic and Bio-Dynamic Produce* (ACMF 2014).

Sensitive area - any watercourse including a river, creek, lake, dam (not farm), wetland, public road

Sensitive receptor - any residence, residential development, town or public facility (e.g. school, public hall, recreation area)

Separation distances – distances between the meat chicken operation and sensitive receptors or areas (residential, recreational, watercourses, public roads, etc)

Sodicity – measure of the exchangeable sodium in a soil

Soil profile – vertical cross-section of a soil from the surface to the parent material or substrate

Spent litter – litter that is no longer used for bedding material. If litter is reused for several batches of birds, used litter would not be considered to be spent litter, until such time as it is finally removed from the shed.

Surface water – includes water in dams (not farm catch dams), reservoirs, rivers, creeks and all other waterways where rainfall is likely to collect

Tunnel ventilation – tunnel ventilated sheds are fitted with banks of large fans at one end of the shed that draw air into the shed from the opposite end, through cooling pads, and out the fan (exhaust) end.

1. Introduction

This environmental practice manual details operating and management practices to ensure meat chicken farming can be environmentally sustainable. Potential environmental impacts of meat chicken farms (community amenity, water and soil) have been identified, along with measures to minimise the potential for these impacts. The document covers:

- Background information on the meat chicken industry in Australia.
- Guidance on appropriate siting and design of facilities to minimise environmental impacts.
- Shed and free range area management.
- Improving energy and water use efficiency.
- Manure production rates.
- Spent litter management.
- Sustainable application of spent litter for plant production.
- Dead bird management.
- Chemical storage and use.
- How to minimise environmental impacts.
- Contingency measures for controlling environmental impacts.
- Details of environmental management plans.

Photograph 1. Meat chicken shed.

2. The Australian Meat Chicken Industry and Environmental Issues

2.1 The industry

The size of the Australian meat chicken industry is continuing to expand. Approximately 1,050,000 tonnes of chicken meat will be produced in 2013-14, which is predicted to increase by 3% per year to 1,210,000 tonnes by 2017-18 (ABARES 2014), with a retail value exceeding $4.4 billion. Most chicken meat is produced for the domestic market with only about 3% exported in 2012-13. In the past few years chicken meat consumption has exceeded beef and veal as Australian consumers most popular meat with every person in Australia estimated to consume 44.6 kg in 2012-13 (ABARES 2014).

A number of vertically integrated companies dominate the industry. Each of these companies invests significant funds into in-house R&D, particularly in the areas of product development, processing technologies, quality control procedures, distribution and packaging, and market research.

The intensive meat chicken industry has been traditionally located close to markets and processing plants. Most of the feed mills and processing plants are located in metropolitan areas, with the chicken growing sector of the industry concentrated in rural areas on the outskirts of these areas. With increasing urban expansion into these "traditionally" rural areas there has been a rise in complaints by neighbouring residents, mainly pertaining to odour, dust, noise and flies from the farms. The development of environmental and planning acts, policies and regulations to minimise environmental impacts has accompanied this conflict. These devices aim to assist the development and function of the meat chicken industry, while also minimising associated environmental impacts. The meat chicken industry is also addressing these issues with research and development programs to reduce potential impacts.

Driven largely by consumer demands, there has been an increase in the increase in the number of free range meat chicken farms. The adoption of free range systems imposes new environmental challenges for the industry in terms of biosecurity, production efficiencies and nutrient management.

2.2 General environmental duty of the industry

All meat chicken farms must comply with applicable planning and environmental protection legislation relevant to each State. Most meat chicken farms require the consent of the local government authority and/or relevant state government department/agency to operate. For the farm to continue to operate, it should also comply with a set of minimum operating standards.

The meat chicken industry aims to operate in an environmentally sustainable manner by following "best practice environmental management", as detailed in this manual.

The meat chicken industry strives to maintain itself as an environmentally responsible industry by adopting economically viable best practice options in minimising environmental impact. On-farm management practices that provide the optimal environment for bird performance will assist in minimising adverse environmental impacts, such as excessive odour generation from wet litter.

The main by-product of the meat chicken industry is spent litter. This is valuable as an organic fertiliser and soil ameliorant for industries such as horticulture and broad acre cropping. The long-term sustainability of the industry will only be achieved through an integrated industry approach. The building and maintenance of cooperative working relationships between integrators/suppliers, growers, spent litter contractors and end users of spent litter is required to maximise the environmental performance of the industry.

This manual is not intended to replace the relevant environmental codes of practice and guidelines that exist in each state, but to provide the industry, governments and the community with general information on good environmental management practices for meat chicken farms.

2.3 Potential environmental impacts of meat chicken farms

Well-designed and managed meat chicken farms (as outlined in this Good Environmental Management Practices Manual) will cause minimal environmental impact. If farms are not designed and managed appropriately, they may interact adversely with the environment in a range of ways. Possible adverse impacts may include effects on community amenity, surface water, groundwater and soil.

2.3.1 Community amenity

Community amenity impacts occur when the operation of an enterprise causes unreasonable interference with the comfortable enjoyment of life. A meat chicken farm could disrupt community amenity through odour generation, noise associated with farm operations and traffic, dust and visual amenity.

There are no known physical health effects on humans of exposure to odour from intensive animal industries. Excessive dust impacts may be harmful for some people, for example, with some experiencing respiratory conditions. The management of sheds and the application of spent litter to land require careful management to avoid any potential human health impacts.

The most effective way to address community amenity issues is to adopt and maintain good management practices, and to maintain appropriate buffers between the farm and receptors. These buffers protect both existing meat chicken farms from residential development encroachment and the community's amenity from adverse impacts associated with meat chicken production. If these buffers include vegetative screens, they have the added benefit of providing improvements in visual amenity. If buffers are inadequate, it may be necessary to use additional management measures to control impacts.

2.3.2 Surface water

If large quantities of nutrients are exported to surface water from spent litter storage and/or from the spreading of litter as a fertiliser, eutrophication may occur or elevated nutrient levels in surface waters (creeks, rivers, dams, lakes, etc) may be found. This promotes the growth of algae, including toxic blue-green algae. High nitrate levels in water are also toxic to fish, birds, wildlife, stock and humans. Elevated organic matter levels in water reduce oxygenation, affecting fish and other aquatic life. Hence, runoff from any nutrient rich sources requires containment or avoidance.

2.3.3 Groundwater

Nutrients and salts that may leach through the soil can contaminate ground waters. The base of sheds, spent litter storage, composting areas and carcass disposal pits require adequate sealing to minimise the risk of this occurring. Inappropriate spent litter spreading rates and overstocking free-range areas can also potentially lead to accumulated soil nutrients and the potential for leaching. The difficulty with groundwater contamination is that it can go undetected and, once established, remediation is often difficult and very expensive.

2.3.4 Soils

Poultry manure and spent litter is a valuable organic fertiliser and environmentally safe product when applied at sustainable rates. However, free-range areas and the spreading of spent litter on land requires careful management to avoid soil degradation. Soil degradation can occur through elevated nutrient levels and associated changes in pH, elevated salinity and sodicity levels, soil structural decline, increased soil erosion, chemical and microorganism contamination.

2.3.5 Gaseous emissions

Meat chicken farms emit gases that contribute to environmental concerns, namely the greenhouse gases carbon dioxide (CO2), nitrous oxide (N2O) and methane (CH4). Indirect emissions also occur from the emission of ammonia (NH3) from sheds that is deposited and re-emitted as N20. In addition, further indirect emissions, namely CO2, are produced during the production of energy used by the poultry farm in the form of electricity or gas. Direct emissions from a poultry farm include CH4 and N2O from manure/litter in the sheds and N2O is emitted post application of spent litter to land and from free-range areas. On-farm fuel usage can also emit greenhouse gas emissions i.e. burning of fuel for heat production.

NPI reporting

Meat chicken producers with farms with a capacity of 87,600 or more birds are required to report their annual ammonia emissions to the relevant state or territory environment protection agency by the 30th of September each year. Meat chicken farms with a capacity of 42,857 birds or more are also required to report transfers of total nitrogen and total phosphorus. For details of ammonia and total nitrogen and total phosphorus thresholds and techniques for estimating these emissions and transfers, refer to the Emission Estimation Technique Manual for Intensive Livestock – Poultry Raising, Version 3, June 2013 (http://www.npi.gov.au/resource/emission-estimation-technique-manual-intensive-livestock-poultry-raising-version-30) (Department of Sustainability Environment Water Populations and Communities 2013). Some larger facilities may also trip fuel usage thresholds and would be required to report a range of gaseous emissions. For more information on fuel usage thresholds and techniques for calculating applicable gaseous emissions, refer to the National Pollution Inventory Guide available from http://www.npi.gov.au/resource/national-pollutant-inventory-guide (Department of Sustainability, Environment, Water, Population and Communities, 2012). To work out if you are required to report your emissions or to access a copy of the current technical manuals for estimating emissions and transfers, visit the NPI website: http://www.npi.gov.au.

National Greenhouse and Energy Reporting Scheme

Some larger meat chicken corporations that exceed set thresholds for energy consumption and production and greenhouse gas emissions must also register and report under the federal governments National Greenhouse and Energy Reporting (NGER) Scheme.

The NGER Scheme divides GHG emissions into the following categories:

Scope 1 direct GHG emissions that occur from sources owned or controlled by a business or facility.

Scope 2 indirect GHG emissions associated with the off-site generation of the electricity, heating/cooling or steam purchased for consumption by a business or facility.

Scope 3 other indirect GHG emissions generated because of a facilities activity, but physically produced by another business or facility.

Corporations which produce 25 kt of CO2-e/year or more of scope 1 or scope 2 emissions, or which consume more than 100 TJ/year of energy, need to report their emissions or energy consumption to the Clean Energy Regulator. There are higher thresholds for corporate groups: 50 kt of CO2-e/yr and 200 TJ of energy from 2011-2012. Currently, NGER does not include agricultural emissions such as CH4 and N2O, however, any facility that exceeds the set thresholds through use of fossil fuels must report the associated GHG emissions and energy use or consumption.

More information on how to register and report through the NGER Scheme is available at http://www.climatechange.gov.au/climate-change/greenhouse-gas-measurement/national-greenhouse-and-energy-reporting, The NGER calculator is also available from this website:

http://www.cleanenergyregulator.gov.au/national-greenhouse-and-energy-reporting/forms-and-calculators/Pages/default.aspx.

2.4 Environmental responsibilities of suppliers and growers

In some states, environmental legislation dictates that the meat chicken farmer has a duty of care for the sustainable use of spent litter supplied to off-site users. It may be useful for growers to have a contract with end users setting out the quantity of spent litter to be traded and the intended use. However, meat chicken farmers contracted by the large integrators have little control over diets and hence the chemical composition of the spent litter. Thus, growers, suppliers of feed and end users of the spent litter need to work cooperatively to ensure that the product is both safe and used in an environmentally sustainable manner.

Increased litter moisture is likely to cause increased odour generation and emissions. Dietary disruptions and reduced bird health can increase fluid excretion by meat chickens, causing increases in litter moisture content. Individual meat chicken farmers may have limited control over these factors, which require close management by both the feed suppliers and the farmers.

Transport noise from meat chicken farming may create nuisance, particularly if it occurs at night when it may interrupt sleep. Delivery and pick-up of both feed and birds requires careful management by the processor, their pickup operators (both company and contractors) and the growers to minimise potential off-site noise nuisance.

Some sectors of the industry are currently investigating linking the farm EMP with grower contracts so that there is a formal legal agreement between the grower and processor regarding environmental management responsibilities. Thus, if an environmental problem occurs with the farm it can be more clearly defined if it is the grower, the processor or both that are responsible for rectifying the problem.

3. Meat Chicken Production

3.1 Production systems

An understanding of meat chicken production systems is useful to understand how meat chicken farms may interact with the environment. This section provides a brief description of these.

3.1.1 Breeding farms

Breeding farms produce the fertile eggs that are hatched to become the chickens for commercial meat production. Grandparent birds are reared to laying age and then mated to produce fertile hatching eggs from which are hatched the next (parent) generation. Parent birds are reared to laying age and then mated to produce the fertile hatching eggs which are hatched to produce commercial meat chickens. The grandparent and parent breeder flocks are generally housed in large deep litter sheds. The fertile eggs produced by these flocks are collected daily and stored for transport to the hatchery. The grandparent and parent stock are productive for about 12 months. At the end of their productive life, these birds are generally processed. The litter is removed and the sheds and all the equipment are cleaned and sanitised ready for the next batch. Birds are normally grown to 16 weeks on rearing farms before they are transported to production breeding farms.

3.1.2 Hatcheries

Fertile eggs from grandparent and parent flocks are incubated at hatcheries. The chickens produced are graded for quality (and possibly sexed), vaccinated, and consigned to parent rearing farms or meat chicken farms within hours of hatching.

This manual does not cover hatcheries, as their operations are distinct from breeder and meat chicken farms.

3.1.3 Meat chicken farms

Batches of day old chicks are delivered to grow-out farms. Here they are raised within large naturally or mechanically ventilated sheds with varying degrees of climate control. Usually the day old chicks are placed in an insulated, heated brooding section (heating usually being provided by gas fired hot air or radiant heat brooders), which occupies about one third to half of the shed. The floor space is increased over the next 10-14 days when the chicks occupy the entire shed. In some locations, brooding may use the whole shed with barriers to keep the birds close to the heaters.

Meat chickens feed on demand from automatic feeders filled from bulk bins or silos. Drinking water is continuously available through designated waterers.

The meat chickens are reared on litter, which may consist of sawdust, wood shavings, paper, rice hulls or chopped straw, depending on availability, price and absorbency. The litter layer is generally 40 to 100 mm thick. It may be cleaned out and replaced at the end of each batch (single batch), partially cleaned out after each batch (partial reuse), or cleaned out after several batches (multi-batch).

Photograph 2. Day old chicks in shed.

Sheds are mostly 100 to 170 m long and 12 to 20 m wide and house approximately 20,000-50,000 meat chickens. Most farms have three to four sheds. Meat chickens are generally raised in batches and when they reach market age, they are caught (often at night), placed in crates and transported to processing plants. Part of the flock is generally processed after about five weeks (thin-out), with the majority of the flock harvested between six to eight weeks of age. Sheds are empty for one to two weeks after final bird harvest to allow for shed cleanout and disinfection between batches. Farms generally raise five to six batches of meat chickens per year.

Photograph 3. Loading market age birds.

The addition of free range areas to conventional sheds is becoming increasingly popular as the demand for free range poultry rises. Most systems are set up to enable the sheds to be adapted for use for either conventional or free range production. Free range chickens must be provided with outdoor access after they become fully feathered (by 21 days of age). Depending upon the accreditation program adhered to, free range and organic production systems often have lower stocking densities than would be typical of conventional chicken meat farms and certified organic systems have a longer grow-out period of 65-80 days versus 32-55 days for conventional and free range systems. Free range chicken

meat (including organic chicken meat) currently accounts for approximately 15% of chicken meat produced in Australia (ACMF 2014).

Growers have contracts with vertically integrated meat chicken processors. The farmer provides labour, management, energy, shedding, equipment and bedding material. The processor supplies and delivers the day old chicks, supplies and delivers feed, medication, technical support (including veterinary advice), chicken pick-up crews and transport.

There is also a small percentage of extensively run meat chicken farms. However, this manual only covers the production of intensive meat chicken farms and associated breeding farms.

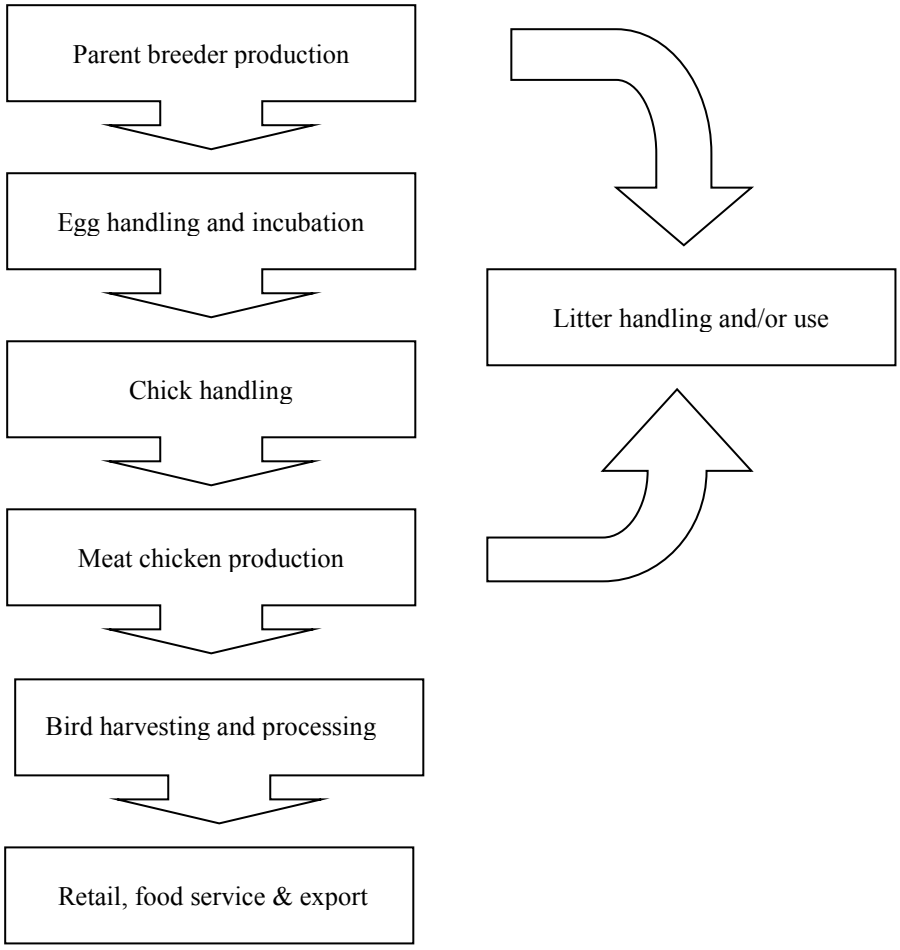

Figure 1. Flow diagram of meat chicken production system.

3.2 Biosecurity

The *National Biosecurity Manual - Meat Chicken Farming* (ACMF 2010) establishes animal health and food safety standards for meat chicken farms. Disease outbreaks can significantly affect the meat chicken industry through substantial loss of income and can create significant environmental problems with the disposal of large numbers of birds. The risk of disease transmission within the industry can be reduced through appropriate site location and management. Factors to consider include:

- Poultry farms should be located a reasonable distance from one another to minimise the risk of disease transfer between farms. This will also reduce the potential for the cumulative effects of closely located enterprises. There is no set distance that will eliminate the risk of disease transfer, but generally the greater the distance the lower the risk. Most state planning policies and guidelines recommend a minimum separation distance of 500 – 1000 m between poultry farms. Breeder farms should generally have greater separation distances to other farms (3 to 5 kilometres), as the consequences of disease transfer are greater given the longer occupancy time for a batch.

- Where possible, avoid building meat chicken farms in close proximity to waterways and wetlands that are used by waterfowl as these may carry avian diseases. If unavoidable, there will need to be a higher level of disease risk management practiced. All water used for drinking, cooling and washdown must meet the water standards established in the industry's *National Biosecurity Manual*, or otherwise be treated to the standard set out in the Manual. All surface water (dam, river etc) must be treated before use. The *National Water Biosecurity Manual - Poultry Production* (DAFF 2009) provides further guidance on water quality standards and treatment options.

- Persons entering a meat chicken farm should strictly follow the biosecurity protocols of the farm to avoid cross contamination. Trucks collecting dead birds, picking-up birds for processing and delivering feed should strictly follow farm biosecurity protocols to avoid contamination on-farm.

- Dead birds should be disposed of properly.

- Rodents and feral animals should be controlled on the farm.

- Native animals and wild birds should not come in contact with the flock. It is recognised the free-range birds will have some exposure to wild birds, however measures should be taken minimise exposure (ACMF 2010).

3.3 Nutrition and hygiene

The meat chicken industry has a primary concern for cleanliness and sanitation to ensure that the birds are healthy and that the chicken meat marketed to the public is wholesome and disease free. All farms should have an appropriate shed clean out and hygiene program to minimise the potential for health problems. Protocols for shed clean-out are available from the supplier/integrator.

Feed and water is readily available to the chickens. Feed mixtures are predominantly grain based and designed to optimise production and bird health. Feeding of ingredients containing potential contaminants such as heavy metals should be carefully considered to avoid problems with the eventual land application of spent litter. Diets should also be formulated to minimise the incidence of wet manure associated with performance reductions and possible environmental impacts. Disruptions and sudden changes in diet may increase the incidence of wet manure, thus nutritionists should consider price, animal health and performance when formulating diets.

4. Siting and Design

Appropriate siting and design of meat chicken farms is essential for a sustainable operation and to minimise environmental conflicts and impacts.

4.1 Locality

Meat chicken farms need to be located as close as possible to feed mills, processing plants and hatcheries to minimise the cost of transporting feedstuffs and day-old chickens onto farms, and finished chickens and spent litter off-farm. Most processing plants are located in capital or large cities. Other factors influencing the location of farms are considered below.

4.1.1 Water supply

Meat chicken farms must have an adequate and reliable supply of water for drinking, cooling and shed washdown (disinfection). All water must be treated to the standard required in the National Biosecurity Manual (ACMF 2010) on farm - his would normally exclude town water supplies provided it properly treated. The use of treated water is essential to minimise the risk of disease transmission from wild birds. Other factors to consider in regard to water are:

- The composition of all water sources (other than town) should be analysed to check their suitability (particularly salinity and microbial content).
- Provision of a back up supply or storage holding at least two days' supply in the case of breakdown or loss of supply.
- State government guidelines and regulations for drawing water from surface watercourses or bores, or for catching water in dams.
- Adequacy of water supply. Czarick and Fairchild (2009) provide an estimate of drinking water consumption per bird from the day of placement until they reach harvest weight. Each bird will drink approximately one litre of water for every half kilogram of feed consumed. Using a typical bird weight of 2.5 kg live weight and using a feed conversion ratio of 1.75, this equates to 4.4 kg of feed and 8.8 L of water consumed. Drinking water usage should be about 3.5 litres per kg of liveweight gain. Thus every 100,000 bird produced (2.5 kg) would require about 0.9 ML of drinking water. Additional water is also needed for cleaning, shed cooling, fire-fighting etc.

Photograph 4. Birds drinking.

4.1.2 Power supply

A constant supply of power (3 phase) is needed to provide water and to deliver feed to the birds, and to light and ventilate (particularly running fans) the sheds. Access to reliable and adequate power is necessary. Requirements for possible future expansions of the farm should be considered, including the ability to access equipment buried underground such as power cables. If future expansion is likely, consider installing cabling to match future design capacity. Installation of standby generators with auto-switch control is essential to manage temporary fluctuations in power supply or total power supply failure. If a temporary drop in supply voltage to your farm occurs, then electrical motors may operate in overload during the fluctuation. This may lead to the motors being shut down by the overload protection system. A standby electrical generator, which runs on an alternative fuel such as diesel, will automatically start and provide back-up power during the period of fluctuation or total power failure. Automatic control is essential as power fluctuations and total failure can occur at any time.

4.1.3 Clean bedding availability

Bedding needs to be readily available. The type of bedding used will be dictated by price, availability and moisture adsorption qualities. Details of preferred bedding materials are provided in Section 5.2.

Clean bedding generally has a low density, thus making transport costs over long distances impractical and expensive.

4.1.4 Road access and transport

All weather road access is essential for the delivery of fresh bedding, day-old chickens and feed and the transport of meat chickens for processing, removal of spent litter and dead bird removal (if necessary). Access roads and entries must be suitable for use by semi-trailers and B-Doubles. Other factors to consider include:

- Locating the entrance point to the property on a straight stretch of road with good visibility in both directions.
- The possible noise, dust and light impacts of a meat chicken farm from transport services.

4.1.5 Land use and future development

Land use and future development is an important issue when planning a meat chicken farm. Factors to consider are:

- Meat chicken farms should be located on land designated rural.
- Ideally, new farms should not be located near urban or rural residential development.
- Future land use planning should be considered when locating a new farm.
- Existing meat chicken farms should be protected by future development in planning schemes.
- If you plan to apply spent litter on-farm, you will need adequate suitable land for the sustainable use of the nutrients.

4.1.6 Designated areas

Most states have declared water catchments and groundwater recharge areas in which intensive livestock production, including meat chicken farming, is not permitted. This will need to be

ascertained from the relevant authority/agency before a site is chosen. Vegetation clearing legislation may also restrict the establishment of an enterprise.

4.2 Buffer distances

4.2.1 Biosecurity

Meat chicken farms should be sufficiently separated (ideally, by one kilometre for new farms) from neighbouring poultry farms to minimise the risk of disease transfer, as discussed in Section 3.2.

4.2.2 Community amenity

Community amenity issues, particularly odour nuisance, are by far the greatest source of complaints against meat chicken farms. The most effective means to minimise nuisance is to maintain an adequate buffer between the enterprise and neighbouring residences. The greater the separation distance, the lower the probability of offensive odours, dust and noise impacting on the surrounding community. The planting of vegetative screens around a farm, or the locating of sheds in vegetated areas (provided they do not impact on shed ventilation) will screen the enterprise and may reduce odour and dust impact. Although vegetation is not technically efficient in reducing noise, the visual screening can assist by improving perception.

State government departments and agencies, and individual local governments have requirements for minimum separation distances between new and expanding meat chicken farms and neighbouring houses, property boundaries, residential developments, watercourses, flood prone areas and other sensitive receptors. However, separation distances alone do not always guarantee an absence of environmental impacts on neighbours.

4.2.3 Natural resources

Factors to consider when planning buffer distances to natural resources include:

- Meat chicken farms, including spent litter application areas, need separation from other sensitive areas, such as surface water bodies (rivers, creeks, wetlands etc) to avoid possible contamination.
- Separation distance documents and local government by-laws will generally stipulate minimum separation distances.
- Topography, vegetative cover and spent litter application methods dictate the potential risk of an enterprise or management practice.
- Vegetative buffer zones help reduce the risk of surface water contamination from runoff. The greater the vegetative cover and distance the greater the possibility of filtering out nutrients, particularly phosphorus.
- Riparian zones around watercourses should be protected.
- As a rule, the meat chicken enterprise (sheds and spent litter stockpiles) should be located above the 1 in 100 year flood line. Information on flood levels should be available from the state natural resource departments or equivalent.

4.2.4 Land area

Many properties on which meat chicken farms are sited are small (10 – 20 ha). The property size often dictates the number of sheds (number of birds) on the farm, after providing adequate buffers to sensitive receptors and watercourses. The buffers help to minimise community amenity impacts and reduce the risk of surface water contamination.

Some state and local government codes of practice, guidelines and planning policies specify minimum property sizes for meat chicken farms. Separation distance requirements for new enterprises are now generally greater, which increases the property size and may allow for more utilisation of spent litter on-farm. Consider future expansion of an enterprise when establishing a new farm, as a limited land area can inhibit future development.

Square-shaped properties are preferred over long thin shaped properties of similar area in order to maximise farm layout, design options and buffer distances from the sheds to the boundary of the property.

The amount of spent litter that can be sustainably used on-farm and the number of free range birds will be determined by the land area available, the types of crops grown and the capacity of the soil to store the applied nutrients. For more information see Section 8.2.

4.3 Topography

Topographical features to consider when establishing a farm or spreading spent litter include:

- A gently sloping site will generally have enhanced drainage and low erosion potential. Flatter sites will reduce the earthworks costs associated with construction.
- If the sheds are naturally ventilated they should be situated on an elevated site to maximise air movement.
- Sites that have the potential for increased odour and dust impacts on neighbours should be avoided i.e. valley drainage zones.
- If spreading spent litter on farm, flat to gently sloping land is preferred.
- Use topographical features to shield meat chicken farms and lessen any potential visual impact.

4.4 Vegetation

Vegetation management practices include:

- Areas around sheds should be cleared of trees to promote building ventilation (particularly for naturally ventilated sheds) and minimise vermin habitat. Adequate area should be cleared for a large load-out pad at one end of the shed.
- Unpaved areas around sheds should be grassed to prevent soil erosion and minimise the heat load on the buildings through radiation from bare ground.
- The vegetation in free range areas should be adequately maintained to prevent soil erosion and nutrient loss from surface runoff.
- As mentioned in Section 2.3.1, vegetative buffers should be planted and maintained to reduce both visual and odour impacts on the surrounding community without compromising shed ventilation.
- Clearing of vegetation for sheds etc. may need a permit or licence depending on state requirements.

4.5 Sheds and surrounding infrastructure

4.5.1 Shed construction

Most meat chicken sheds are steel framed, clear span, gable roofed structures. Sidewalls are generally solid up to 300 – 400 mm. The balance of the wall is usually netted and fitted with woven plastic curtains, hinged metal shutters or solid sides. These are raised or lowered manually or automatically to control ventilation and temperature, and to provide protection from adverse weather conditions if the shed is naturally ventilated. Tunnel ventilated sheds with 'solid sides' may have sections which open in the event of complete power failure (i.e. generator also fails to start).

Most newly constructed sheds are tunnel ventilated. These sheds generally have curtains or solid sides and are fitted with large fans at one end that draw air through the length of the building and discharge it. Give careful consideration to buffer distances at the discharge end of these buildings to prevent odour, dust and noise nuisance.

Roof overhang and sidewall height should be sufficient to prevent rainwater from entering the shed and wetting the litter (naturally ventilated sheds).

Modern tunnel ventilated sheds are constructed to minimise uncontrolled air leaks into the shed. This includes leakage of cold air during the cooler months and warm air during summer. Modern sheds are typically built with solid side walls (sandwich panels) which provide insulation and reduces air leaks into the shed. Older sheds can be fitted with side-curtains, which require careful maintenance to prevent significant air leaks from occurring.

4.5.2 Groundwater management

- Meat chicken farms should not be located on areas with shallow groundwater.
- The base of sheds, spent litter storage areas and carcass disposal pits should be at least 2 m above the water table at all times.
- The base of sheds, spent litter storage areas and carcass disposal pits should be adequately sealed by compacting with clay or other suitable material to prevent leaching of nutrients. Highly vulnerable sites may require the construction of a concrete base. Appropriately constructed shed floors will aid in shed clean out.
- Free range areas will accumulate nutrients over a period of time from the deposition of poultry manure. To reduce the likelihood of nutrients leaching into groundwater, several management strategies could be adopted, including creating a compacted base in areas most frequented by birds (i.e. under shaded areas) and scraping and removing manure every one or two years, or growing and harvesting crops in free range areas to remove accumulated soil nutrients. To date little research has been done in regards to managing nutrient accumulation in intensively managed free range areas. However, a recently completed RIRDC project, *Free range chicken farms – odour emissions and nutrient management* (Brown & Gallagher 2013) may provide relevant data and guidance in this respect.

4.5.3 Surface water management

- The meat chicken sheds, free range areas, roads and spent litter application areas should not be in flood prone areas.
- Fill or drain depressions around sheds that hold water.
- Raise the base of the sheds above the natural surface level to prevent the entry of stormwater runoff. If this is not possible, install adequate surface drains.

- Locate and design spent litter stockpile, composting and carcass disposal sites to prevent stormwater run-on and contaminated runoff exit. Consider the construction of drains or bunding and ground reshaping.

- Direct nutrient-rich water captured in bunded areas to containment dams.

4.5.4 Shed fittings and associated plant and equipment

- Modern ***watering systems*** are sealed and designed to operate at specific pressures depending on the nipple design and the age of the birds. Repair or replace inefficient systems that leak or allow excess spillage to avoid unnecessary wetting of the litter. Properly installed and maintained *feeders* should minimise feed wastage. This in turn reduces both production costs and the nutrient content of the litter.

- Properly maintain ***silos and feed-lines*** to avoid feed spillage and ingress of water. Wet and spoiled feed can produce excessive odours.

- *Foggers* have traditionally been used to reduce shed air temperatures by directly injecting fine water particles into the air. The use of foggers has been successful in conditions where midday temperatures are high but humidity levels are low. Care must be taken when operating foggers in warm and humid conditions, such as south east Queensland, to avoid creating excessive humidity levels inside the shed which is detrimental to bird health. The continual use of fogging systems can also result in wet litter, leading to bird performance and health problems and increased odour emissions.

- ***Cooling pads*** on tunnel ventilated sheds provide evaporative cooling in hot weather to improve the environment for the birds inside the shed. Cooling pads are typically located on the side walls at the opposite end of the shed from the main ventilation fans. When the fans are operated in tunnel ventilation mode, air is drawn into the shed through the cooling pads and along the shed to the ventilation fans. The temperature of air passing through the cooling pad is reduced as water is evaporated into the air. A potential negative effect of this system is the corresponding increase in relative humidity that occurs due to the addition of water to the air stream. Birds rely on two mechanisms to remove excess heat from their body: heat losses to the surrounding air and heat loss due to evaporation of water during breathing. When the cooling pads are operating, the decrease in air temperature and increase in air speed over the birds helps to keep the birds cool.

- ***Fans*** are fitted in sheds to provide adequate ventilation and cooling through air movement. Modern tunnel ventilated sheds have a group of six to twelve large tunnel fans located at one end of the shed. There are often two fan systems present in tunnel ventilated sheds - minimum ventilation fans and tunnel ventilation fans. Typically, minimum ventilation fans are located at each end of the shed and are operated to always ensure that a minimum flow of fresh air is provided in the shed by drawing air in through wall vents such as mini vents. During the early stages of a batch, the birds may require heating to keep warm. During this period, minimum ventilation is required. The side vents may be used throughout the batch during cold weather to maintain appropriate temperatures in the shed. As the birds grow and the heat load increases, the shed control system changes to tunnel ventilation mode and the main ventilation fans are started. Other shed configurations include fans on very long sheds being fitted on either side in the middle of the shed with the inlets and cooling cells located at either end of the shed. There also have been sheds fitted with roof fans. Whatever system is used it must create airflow over the bird.

- ***Mini vents*** are typically installed along the upper section of the wall in well-sealed sheds. Each vent has an insulated flap which can be drawn down by a winching system. This directs fresh air into the upper roof area of the shed where it mixes with warm house air before being drawn down to the area occupied by the birds.

- ***Generators*** are required in the case of power failure to maintain water supply, feed, lighting and fans for ventilation.

- Many new sheds and refitted existing sheds are fitted with ***automatic controllers*** for feed, water, fans and blinds (temperature and ventilation).

4.5.5 Shed orientation

- Sheds should preferably be oriented with the long axis east-west. This helps minimise solar heat absorption during hot weather. This is particularly important for naturally ventilated sheds.

- Varying the shed orientation may help to minimise odour, dust and noise impacts on the surrounding community. This is particularly worthwhile for tunnel ventilated sheds.

4.5.6 Shed spacing

- Providing a parallel distance of at least 15 m between sheds improves ventilation and lowers the temperature and humidity in the sheds. This distance is less critical with tunnel ventilated sheds.

4.5.7 Ventilation

- Adequate ventilation is essential for maintaining bird health and welfare.

- Controlling shed ventilation is critical in maintaining acceptable moisture content in the litter. This helps to prevent excessive odour generation and controls the accumulation of water vapour, heat, gases and dust particles.

- Modern sheds normally include an automatic control system that monitors internal shed conditions such as temperature and humidity and controls heating, ventilation and cooling systems.

- Maintaining a uniform airflow through the shed and installing fans to facilitate air movement achieves good ventilation.

- In older style sheds (without dropped ceilings) converted to tunnel ventilation, deflectors (baffles) can be installed to direct most airflow below this level, thereby increasing air velocity and therefore ventilation efficiency. Most deflectors are typically curtain material hung at intervals across the width of the shed with the bottom edges at about the height of a dropped ceiling. Refer to Donald (1997) for more information. Ceiling stirring fans can also be installed in tunnel ventilated sheds to optimise uniform airflow (refer to APEE 2001).

- Whenever possible, the atmosphere in sheds should be maintained between 50% and 75% humidity to optimise bird health, prevent dust and allow the drying of litter.

- In naturally ventilated sheds, odorous air may build up in the sheds overnight. Gradually open the sheds first thing in the morning, to avoid a large sudden release of odorous air.

5. Shed Management

5.1 Stocking density

Sheds must only be stocked at densities complying with animal welfare codes of practice. The Model Code of Practice for the Welfare of Animal – Domestic Poultry (PISC 2002) states a maximum 40 kg of live birds per m^2. Stocking densities in sheds that are not mechanically ventilated are reduced to around 28 kg of live birds per m^2. Most companies recommend placement densities that ensure peak densities are well below these Code-specified maximums however. Overstocking causes increased litter moisture and potential odour problems, and is deleterious to bird health and performance. Breeder farms will use a lower stocking density of around 6 birds per m^2 (approximately 20 kg of live birds per m^2). Farms accredited under the RSPCA Approved Farming Scheme must not exceed densities of 34 kg of live birds per m^2 (or 28 kg of live birds per m^2 for sheds that are not mechanically ventilated).

The stocking densities of free range systems are often lower than conventional sheds and according to the Free Range Egg & Poultry Australia (FREPA), an accreditation organisation responsible for accrediting most free range farms in Australia, shed stocking densities must not exceed 28 kg of live birds per m^2 of floor space, unless there is mechanical ventilation, in which case densities must not exceed 30 kg of live birds per m^2 of floor space (FREPA 2012). Certified organic sheds must not exceed 10 kg of live birds per m^2 for juvenile birds and no more than 5 birds per m^2 for adult birds including the roosting area (Standards Australia 2009).

5.2 Bedding material types

The material used for bedding in meat chicken sheds should have the following characteristics:

- Dry.
- Light.
- Highly absorbent.
- Dries rapidly.
- Remains friable.
- Free of contaminants such as heavy metals, fungal toxins.
- Suitable for use as a soil conditioner, compost or fertiliser or for combustion for power generation.
- Cost effective.

Examples of suitable bedding material include hardwood sawdust, softwood sawdust, timber shavings, shredded paper, rice hulls and chopped straw. The type of clean bedding used by a meat chicken farmer depends on the availability and price of products in their area. Other types of fresh bedding may become available. The suitability of alternate products needs to be measured against the characteristics listed above.

Table 1. Characteristics of Australian chicken meat bedding materials.

Bedding material	Characteristics
Timber Shavings and Sawdust	• Timbers are local and imported, soft and hardwoods • Some timbers may contain chemicals and persistent organochlorine insecticides, which can be retained in edible tissue • It is only acceptable to use untreated timber by-products for poultry litter • Dry softwood shavings are available in bales • Some overseas countries produce a product specifically for the intensive livestock industry to avoid the risk of using a contaminated product.
Rice Hulls	• Good particle size, density, thermal properties for poultry litter • Free from dust • When sterilised are free from weed seeds • A popular choice for market gardeners and mushroom growers • Produced in bales that can be stored on farm easily.
Shredded Paper	• Several companies have developed shredded paper products suitable for use in the poultry industry • If incorrectly placed in the shed, material tends to 'cake' during the first two weeks. • Compaction can be reduced if turned to break up layers • Only news print can be used as some inks are toxic and glossy paper is not absorbent • Produced in weatherproof bales that can be easily stored.
Chopped Straw	• Wheaten straw is most popular • Dries quickly after cutting therefore discouraging growth of fungi • Straw should be chopped in pieces no longer than 25mm* • If the straw is too long it will mat over quicker* • Length of straw is more important than types of straw* • Straw needs to be free from weed seeds and pesticides and chemicals • Supplies of dry and fungus free straw are not consistent from season to season.
Wood Chips	• Variable particle and quality due to range of trees used • Some shredded trees are toxic to poultry.

Source: NSW Agriculture (2004); *Grimes *et al*. (2002)

5.3 Litter management

5.3.1 Controlling moisture

- The moisture content of the litter in the shed has the greatest influence on whether a meat chicken farm will cause an odour or dust nuisance.
- Litter moisture should be maintained between 15% and 30% (wet basis). At this moisture content, the litter should be relatively dry and friable.
- When litter is too dry (less than 15% moisture – wet basis), dust problems occur. These give rise to dust nuisance, poor bird health and potential health problems for farm workers.
- When the litter is too wet (greater than 40% moisture – wet basis), it becomes anaerobic and odour and ammonia emissions increase. This leads to odour nuisance, poor bird health and possibly to health problems for farm workers.

- Shed litter with a moisture content exceeding 50% (wet basis) can generate and emit significantly more odours as it breaks down. Take immediate action to reduce the litter moisture content or to remove the litter from the shed.
- It may be necessary to top up areas of wet litter within the shed or to remove and replace the litter.
- Interruptions in diet due to feed formulation, medication or poor bird health can produce wetter manure. This increases litter moisture content and subsequently increases ammonia generation and odour emissions. Close liaison between meat chicken farmers and feed and chicken suppliers can help to minimise these interruptions.

Table 2 provides a guide to litter moisture content and properties.

Table 2. Description of litter at corresponding moisture contents.

Litter Description	Moisture Content (% w.b.)
Dusty	<15
Dry to friable	15 – 20
Friable to moist	20 – 30
Sticky – beginning to cake	30 – 40
Wet and sticky – heavy caking	40 – 50
Very wet and sticky	>50

5.3.2 Litter and manure beetles

Control litter and manure beetles (darkling beetles) to avoid damage to insulation and wood structures and to reduce the risk of disease spread, including salmonella. Beetles may breed in litter in sheds or stockpiled on-farm. Control measures may include either pesticide application; pasteurising spent bedding; total shed clean out or a combination of these.

5.4 Litter cleanout

Shed clean-out enables each batch of day old chicks to be introduced to clean bedding in the brooding section of the shed. This minimises the risk of disease. There are three common practices adopted in Australia for litter clean-out:

- Single use litter.
- Partial reuse.
- Multi-use litter.

There is no conclusive evidence to suggest that one system is better than another for bird health, production or environmental management. System considerations include:

- Availability of new bedding material.
- Availability of application areas for spent litter.
- Potential for increased odour generation.
- Shed environment.
- Concentration of nutrients and heavy metals in the spent litter.

- Risk of disease transfer between batches.
- Litter beetles may cause an increased problem with multi-use litter (unless the litter is pasteurised between batches). Extra disinfection may be required between batches to control this potential problem
- Chemical usage for disinfection.

When litter is removed from sheds, the side shutters or curtains should be opened to prevent the build-up of gases in the shed that may threaten the health and safety of workers.

If possible, the litter in the shed should be removed when the wind is blowing away from sensitive receptors/places.

Photograph 5. Spent litter clean out.

5.5 Other factors

Wet litter is not only deleterious to bird health, but creates a condition where more nitrogen is released from the litter in the form of ammonia. This may create odour and health issues. The two key factors to controlling litter moisture are ventilation and an effective, well-maintained watering system to minimise spillage onto the litter. Carefully adjust waterers for such factors as height and water depths. Reducing water spillage will:

- Save water.
- Improve bird quality.
- Improve the production environment.
- Reduce ammonia release from the litter.
- Reduce volume of wet manure.
- Extend time between litter cleanout (if multi batch litter is used).

Other shed maintenance factors include:

- Inspect shed walls and roofs for leaks and repaired immediately to prevent wet patches forming in the litter.
- Shed roof should be insulated internally to prevent condensation from wetting litter during cool weather.
- Drinkers and foggers should be inspected regularly to ensure they are working effectively, and repaired and replaced if necessary.
- Remove dead birds daily from the shed.
- The ventilation system needs to be checked regularly to ensure that air movement is at the design level. This aids in maintaining optimum shed environment and helps to keep the litter dry. Modern tunnel ventilated sheds are computer controlled and monitored to maintain an optimum shed environment.
- The compacted layer at the base of the shed needs to be retained after each clean-out and repaired when necessary.

5.6 Improving energy use efficiency

5.6.1 Metering

Typically, overhead or underground cables will supply high voltage power to a transformer located near the boundary of the farm or near the farm sheds. The transformer steps high voltage power down to low voltage three phase 415 volt power. The power company installs a power meter in a steel cabinet and all of the electrical users on the farm are supplied through the power meter. Large farms may have more than one power supply and power meter. A typical medium sized poultry farm will have only one main power meter which allows the power company to monitor electrical energy consumption and issue monthly or quarterly power invoices. The power meter normally provides a usage reading which the power company can read to verify power usage. The farm manager can also periodically read this number from the meter and monitor power consumption. Some companies will provide a different type of meter that provides daily totals of power consumption. It is also possible to have an online power monitoring logger installed that will provide the farm manager with real time information of power consumption.

Photograph 6. Power meter and data logger installed in a poultry shed.

5.6.2 Lighting

Modern poultry sheds incorporate different lighting systems for the brooding and grow-out phase of the batch. Traditional lighting systems used incandescent light often with dimmers to allow adjustment to match the required lighting conditions. The Australian Government began phasing out incandescent bulbs in February 2009 as part of a minimum energy performance standard (MEPS). Incandescent bulbs are no longer available for purchase and have been replaced by more energy efficient bulbs. A poorly designed and operated shed lighting system can cost the operator approximately $2,000 per year more than a shed fitted with energy efficient bulbs. Modern energy efficient bulbs include compact fluorescent lamps (CFL) and triphosphor bulbs, and cold cathode fluorescent lamps (CCFL).

With a greater variety of fittings and reduction in cost, LED lighting has become a viable option to other types of lighting. LED has the advantage of very low power consumption hence operating costs. LED lighting can be dimmed with an appropriate control unit available for most shed controllers. Lighting technology is rapidly developing and new lighting solutions are currently emerging.

Modern shed lighting programs vary, but all include a period of continuous dark after seven days of age. Farms accredited under the RSPCA Approved Farming Scheme must also adjust the light intensity between lighting periods (ie light and dark periods) in a gradual manner over at least 15 minutes. New sheds should be fitted with the most energy efficient lighting system available. EPA & QCGA (2004a) has published a factsheet to assess the viability of converting an older lighting system to an energy efficient lighting system available from http://ww2.gpem.uq.edu.au/CleanProd/poultry/lighting.pdf. Lights used for bird pick-up and for the grow-out stage must be capable of being dimmed and turned on in the dimmed state.

5.6.3 Heating and cooling systems

Providing the optimum shed temperature and ventilation is one of the most critical and expensive components of running a meat chicken farm. Increasing the efficiency of shed heating and cooling systems can represent large cost savings for the producer, largely in electricity and gas costs. RIRDC have previously commissioned a project on using life cycle assessment to quantify the environmental impact of chicken meat production, (Wiedemann et al. 2012). The report presents research on the environmental intensity of meat production, focusing particularly on energy, greenhouse gas emissions and water use. The report provides bench mark information for energy use in meat production facilities.

Ventilation fans

The ventilation of tunnel ventilated sheds can account for 70-80% of poultry shed electricity usage (EPA & QCGA 2004b). The energy efficiency of ventilation systems can be improved by:

- Installing the right fan system
- Use of automatic controls in tunnel ventilated sheds to continually monitoring shed conditions and adjust ventilation accordingly.
- Minimising air leaks to reduce loads on fans.
- Regular maintenance and servicing of fans to maintain optimum efficiency.

RIRDC have recently published a "Review of fan efficiency in meat chicken sheds" (Dunlop & Grant 2012). As well as reviewing new fans, the report provides methods to measure air flow and energy efficiency. Simple methods to identify underperforming fans are provided are will likely yield useful results. The report is a useful resource for meat chicken growers looking to review the performance and efficiency of fans prior to purchasing new fans. The report will be available online at www.rirdc.gov.au. Additionally, RIRDC have also published a report on "Reducing costs and energy

by replacing inefficient ventilation fans" (Brown 2014). This report assesses the economic feasibility of replacing fans. The report will aid meat chicken growers in the decision making process regarding fan replacement, focussing on two fan replacement scenarios (i) replacing a full shed of fans; (ii) replacing only the most used fan. This report will be made available on the RIRDC website.

Choosing the right fan system

The initial fan design for a poultry shed is based upon establishing a minimum air speed inside the shed to cool the birds during peak summer temperatures. The combination of air speed and shed dimensions provides the total volumetric capacity required by the ventilation system, represented in cubic feet per minute (CFM). During periods of high temperatures all fans will be running and during periods of low temperatures only one fan will operate intermittently to remove stale air and gases such as ammonia from inside the shed. Ventilation fans are available from a wide range of suppliers and are typically grouped into fan blade diameters for example 915 mm (36″), 1219 mm (48″) or 1321 mm (52″). There are three performance factors to consider when purchasing exhaust fans for a tunnel ventilated shed (EPA & QCGA 2004b):

- Air moving capacity (CFM – cubic feet per minute)
- Energy efficiency (CFM / watt).
- Airflow ratio (CFM @ 0.20" / CFM @ 0.05" static pressure).

The airflow ratio is an indicator of how well a fan can move air as the static pressure increases i.e. from dirty shutters, pads or side curtains not fully opening. Air flow ratios typically vary from 0.50 to 0.85. The higher the ratio, the less the fan is affected by high static pressures (Czarick 2005). The higher the static pressure inside a shed, the harder it is for a fan to draw air into the shed and the lower the amount of air that can be moved by the fan.

Some fans have a very good air flow ratio but a poor energy efficiency rating and vice versa. In general for every 2 CFM / watt increase, electricity usage is reduced by approximately 10%. A fan should have an energy efficiency rating of at least 19 CFM / watt (0.5" SP) and an air flow ratio of at least 0.71 (EPA & QCGA 2004b). The following US websites provide regularly updated performance information on ventilation fans: www.poultryventilation.com and www.bess.uiuc.edu.

Outlet louvres or shutters are typically included with each ventilation fan. Shutters open when the fan starts and close when it stops to prevent air moving into the shed. Various designs of fan shutters, discharge cones and cooling pads are available. Manufactures are continually developing new ways to improve energy efficiency. Popular modifications to fans include replacing shutters with discharge cones to eliminate interference from outlet shutters and higher fan motor loads; replacing inlet shutters with butterfly flaps to provide less flow resistance; and slanting the fan slightly downward from horizontal.

Photograph 7. Shed ventilation fans and discharge cones.

Automatic control systems

Automatic control systems, improve the efficiency of tunnel ventilated sheds by continuously monitoring parameters inside the shed including such light, temperature, humidity and static pressure and adjusting the sheds ventilation system to best suit the conditions (EPA & QCGA 2004b).

Minimising air leaks

The benefits of a well-sealed shed include reduced energy consumption, and an improvement in litter quality and shed temperature control. To measure air leakage in a sheds, close all air inlets and curtains and run one 1219 mm (48") fan or two (915 mm) 36" fans. The target static pressure for a well-sealed shed is at least 30 Pa to 38 Pa (0.12" to 0.15") and a very well-sealed shed may achieve 62 Pa (0.25"). For a more detailed methodology refer to Poultry Housing Tips: Static Pressure Testing (Czarick 2004). To reduce air leaks ensure all sidewall curtains are tightly closed, any cracks around doors and shutters are sealed and holes in ceiling insulation are fixed. Sheds built with solid sides (sandwich panels) instead of side curtains have reduced air leaks.

Fan maintenance

Good fan maintenance includes cleaning and checking that the drive system is correctly setup and cleaning the fan blades and shutters regularly to remove any build-up of foreign material. Typically, a small single phase or three phase motor drives the fan through a continuous fan belt and pulley system. As fan belts wear out, they sit lower in the motor pulley and the fans spin slower, reducing the fans air flow capacity especially at higher static pressures (Czarick 2003).

Photograph 8. Close up of ventilation fan showing three phase motor.

Recirculating heated air

It is common practice to install proportionally more heaters at the brood end of a partial-brood house. Installing fans to recirculate heated air that accumulates at the ceiling, will reduce gas consumption. Two types of ceiling fans can be installed to achieve this. Variable speed 457 mm to 610 mm (18 to 24 inch) vane axial fans run horizontally in the shed or paddle fans operated in the updraft mode which pull air up through the fan and direct air towards the sidewall of the shed (Auburn University 2001). Thermostats should be installed in sheds to monitor sheds internal temperature and should be checked regularly to ensure they are accurate. Thermostats should be placed near the centre of the house cross-section that the heater supplies and as close to bird level as possible (University of Kentucky 2010).

Photograph 9. Gas heater.

5.6.4 Generating electricity/heat on-site

Solar panels

Although not common industry practice, meat chicken farms may be a good candidate for installing solar panels to generate enough electricity for "peak usage" times of the day, to cut down on electricity costs.

Solar panels (photovoltaic (PV) modules capture the sun's rays and convert them into direst current (DC) energy. An inverter then converts the DC energy into alternating current (AC) electricity. Solar systems can be set up as a stand-alone system, which requires a battery to store excess energy, or directly connected to the electricity grid, which feeds excess energy into the grid. There are three types of solar cells, monocrystalline, multicrystalline, or amorphous type. The different module types are suited to different applications Solar modules can be mounted on a frame (either free standing or on the roof) or incorporated in the building fabric (Stapleton et al. 2013a).

Solar panels should installed so that they face north, pointed directly at the sun, ideally they should be in full sun from 9 am to 3 pm in mid-winter, at the right angle and are not overshadowed by trees or shading (Stapleton et al. 2013b).

On-site pyrolysis plant

Pyrolysis and gasification research and development is rapidly advancing to convert poultry litter into electrical energy, and by-products such as syngas, bio-oil and biochar. The technology is not yet mature and farm sized plants are not yet commercially available, although pilot plants are currently under trail in Australia. The potential benefits include establishing a renewable energy source with a potentially valuable by-product, eliminating pathogens and odour associated with poultry litter and increasing bulk and nutrient density. The economic viability, risk profile and real benefit to the grower remains to be proven. The developments in this technology appear promising and will be closely monitored by the industry.

5.7 Improving water use efficiency

The main uses for water on a meat chicken farm are for drinking, cooling and cleaning sheds. Water is increasingly becoming a scarce resource and if meat chicken farms are reliant on scheme water, an increasing expensive one. It therefore makes sense to quantify the fresh water usage in a facility in order to increase overall water use efficiency by implementing management or equipment changes. To accurately quantify water use it needs to be metered. At a minimum, a meter should be installed on the inflow pipe to the facility from each source of water (scheme, bore, surface water storage). For a more comprehensive review, the water used for drinking and cooling could also be metered and the difference assumed to be for cleaning sheds. RIRDC have previously commissioned a project on using life cycle assessment to quantify the environmental impact of chicken meat production, (Wiedemann et al. 2012). The report presents research on the environmental intensity of meat production, focusing particularly on energy, greenhouse gas emissions and water use. The report provides bench mark information for water use in meat production facilities.

Drinking water

- Ensure drinkers are not leaking.
- Provide optimum environment for birds so birds are not heat stressed, as this will increase water consumption.
- Ensure water is treated to standard required in the National Farm Biosecurity Manual for Chicken Growers (ACMF 2010).

Cooling pads

Typical water consumption figures for a cooling pad system in summer for a standard 40,000 bird shed is estimated to range from 80,000 to 130,000 litre/batch. This data is however, highly dependent on climatic conditions. Cooling pads need to be properly installed and cleaned regularly to maintain best operating performance. The pads are typically 150 mm thick and water runs down the pad to be collected in a sump that sits under the pad. A small submersible pump recirculates water from the sump to keep the pads wet. During hot summer conditions, the pads are designed to be maintained in a fully wet condition to maximise water evaporation and air-cooling and the pump should be run continuously to wash dirt and dust from the pad surface. The maintenance program should include repair of ball-cock level control valves and the repair of leaks around the cooling pad sump as a small continuous leak can result in the loss of a large quantity of water over time.

Photograph 10. Cooling pads.

Shed cleaning

- Use hoses with attachments designed to use less water.
- There needs to an appropriate combination of pressure (dislodging dust), and flow rate (flushing material off surfaces), to minimise water use and excessive water on the floor.

6. Manure Production

6.1 Introduction

The quantity and composition of spent litter from a meat chicken farm varies widely, depending on:

- Diets used.
- Amount of feed wastage.
- Bird stocking density.
- Amount of fresh bedding used.
- Whether the litter is single batch, partially replaced or multi-batch litter.
- The amount of nitrogen volatilised.

These factors make textbook or 'standard' values of spent litter composition difficult to apply to individual operations. The following sections describe methods for both estimating the amount of manure produced by a meat chicken farm and the composition of the spent litter; and typically measured amounts and composition of manure.

Nutrient excretion by meat chickens has decreased substantially in recent years due to advancements in bird genetics and feed formulation. This will also affect the final composition of the spent litter, with many older references reporting values that are not representative of the industry today.

6.2 Estimated manure production

Meat chickens consume approximately 2.8 kg of dry matter up to 35 days of age (typical first thin-out) and 5.1 kg of dry matter up to 49 days of age (typical final clean-out). Based on a feed dry matter digestibility of 72.6%the total amount of solids excreted by a 35 day old meat chicken is 0.76 kg and for a 49 day old meat chicken is 1.4 kg.

At a manure moisture content of 90%, total manure production will be 7.6 kg and 14.0 kg for 35 and 49 day old meat chickens, respectively.

A nutrient mass balance for a meat chicken farm that runs 100,000 birds per batch and 5.5 batches per year is shown in Table 3. This farm was modelled to sell one third of the birds at 35 days and the reminder at 49 days. The liveweight turnoff is 1,289 t/annum.

Table 3. Annual solids and excreted by a 100 000 bird operation, running 5 batches/yr.

Component	TS	N	P	K
Feed Usage (kg/yr)	2,055,698	78461	20395	1792
Feed Composition (% as fed)		3.43%	0.89%	0.67%
Output (kg/yr) (excreted + waste)	904,093	35,823	14,305	13,125

Assumptions: Diet modelled was an average Australian diet based on sorghum, wheat, canola and soymeal.

6.2.1 Estimated amount and composition of the spent litter

Table 4 shows predicted nutrient contents (dry matter basis) of spent litter under various management conditions. These values were calculated from mass balance principles of the amount of nutrients excreted and the amount of nutrients in the spent litter. The amount of total solids (dry matter) produced by a 100,000 meat chicken farm, producing 5.5 batches/yr is also shown. This table illustrates the potential large variations in spent litter composition. The most accurate method for determining the composition of spent litter is to take a representative sample and have it analysed. Provided management practices (feed type, clean bedding type and amount) remain constant, the composition of the spent litter being produced should be relatively constant.

Table 4. Predicted nutrient contents (dry basis) of spent litter under various management options

Bedding Material	Depth added/batch (mm)	Total solids (t/yr)	Nitrogen (%)	Phosphorus (%)	Potassium (%)
Softwood Sawdust	100 (singe batch)	1,273	2.9	1.1	1.0
Softwood Sawdust	50 (Partial reuse)	904	3.96	1.58	1.45
Softwood Sawdust	25 (Multi batch)	719	4.9	2.0	1.82
Chopped Straw	100 (singe batch)	989	3.9	1.5	2.5
Chopped Straw	50 (Partial reuse)	762	4.8	1.9	2.5
Chopped Straw	25 (Multi batch)	648	5.6	2.2	2.5

Assumptions:
Diet modelled was an average Australian diet based on sorghum, wheat, canola and soymeal.
Feed wastage of 3%, 2% and 1% for starters, growers and finishers respectively.
Shed nitrogen volatilisation and total solids losses of 20% and 10% respectively.

6.3 Typical measured spent litter composition

Poultry litter is a mixture of bedding substrate material, moisture, excreted manure and minor amounts of spilled feed. The chemical characteristics of litter have been reported by a number of sources, as summarised in Table 5.

Table 5. Characteristics of poultry litter from several Australian literature sources.

Parameter	Dorahy & Dorahy (2008)	Chan et al. (2008)	Griffiths (2011)
pH (1:5 H2O)	6.5 (5.8-8.0)	8.1	8.4
EC (dS/m)	11 (7.1-16)	9.2	7.2
Carbon	28	-	39
OC (%db)	43 (34-83)	32	-
N (%db)	4.1 (2.7-6.5)	3.1	3.3
P (%db)	1.9 (1.2-2.8)	-	1.33
K (%db)	1.8 (1.0-2.8)	-	1.33
S (%db)	0.5 (0.4-0.8)	-	0.43
Ca (%db)	2.9 (1.7-4.4)	-	1.9
Mg (%db)	0.6 (0.4-0.9)	-	0.44
Na (%db)	0.4 (0.1-0.6)	-	0.4

Source: Dorahy & Dorahy (2008)

Table 6 shows the results of a recent and comprehensive study of poultry litter chemical properties has been completed by Craddock & Hollitt (2010). This study collected 123 samples of poultry litter from across Australia. Farmers were asked to provide information on bedding material type, batch size or litter depth to see if these properties influenced nutrient levels in the poultry litter.

Table 6. Average chemical analysis for macro-nutrients in Australian poultry litter (range in brackets).

Litter type/base	Moisture (%)	N (% dwt)	P (%dwt)	K (%dwt)	S (%dwt)
Straw	20	4.0	1.1	2.2	0.63
(n = 28)	(14.5 - 25.1)	(2.0 - 5.3)	(0.7 - 1.8)	(1.6 - 2.8)	(0.5 - 1.1)
Sawdust	25	3.8	1.2	1.8	0.54
(n = 26)	(20.1 - 28.8)	(2.8 - 5.9)	(0.75 - 1.53)	(1.3 - 2.5)	(0.4 - 0.7)
Wood shavings	26	3.9	1.3	1.9	0.51
(n = 65)	(20.5 - 31.2)	(2.8 - 5.5)	(0.68 - 1.7)	(1.1 - 2.8)	(0.3 - 0.7)
Multi-batch	21	4.0	1.7	2.4	0.58
(n = 4)	(20.6 - 22.2)	(3.6 - 4.3)	(1.3 - 2.0)	(1.9 - 2.7)	(0.5 - 0.8)

Source: Craddock & Hollitt (2010).

The amount and type of clean bedding used, and the diet of the meat chickens will largely determine the composition of the spent litter. Diets for meat chickens are generally formulated and supplied by large integrators, with individual growers having little control over the composition of the diet. Thus, feed suppliers need to liaise with growers and spent litter end users to ensure contaminants, such as heavy metals, in spent litter do not exceed guidelines for its safe land application.

6.4 Methods of reducing manure output

There are a number of ways to improve the nutrient utilisation or feed conversion in meat chickens. These include, in order of importance:

- Improved standards of housing and husbandry to maintain a thermo-neutral environment for the chickens.
- Improved digestion through digestion enhancers (e.g. enzymes).
- Improved diet formulation.
- Genetics and breeding to improve growth and nutrient utilisation.
- Behavioural control to reduce stress and increase growth rate.
- Optimising stocking density to reduce stress and improve growth.

The advantages of improving the protein and mineral utilisation in birds are:

- Savings in feed costs.
- Reduced nutrients in manure.
- Reduced crop land required for spent litter application and hence lower transport costs.
- Lower nitrogen losses through ammonia volatilisation.
- Decreased mineral (e.g. phosphorus and potassium) accumulation in the soil of areas used to spread the spent litter.

Reducing feed wastage is another very important method for reducing the nutrient content of the spent litter. An increase in feed wastage of a few percent can substantially increase the amount of nutrients produced in the by-product from meat chicken farms.

7. Spent Litter Management

7.1 Litter removal from shed

The amount of litter and the interval between clean-outs will vary from farm to farm depending on the bedding reuse practices adopted. All meat chicken farms should have a well-managed shed clean-out program to minimise the risk of disease transmission between batches. During full cleanouts, any material that represents a risk to flock health should be swept or vacuumed from the sheds. Sheds (either part or whole) should then be washed with a biodegradable detergent. Sanitisers and or insecticides are then used as required by the processor.

Photograph 11. Sweeping edges and corners of shed.

After shed clean-out spent litter is either:

- Removed from the farm for further processing or direct application.
- Temporarily stored on-farm until collection.
- Stockpiled or composted on-farm.
- Partially or fully applied on-farm.

The majority of spent litter is removed from the farm immediately after shed clean-out. The immediate removal of litter is encouraged to reduce the risk of disease transfer from one batch to the next. It also reduces the risk of groundwater and surface water pollution on-farm and the risk of dust and odour nuisance.

Shed clean-out is mainly undertaken by contractors, who supply bob-cats and front end loaders. This equipment needs to be thoroughly cleaned and disinfected between each farm. Some farms have their own shed clean-out equipment.

During shed clean-out there is an increased risk of odour, dust and noise emissions from the farm. Thus, shed clean-out needs to be carefully managed to avoid these risks (see Section 12.1).

Photograph 12. Loading spent litter onto a truck.

7.2 Spent litter storage

When storing spent litter on-farm the following design and management practices need to be considered:

- Any spent litter storage and stockpile areas need to have an impermeable base to avoid leaching and possible groundwater contamination.
- If spent litter is to be stored for a short period of time after shed clean-out (less than one week) the spent litter should be covered to avoid nutrient leaching from rainfall and to minimise dust and odour emissions.
- Appropriate siting of spent litter stockpiles and additional bunding may be required to prevent entry and contamination of stormwater runoff.
- Long-term, uncovered spent litter stockpiles should also have a pond to catch any runoff from the pile. Effluent collected in the pond should be land applied at sustainable nutrient loading rates.
- While spent litter is being stored, there is an increased risk of fly breeding and stored heaps may need to be turned and/or sprayed to control fly breeding. In Western Australia, stable fly breeding is of particular concern and local regulations need to be checked with regard to spent litter storage and land application.

7.3 Spent litter composting

Composting is generally conducted in windrows about 1.5 m high and about 2-3 m wide at the base. To maintain enough oxygen, the windrows need to be turned weekly. Without weekly turning, the process proceeds more slowly. The process should be complete in about 6-8 weeks, with an additional 4 weeks of curing time. By maintaining the correct moisture content (around 50-55% wet basis), carbon to nitrogen ratio (15:1 to 30:1) and oxygen concentration (through turning), the compost should reach and maintain temperature of 60-65oC. This temperature should be sufficient to destroy most weed seeds and pathogens. It is important that the windrow is completely turned to ensure all of the material is subjected to these temperatures.

Because the bedding material in the spent litter is a good carbon source, the correct carbon to nitrogen ratio is generally present in the raw clean-out material. Thus, the addition of additional nitrogen or

carbon is not generally required. The moisture content of spent litter removed from the shed is generally 25-30%, if the litter has been managed properly during the growing cycle. Thus additional water will need to be added to raw litter to raise the moisture content to 50-55% (wet basis).

7.3.1 Design and management considerations

- Compost areas need to have an impermeable base to avoid leaching and possible groundwater contamination. This can be achieved with compacted clay, gravel and clay, lime or cement stabilised soils.
- The site should be well drained to avoid muddy conditions and excessively moist composting material.
- Appropriate siting of spent litter compost sites and additional bunding may be required to prevent entry and contamination of stormwater runoff.
- Nutrient rich runoff from the compost piles should be collected in a sump or dam. It may be reused to add moisture to the pile.
- Compost piles need to be carefully managed to avoid dust and odour emissions. If the compost is too dry the process will be slower and excessive dust may be generated. If the compost becomes too wet, it may become anaerobic and produce excessive odour emissions. The optimum moisture content is around 50-55% (wet basis).
- While spent litter is being composted, there is an increased risk of fly breeding. In Western Australia, stable fly breeding is of particular concern and local regulations need to be checked with regard to spent litter composting.
- In some states, a separate licence or works approval is needed for compost production (e.g. South Australia and Victoria).

Photograph 13. Windrow composting.

8. Sustainable Spent Litter Spreading – On-farm

8.1 Introduction

The use of spent litter as a fertiliser is not generally conducted on farm for the following reasons:

- Meat chicken farms are often small and there is not enough area to sustainably use the spent litter.
- There are bio-security issues of disease transfer if spent litter is spread near sheds (including sheds on adjacent land). Some sectors of the industry discourage spreading spent litter on-farm.
- Meat chicken farmers primary concern is producing chickens for slaughter and applying spent litter would require additional skills, resources and time devoted to crop production.

Newer meat chicken farms are generally larger than older farms because of requirements for larger buffer distances between farms and neighbouring residences. For farmers to gain some productive benefit from this additional land, more spent litter is being used on-farm. This section, describes best management practices for spreading spent litter on farm, including how to calculate required land areas for sustainable application. The mass balance principles presented in this chapter can be used for spreading spent litter off-farm (Section 9).

Land application to crops (horticulture and broadacre) and pasture is the most widely adopted and cost effective way of utilising the nutrients in spent litter. It also reduces the need for commercial fertilisers and lowers the cost of crop production. An advantage of applying organic fertilisers, such as spent litter from meat chicken farms, is that not all the nutrients are available to the plant immediately. It acts as a slow release fertiliser, thus allowing the plant to access nutrients when they are required.

An important point to note is that spent litter from meat chicken farms, like other organic manures, is not a balanced fertiliser. Hence, some nutrients need to be added via inorganic fertilisers to meet crop requirements. The application of spent litter also needs to be carefully managed. Inappropriate and over application can result in nutrients leaching through the soil profile or being exported off-site in runoff or eroded soil.

It is also illegal to feed litter to livestock. There is a very high risk of botulism due to toxins in the litter. Suppliers of litter have an obligation to inform purchasers of this situation. Similarly, spent litter spread onto pastures, as a fertiliser must be firstly spelled for a period of time or composted to reduce pathogen levels before livestock are reintroduced onto the pasture. Refer to the Guidelines for On-Farm Food Safety for Fresh Produce (DAFF 2004) for guidance on pathogen levels and withholding periods.

8.2 Nutrient loading rates

8.2.1 General principles

In calculating a sustainable utilisation area for spent litter, nutrient applications (particularly nitrogen and phosphorus) should not exceed the following:

- The rate at which an element can be taken up by the plant and removed from the site. The amount that can be safely stored in the soil (primarily phosphorus, although soil storage of the phosphorus in spread manures is not permitted in some states (e.g. South Australia). Phosphorus storage capacity of different soils can be found in Table 7.

- The amount released to the atmosphere in an acceptable form (primarily the gaseous loss of nitrogen via ammonia volatilisation).

When planning an appropriate application area, each element (nitrogen, phosphorus, potassium, salt, heavy metals etc) needs to be considered individually. As previously mentioned, spent litter will not generally be a balanced fertiliser, thus the sustainable application rate will be determined by the most limiting element (the element/nutrient that limits the amount that can be applied).

When applying the spent litter, the aim should be to make the maximum use of the fertiliser value of the product and at the same time avoid any potential deleterious effects, such as soil degradation and contamination of ground and surface water.

8.2.2 Land suitability

In selecting a site for spent litter application, the following should be considered:

- Avoid land immediately adjacent to watercourses. Most separation/buffer guidelines will specify minimum separation distances, but it should be a minimum of 50 metres. The planting of appropriate buffer strips (grass and trees) can also be useful in intercepting nutrients.
- Avoid land subject to frequent flooding.
- Avoid steep slopes with inadequate groundcover. Slopes of greater than 10% should be avoided.
- Avoid rocky, slaking or highly erodible land.
- Avoid highly impermeable soils.

The best soils for the application of spent litter are deep, well-structured and well-drained clay loams. These are more suitable than both highly permeable sands and impermeable heavy clays. Shallow soils with significant amounts of rock and gravel or soils with a high salt content should also be avoided. Soils with high clay contents are better able to store nutrients, while sandy soils are more susceptible to nutrient leaching.

A number of soil degradation issues should be considered when spreading spent litter, including erosion, salinity, sodicity, soil structure decline and chemical contamination.

Soil phosphorus sorption capacity

Soils vary in their ability to store phosphorus. In general, sandy soils have a poor phosphorus sorption capacity, while strongly weathered clay soils such as krasnozems have a high storage capacity. The amount of phosphorus that a soil can safely store is known as the safe phosphorus storage capacity. Because of the low nitrogen to phosphorus ratio of spent litter (typically 2:1), compared to the high nitrogen to phosphorus ratio of most crops (typically 5:1), phosphorus will generally be the most limiting nutrient when applying spent litter if no allowance is made for phosphorus storage capacity. Consideration of the safe phosphorus storage capacity may significantly increase the allowable spreading rate. However, the allowance for phosphorus storage capacity on by-product utilisation areas varies from state to state and local codes of practice and guidelines will need to be checked. In some states, the phosphorus application rate is restricted to the phosphorus uptake by the plants. Table 7 shows the safe P storage capacity of different soils (kg/ha) based on one metre of soil depth.

Table 7. Safe phosphorus storage capacity of different soils (kg/ha).

Australian Soil Classification	Great Soil Group	Soil Bulk Density (kg/m3)	P Sorption Capacity (mg P/kg soil)	Safe P Storage Capacity (kg/ha)
Brown Sodosol	Soloths	1,300	50	650
Stratic Rudosol	Podzol	1,500	45	680
Grey Vertosol	Grey Clay	1,200	73	880
Black Vertosol	Black Earth	1,300	73	950
Brown Dermosol	Prairie Soil	1,200	102	1220
Brown Kandosol	Yellow Earth	1,300	142	1850
Brown Chromosol	Yellow Podzolic	1,200	194	2330
Red Ferrosol	Krasnozem	1,300	280	3640
Red Chromosol	Red Podzolic	1,200	304	3650

Crop production

The quantity of nutrients exported in a harvested crop depends on the nutrient content of the crop and the crop yield. The most efficient way to remove nutrients is to grow a crop that is removed from the paddock; grazing only has a low nutrient removal rate.

Since the meat chicken industry in Australia is mostly located close to urban centres, a large proportion of spent litter is utilised on horticultural crops. These crops are generally very intensive, with high yields and corresponding nutrient removal rates can be quite high. Table 8 shows the typical nutrient content of various broadacre and horticultural crops and normal dry matter yields.

Table 8. Nutrient content (dry basis) and typical yield range for various crops.

Crop	Dry Matter Nutrient Content (%)			Normal Yield Range
	N	P	K	Dry Matter (t/ha/yr)
Dry Land Pasture (cut)	3.0	0.3	1.5	1 to 4 t/ha/yr
Irrigated Pasture (cut)	3.0	0.3	1.5	8 to 20 t/ha/yr
Lucerne Hay (cut)	3.1	0.3	2.5	5 to 15 t/ha/yr
Maize Silage	3.0	0.5	2.0	10 to 25 t/ha/yr
Forage Sorghum	2.2	0.3	2.4	10 to 20 t/ha/yr
Winter Cereal Hay	2.0	0.3	1.6	10 to 20 t/ha/yr
Seed Barley	1.9	0.3	0.4	2 to 4 t/ha/yr
Seed Wheat	1.9	0.4	0.5	2 to 4 t/ha/yr
Rice	2.0	1.7	1.3	4 to 8 t/ha/yr
Seed Oats	1.5	0.3	0.4	1 to 4 kg/ha/yr
Grain Sorghum	2.0	0.3	0.3	2 to 8 t/ha/yr
Grain Maize	2.0	0.3	0.4	2 to 8 t/ha/yr
Chickpea	4.0	0.4	0.4	0.5 to 2 t/ha/yr
Cowpea	3.0	0.4	2.0	0.5 to 2 t/ha/yr
Faba Bean	4.0	0.4	1.2	0.5 to 2 t/ha/yr
Lupins	4.5	0.3	0.8	0.5 to 2 t/ha/yr
Navy Bean	4.0	0.6	1.2	0.5 to 2 t/ha/yr
Pigeon Peas	2.6	0.3	0.9	0.5 to 2 t/ha/yr
Cotton	2.0	0.4	0.8	2 to 5 t/ha/yr
Asparagus	0.4	0.4	2.5	0.5 to 2 t/ha/yr
Beans	3.1	0.3	2.6	4 to 8 t/ha/yr
Beetroot	4.2	0.3	4.0	5 to 15 t/ha/yr
Broccoli	3.9	0.5	3.0	5 to 15 t/ha/yr
Cabbage	3.5	0.4	4.0	5 to 15 t/ha/yr
Carrot	0.9	0.4	1.7	5 to 15 t/ha/yr
Cauliflower	3.6	0.5	4.3	5 to 15 t/ha/yr
Celery	2.1	0.3	4.0	5 to 15 t/ha/yr
Lettuce	4.0	0.5	6.0	5 to 15 t/ha/yr
Onion	1.3	0.4	2.2	5 to 15 t/ha/yr
Peas	2.0	0.2	1.2	4 to 8 t/ha/yr
Potato	2.5	0.2	2.2	5 to 15 t/ha/yr
Tomato	3.6	0.7	4.7	5 to 15 t/ha/yr

Calculating area requirements

Listed below are examples of area requirements for different production systems. Spent litter nutrient availability is based on 500,000 birds turnoff/yr (5 batches/yr of 100,000 birds). The initial clean bedding is assumed to be wood shavings. If chopped straw was used as the clean bedding material, more area would generally be required due to the higher nutrient content of this bedding material.

Table 9. Land requirements for sustainable application of spent litter from a 500,000 bird/yr operation*.

Crop Type 1 & Yield (t/ha)	Crop Type 2 & Yield (t/ha)	Area for N Uptake (ha)	Area for P Uptake (ha)	Area for P Storage of 20 yrs** (ha)	Area for K Uptake (ha)
Irrigated pasture (10)	Irrigated pasture (10)	40	231	91	39
Grain sorghum (5)	Seed barley (3)	151	572	119	459
Maize silage (20)	Cereal hay (15)	26	97	59	18
Lucerne hay (12)	-	64	386	108	39
Potato (10)	Cereal hay (10)	53	262	96	31
Carrot (10)	Cauliflower (10)	53	154	76	19
Beans (6)	Broccoli (10)	41	204	87	26

* Assumes 100% uptake efficiency of nutrients.

** 20 year storage assumes the application area is used for 20 years i.e. P storage per year = total P storage capacity/20.

Nutrient availability

Most nutrient uptake by plants occurs when the nutrients are in inorganic forms. Not all the nutrients applied in spent litter for a crop are available to the plant in that year. Some elements must be converted from the organic to the inorganic form by microorganism decomposition.

The availability of nitrogen in the first year of application will vary greatly between 30% and 80% depending on the spreading method and the environmental conditions. Nitrogen in spent litter is present in both the organic and inorganic forms. Generally, about one-third of the nitrogen in the spent litter is in the ammonium form, the rest is in the organic form. Organic nitrogen needs to be converted via mineralisation to the inorganic form to be available to a plant. During this process, nitrogen may be lost to the atmosphere by ammonia volatilisation and denitrification. After the first year of application about 25 – 50% of the organic nitrogen is converted. All of the inorganic nitrogen (ammonium nitrogen and nitrate nitrogen) is readily available to the plant. However, nitrogen in these forms is also highly mobile and can be readily leached through the soil profile. If spent litter is left on the soil surface and not incorporated, a significant amount of the ammonium nitrogen will be lost to the atmosphere as ammonia gas. Ammonium nitrogen incorporated into the soil is nitrified to nitrate and is then readily available to the plant. With excess water, nitrate can be readily lost through leaching and denitrification.

8.2.3 Other constituents

Spent litter may contain traces of pesticides used for insect and rodent control in the shed and heavy metals and antibiotics used as feed additives. It also contains pathogens, but the level of these is unlikely to pose a risk to human health. The level of risk will depend on the period between applying the spent litter and the harvesting of the crop (particularly when used for direct human consumption, without post-harvest treatment/processing). Pathogens will die-off when desiccated. Care should however be taken when handling and spreading spent litter.

9. Spent Litter Utilisation – Off-farm

9.1 Introduction

The same general principles used for off-farm utilisation of spent litter apply for on-farm utilisation. The spent litter should always be used in a manner that makes the best use of the nutrients while avoiding potential deleterious effects, such as soil degradation and contamination of ground and surface water.

Spent litter is used in a broad range of applications for it nutrient value as an organic fertiliser and for its soil ameliorant qualities. Some of the common uses of spent litter include:

- Broadacre Agriculture.
- Horticulture.
- Mushroom substrate production.
- Pelleted and bagged product for home gardens.
- Turf farms.
- Soil mixes.

Spent litter can also be used in other ways. In the United Kingdom, central processing plants are established where the spent litter is burnt to generate electricity.

It is illegal to feed litter to livestock due to the high botulism risk. For the same reason, pastures spread with spent litter should not be grazed until it is well broken down.

Spent litter should be covered during transportation to prevent spillage and minimise odour emissions.

9.2 Information for end users

In some states, environmental legislation dictates that a meat chicken farmer has a duty of care to ensure spent litter supplied to off-site users is applied sustainably. A contract between growers and end users may define the quantity of spent litter involved and the application method. It is helpful for the grower to inform the purchaser of their environmental responsibilities and give the purchaser some idea of the composition of the spent litter (nutrient analysis). The composition of the spent litter can either be estimated using mass balance principles or determined by chemical analysis. Sections 6.2 and 6.3 provide some predicted and measured nutrient contents of spent litter. Since these measured values show a wide variation in spent litter composition, an analysis provides a more accurate estimate of composition.

9.2.1 Heavy metal content

The concentration of heavy metal contaminants in Australian poultry litter has been investigated by Nicholas et al. (2007b) and Craddock & Hollitt (2010) as shown in Table 10 and Table 11. Of these elements, levels of copper and zinc may exceed current national or state guidelines. If spent litter contains significant quantities of heavy metals they are likely to have originated from the poultry feed, or from contaminants in fresh bedding material. Care should be taken where the spent litter is applied. End users should also be informed of the composition of the spent litter. This will assist in maintaining long-term markets for spent litter.

Table 10. Average heavy metal concentrations in poultry litter (mg/kg) from meat chicken farms in eastern Australia (Nicholas et al. 2007a).

Contaminant	Queensland	New South Wales	Victoria
Arsenic	13.8	10.3	11.6
Cadmium	0.2	0.1	0.1
Chromium	7.1	6.4	14.2
Copper	139.5	107.0	94.0
Nickel	5.6	7.3	10.0
Lead	2.0	1.7	3.5
Selenium	0.9	0.9	0.7
Zinc	479.3	495.8	488.8

Table 11. Average heavy metal concentrations in poultry litter (mg/kg) from poultry litter samples across Australia (Craddock & Hollitt 2010).

Contaminant	Average (mg/kg)	Range (mg/kg)
Arsenic	4.3	< 2 - 19
Cadmium	0.051	< 0.008 - 0.18
Chromium	2.6	0.2 - 15
Copper	161	78 - 299
Lead	0.8	0.2 - 6.2
Nickel	5.8	0.3 - 15.7
Zinc	404	- 672

9.2.2 Pathogen risk

The chicken meat industry has conducted a considerable amount of research to quantify the prevalence and associated risk from pathogens in poultry litter. While it is known that poultry litter may contain pathogens of significance to human health (Runge et al. 2007), the risk associated with these pathogens appear to be low (Blackall et al. 2008).

The risk associated with pathogens contained in litter primarily relates to contamination of food products with litter that are subsequently ingested by humans. Hence, the greatest risk relates to leafy vegetables that are consumed fresh. The level of risk generally depends on the period between applying the spent litter and the harvesting of the crop. Refer to the *Freshcare Code of Practice – Food Safety and Quality 3rd Edition* (Freshcare 2009) and the *Guidelines for On-Farm Food Safety for Fresh Produce 2nd Edition* (DAFF 2004) for information regarding the application of organic manures. Some recommendations include:

- Incorporating applied product into the soil within 36 hours of application to minimise contamination from wind drift or rainfall runoff.
- Maximise the time between when the product is applied and when the crop is harvested. Do not apply untreated animal manure after planting where direct or indirect contact may occur with the edible part of the crop.
- Compost or age the manure to reduce microbe growth. Composting is more effective than aging. Longer treatment periods are required for aging (usually 6 months) than composting (about 6 weeks).

- For side dressing, only use properly composted manure or treated proprietary organic product than contain less that 100 E. coli per gram.

9.3 Records

Many states require recording of off-site sales of animal manures, including spent litter. It is useful to accurately record the amount and destination of the spent litter as part of an Environmental Management Plan. Any chemical analyses of the spent litter should also be recorded. Applicable state Environmental Codes of Practice and Environmental Protection legislation should be checked to ensure compliance of appropriate and detailed record keeping.

10. Dead Bird Management

Disposal of carcasses is a daily operation on a meat chicken farm. Poor carcass disposal practices may contaminate ground and surface water, cause odour nuisance, spread infectious diseases and attract vermin. Current meat chicken carcass disposal methods include rendering, incineration, composting and burial. Dumping of carcasses is not an acceptable disposal method. The carcasses become odorous and attract scavenging animals, which increases the risk of disease spread.

10.1 Rendering

Rendering is an excellent method for carcass disposal. If the dead birds are correctly stored before pick-up there is little risk of adverse environmental impacts. The end product is a protein meal that is commercially beneficial as a feed ingredient in livestock production or as a fertiliser. Putrefaction and carcass degradation produces biogenic amines, which are known to be toxic to poultry, thus delays before rendering should be minimal. Management practices when using a rendering process to dispose of carcasses include:

- The collection of carcasses must be managed to avoid the spread of pathogenic micro-organisms. Although daily pick-up and short-term freezing on-farm reduce the chance of pathogen spread, they do not completely eliminate the risk.
- A contingency plan (e.g. short-term freezing or burial) is needed in the event of a failure to dispatch carcasses.
- Rendering is limited by economies of scale and will only be economically viable if a rendering plant is located close by.

10.2 Burning or incineration

While incineration is biologically the safest carcass disposal method, it is not ideal for the following reasons:

- It needs to be performed efficiently and effectively to ensure complete incineration and to avoid odour and particulate nuisance complaints.
- Appropriate incineration is expensive.
- Some state EPA regulations and local council by-laws do not permit incineration as a disposal method.
- The process eliminates the nutrients that can be a valuable by-product.

To meet these requirements, burning needs to be conducted in an incinerator at sufficient temperatures to ensure the entire carcass is destroyed. An appropriate fuel source needs to be used (not sump oil or tyres). Acceptable disposal or reuse of the ash is necessary. Burning of carcasses in open fires is unacceptable, as it creates smoke and odour and is unlikely to maintain a sufficiently high temperature consistently. It is also a biosecurity hazard due to thermal updraughts dispersing feathers and other matter.

10.3 Composting

10.3.1 Basic elements

Composting involves the biological breakdown of organic materials in a relatively short number of weeks, producing a safe, nutrient rich humus like soil conditioner and plant nutrient source.

Done correctly, composting can significantly reduce or eradicate harmful pathogens, reducing biosecurity risks.

Composting requires several basic elements, including:

- The correct range in carbon:nitrogen (C:N) ratios
- Oxygen supply
- Correct moisture levels (Wiedemann et al. 2008).

Carcass composting follows the same principles of other composting processes however there are several ways in which to carry out the process depending on the end goals. Carcasses are potentially odorous and may pose a biosecurity and pathogen risk and attract vermin if not properly managed. To avoid these risk:

- Dead birds must be composted fresh (daily) or stored in a fridge/freezer prior to composting to avoid the build-up of pathogens.
- Maintain complete coverage of carcases in compost piles with a significant buffer between the carcass and surrounding environment (min of 300 mm of bulking material).
- Compost must have adequate moisture, oxygen, C:N ratio to compost effectively. This is demonstrated by high pile temperatures greater than 55°C.
- Compost piles or windrows must be kept aerobic.

However, meeting these conditions is not adequate to ensure effective composting or pasteurisation of the compost material. In addition to these measures, the conditions of the Australian Standard for Composts (AS 4454) (Standards Australia 2012) require:

- Compost piles must be turned a minimum of three times and reach 55°C for 3 consecutive days after each turning to pasteurise the material.
- The composting process must go for a minimum of 6 weeks.
- Maintain complete coverage of carcases in compost piles with a significant buffer between the carcass and surrounding environment (min of 300 mm of bulking material).

C:N Ratio

The composting process is performed by micro-organisms that feed on carbonaceous materials. In order to consume these materials, they require a supply of elemental nitrogen. The correct ration of C to N is key in developing a compost mix. Generally, a C:N ratio of between 15:1 and 40:1 will provide effective composting (Wiedemann et al. 2008). This is achieved by balancing high nitrogen materials (i.e. carcasses) with lower nitrogen sources (i.e. spent litter, sawdust, straw and green waste). The source of C material also needs to be in a form that is available for consumption by the microbes i.e. lower proportion of lignin to cellulose and materials with a high surface area (finely chopped or shredded). By mass, carcasses will require about twice as much carbon bulking material as carcasses.

By bulk (volume), this equals about 3 parts bulking material to 1 part carcasses (Wiedemann et al. 2008).

Oxygen

The beneficial microbes that carry out the composting process require an aerobic environment and will die if oxygen is not available. If the compost is depleted of oxygen, aerobic bacteria will be replaced by anaerobic bacteria which produce odorous compounds. An adequate supply of oxygen is achieved by maintaining porosity, correct moisture levels (below 60%) and sufficient turning. The frequency of turning is best determined by temperature, as any limit to the composting process will result in a decline in temperature (Wiedemann et al. 2008). However, carcass composting requires careful management to ensure carcases are continuously covered which makes turning more challenging. Generally, piles are established and left for 1-3 months after the last carcass is added before turning. For successful composting to occur during this period, adequate porosity must be maintained. This can be achieved by mixing a more porous bulking agent such as straw (less than 30% of bulking agent) to the less porous bulking agent (i.e. spent litter). After an initial phase of static composting, piles can be turned to improve porosity and mixing but after turning any exposed carcases need to be covered with partially finished compost or additional bulking material.

Moisture

Water generally needs to be added during the composting process, depending on the moisture of the initial material. The optimum moisture content for carcass composting is around 50%. Fresh carcasses contain a high level of moisture so it is important to not to initially add to much water before the static phase. No water should be needed during the static phase but water may be added at the point of turning in the later stage. Moisture can reach excessive levels in some cases where a compost site is exposed to rainfall and there is insufficient drainage. This can lead to anaerobic conditions and the generation of odours. To reduce the effects of excessive rainfall, design outdoor composting sites with adequate drainage and collecting runoff from the site to minimise contamination of surface waters with nutrients, organic matter and pathogens. Compost piles should be turned after rain to improve aeration as rain tends to seal the pile (Wiedemann et al. 2008).

Temperature

The temperature inside properly sized and maintained compost piles should reach 50-65oC within days of establishing composting piles. This temperature stimulates the growth of the thermophilic bacteria that promote decay. It also helps to destroy disease-causing micro-organisms. This improves on-farm biosecurity and creates a product that is safe for land application. Compost piles are likely to be cooler close to the edge, so carcasses should be kept at least 300 mm from the edge of the pile. Turning is required when temperatures fall below 45˚C.

10.3.2 Composting in bins

Current carcass composting practices mainly use purpose built rotary composters. The size and number of units needed depends on the size of the operation and normal levels of bird mortality (3-5%). Rotary composters can offer a rapid (5-7 days) contained way of handling carcases, require a low volume of bulking agent and prevent scavenging. They can also be used as a primary stage for carcass composting, allowing for the rapid breakdown of carcasses into a form that can stockpiled prior to land application (Wiedemann et al. 2008). These units require careful management to ensure an aerobic environment in maintained. This reduces the possibility of excessive odour generation.

Photograph 14. Rotary composting unit.

Carcass composting can also be carried out in small scale purpose built binds which can be added to daily until they reach full capacity. They then need to be left for approximately 4 weeks after the last bird is added. Daily mortalities can also be refrigerated or frozen and composted on a weekly basis to reduce handling times. After this initial phase, the material can be removed from the bins and composted in a stockpile for a further 2-6 months to allow further breakdown before spreading or sale (Wiedemann et al. 2008).

10.3.3 Composting in bays and piles

Composting carcasses in open bays and piles is an environmentally and biologically safe alternative, if performed correctly. A major advantage is the production of a nutrient rich humus-like material that can be used as a fertiliser and/or soil amendment. However, these facilities need to be designed and managed correctly to avoid any bio-security issues.

Compost bins can be as simple as large round or large square hay bales configured into an open-fronted bay. They need to be located on an impermeable pad (compacted clay or preferably concrete). Many of the carcass composting operations in the United States are installed in sheds. This design allows for improved environmental control, by excluding rainfall. The sidewalls of these sheds can be timber, concrete or plywood with timber supports. Bins are generally about 2 m deep and 2.5 m wide. The width needed depends on the implements available for turning the compost (front-end loader, bobcat etc).

Photograph 15. Carcass composting in a shed.

10.4 Burial

Burial pits and trenches are common carcass disposal methods. Some major problems with pits and trenches include:

- The carcasses decompose slowly so the daily mortalities need to be covered to avoid scavenging and odour problems. Disposal pits, therefore fill quickly and continually need to be replaced.
- There is potential for groundwater contamination through nutrient and bacteria leaching, particularly if there is shallow groundwater and inappropriate sealing of the bottom of the pits.
- Surface water contamination can also occur through stormwater runoff exiting poorly managed carcass disposal pits.

Some general rules for the construction and management of pits and trenches:

- Individual states have minimum requirements for the depth of trenches above the groundwater level. However, the base of carcass disposal pits and trenches should be at least 2 m above the water table at all times.
- The base of the pit should be sealed with clay to minimise nutrient leaching.
- As each batch of dead birds is added they should be covered with soil or other suitable material to avoid scavenging and excessive odour emission.
- Runoff in and out of the pit should be avoided to minimise possible groundwater seepage and surface water contamination.
- Once the pit is full, it should be covered with at least 0.5 m of compacted clay soil.
- There should be no surface or sub-surface seepage from the pit or trench that may cause the spread of disease or release of contaminants.

11. Chemical Storage and Use

Factors to consider in minimising possible environmental problems associated with the storage and use of chemicals include:

- Minimise the storage and use of chemicals.
- Chemicals used to disinfect sheds after clean-out and other chemicals such as petroleum fuels, herbicides and pesticides used around the farm need to be stored and handled correctly to avoid spills that may contaminate both ground and surface waters.
- Chemicals and fuels should be stored and used in accordance with workplace health and safety codes of practice. This would include locked sheds with an impermeable base (concrete) and appropriate bunding to avoid water ingress and contaminated runoff.
- Chemical concentrations and application methods should strictly adhere to the manufacturer's instructions or to state agricultural department's specifications.
- When selecting a chemical, consider using one with a low toxicity and water contamination potential.
- Have an emergency response in case of a chemical spill.
- A Material Safety Data Sheets (MSDS) should be available for all chemicals stored and used.
- When applying chemicals, spray drift should be avoided by using well-maintained equipment and avoiding application during windy weather.
- All staff should be trained in the safe use and handling of chemicals.
- Ensure procedures are in place and equipment available to contain and clean up a spill or leak.
- Take immediate action to clean up and dispose of spills or leaks.
- Empty drums should be disposed of as per manufacturer's instructions.

For more information on the storage and handling of chemicals on-farm refer to AS 2507-1998: *The storage and handling of agricultural and veterinary chemicals* (Standards Australia 1998). Guidelines for meeting the AS 2507-1998 requirements for the minor storage (less than 1000 kg or L of chemicals on-farm) and the proper handling of chemicals have been prepared by different state departments (DEPI Victoria 2014, DPIW 2004, PIRSA 2007, PIRSA 2013, Rutherford 2005, Woods 2005, WorkCover NSW 2006)

12. Minimising Environmental Impacts

21.1 Community amenity

12.1.1 Odour

Odour is by far the greatest cause for complaint from people living near meat chicken farms. This is partly because most of the industry is located in rural residential areas, close to metropolitan zones. Many of the traditional meat chicken farms have suffered from urban encroachment by people looking for cheaper land and a rural lifestyle. In some cases, suburban residential areas have been developed within acceptable buffer distances. Even with very well managed farms odour will still be generated and have the potential to be detected off-site. This off-site impact can be minimised with appropriate planning and management.

The major cause of excessive odour generation is poor shed management. Sections 5.3, 5.4 and 5.5 discuss management options to minimise odour generation from litter. Other options for minimising odour impact from the farm include:

- The planting of vegetative screens to disrupt airflow, screen out dust and redirects the odour plume. These screens must be constructed and maintained with randomly planted trees and shrubs with a low and high canopy and have sufficient width (30 m) to be effective. The trees and shrubs should have slender, rough foliage. When designing a vegetative buffer strip, the main areas that need to be considered are the primary function of the buffer, an analysis of the site (soil type, groundwater etc), species selection and site preparation.

- Constructed impact walls made from plywood, shade cloth or straw bales at the exhaust end of tunnel ventilated sheds have similar odour dispersion properties to vegetative screens. Constructed earthen mounds may also be used.

- Short stacks placed on the outlet fans of sheds have been shown to reduce odour impact from meat chicken sheds by causing the plume of odorous exhaust air to disperse through a large volume before reaching the ground. Some of the work involving short stacks has focussed on night-time (usually stable meteorology) impacts from meat chicken farms and it is unlikely that the same impact reduction would be achieved with daytime impacts, which are often associated with unstable meteorology.

- Advanced technologies have been investigated as possible options for reducing odour impact from meat chicken farms. These include odour neutralising agents, air scrubbers, bio-filters, chimney stacks, active oxygen, ozone treatment and incineration. However, these technologies are generally either very expensive (cost prohibitive) on meat chicken farms or have not been scientifically proven to be effective at reducing odour impacts.

- Avoid excessively dry litter at clean-out as dust may cause off-site odour impacts.

- Avoid excessively wet litter at shed clean-out, as it may have become anaerobic and has the potential to generate excessive odour.

- Spent litter needs to be appropriately stored or treated (composted) to minimise odour generation if not directly spread or sold off-farm.

- Proper storage and disposal of dead birds are needed to minimise odour generation.

The application of spent litter can also cause odour complaints. Options to minimise odour impact during spreading include:

- Avoid spreading litter during adverse weather conditions (early morning or late in the afternoon).
- Incorporate as soon as possible.
- Consider wind direction and strength.

12.1.2 Dust and feathers

The main sources of dust from a meat chicken farm are from transport operations and dust exhausted from the sheds. Bird collection and shed clean-out are high risk times for excessive dust generation. Dust is also exhausted from sheds and may cause a problem, particularly with tunnel ventilated sheds. These fine dust particles may also be odorous and cause off-site odour impacts. Methods for minimising dust impacts on-farm include:

- Driving at moderate speeds, particularly on unsealed roads.
- Covering loads of clean bedding, feed and spent litter.
- Covering or shedding clean bedding.
- Watering unsealed roads at times of high traffic movement (bird collection and litter clean-out).
- Considering wind direction and strength during litter clean-out.
- Maintaining vegetative ground cover and vegetative screens around sheds.
- Installing impact walls and earthen mounds at the end of tunnel ventilated sheds.

Land application of spent litter may also generate off-site dust impacts. Methods for minimising dust impacts during the spreading of spent litter include:

- Avoid spreading spent litter that is too dry (less than 15% moisture wet basis).
- Consider wind direction and strength at the time of spreading.
- Incorporating spent litter as soon as possible after application, if spread on bare soil.

Feathers may also cause off-site impacts. These can be controlled with similar strategies to controlling off-site dust impacts.

12.1.3 Noise

Because meat chicken farms are mainly located in semi-rural areas where background noise levels are low, excessive noise from vehicles, machinery and mechanical equipment may cause complaints from nearby residents. Complaints are more likely to result when noisy activities are undertaken at night when background noise levels are low and neighbours may be sleeping.

The farm manager needs to liaise closely with drivers, pick-up crews and integrators to ensure that all are aware of the potential conflicts caused by vehicle use. Methods for minimising noise impacts include:

- Vehicles should be driven at moderate speeds, especially delivery and pick-up trucks.
- The use of truck air/exhaust brakes should be avoided near sensitive places.

- The industry prefers night-time pick-up for welfare and product quality reasons. Even with great care, noise levels will exceed background levels. The pick-up of birds should be undertaken with due care and consideration for the neighbours. For example, metal cages for bird transport are noisier to handle by forklift than plastic or plastic-coated metal cages.

- Truck and machinery reverse warning beepers should be replaced or used in combination with flashing lights or other suitable warning devices that don't generate noise.

- As much as possible, feed delivery should be conducted during daylight hours.

- Minimise any tonal effects, frequency modulations or impulses from machinery, fans etc, as these will exacerbate the annoying effect of the noise.

- Maintain equipment so that it meets environmental and legal noise requirements.

- Noise suppression equipment should be maintained to meet manufacturers specifications e.g. mufflers.

- Piped music equipment (MUZAK) needs to be operated responsibly and certainly should be loud enough to be heard beyond the boundary.

Breeder farms may need to have a greater buffer distance to neighbours than meat production farms to avoid off-site noise impacts from the birds.

State Environmental Protection Agencies have limits for noise levels at either property boundaries or neighbouring residences. These need to be consulted for each state.

12.1.4 Light

Security and pick-up lighting and vehicle movements mainly associated with bird collection can cause off-site light impact from farms. Methods for minimising off-site light impacts include:

- Appropriately planted and maintained vegetative screens.

- Earthen banks.

- Constructed walls.

- Lighting for security and bird pick-up should be angled away from nearby residences or shielded.

- Plan roads and parking to avoid stray lighting from vehicle movement.

12.1.5 Pests

Pests include flies, rodents and feral animals. Practices that minimise breeding on-farm are necessary since pests impact directly on community amenity and increase the risk of disease transfer. All pest control materials need to be used in strict adherence with labelling directions. They must be correctly stored away from children and domestic animals. Records of pesticide use should also be maintained.

12.1.6 Fly breeding

Flies can be difficult to control on meat chicken farms in warm and temperate climates. Migrating flies can generate complaints from nearby residences. Effective control measures need to be implemented before the onset of the fly breeding season. Fly production increases dramatically with wet litter, so water leaks and litter moisture need to be closely monitored. Approved insecticides are available for treating infested litter. If eggs, larvae and pupae are present in litter at spreading, it needs either to be

immediately incorporated or spread thinly to promote rapid drying or exposure to ultraviolet light from the sun.

Stable fly breeding is of particular concern in Western Australia. Local guidelines stipulate the handling, treatment and spreading of spent litter in that state.

Rats and mice

Rodents such as rats and mice can migrate to neighbouring properties and generate health and nuisance complaints. As well as posing a risk of disease transfer between farms, they waste feed. Rats can transmit salmonella to humans via contaminated meat chicken carcasses. Rats and mice also damage insulation, curtains, hoses, electrical wiring and can kill young chicks. The occasional siting of a mouse or rat may indicate a large infestation. Methods of controlling rats and mice include:

- Making buildings rodent proof as far as is practical.
- Minimising feed spillage.
- Removing rubbish, timber piles etc.
- Minimising breeding burrows.
- Maintaining a baiting program.

Birds

Wild birds may spread avian diseases to meat chickens. Sheds should be built and maintained to avoid the entry of other birds. Water bodies close to sheds should also be avoided as they potentially attract ducks and other species. Wild birds are attracted to spilled feed and green grass, which often grows adjacent to meat chicken sheds.

Free range birds have an increased risk of exposure to wild birds. Additional measures should be taken to limit the contact of free range birds with wild birds including:

- fencing free range enclosures
- keeping feed and water inside sheds
- regularly mowing grass in free range areas to reduce grass seed set
- Selecting non wild bird attracting species of trees and shrubs as shade trees in and around the free range area.
- employing the use of scarecrows or other devices that will detract wild birds from free range enclosures.

Dogs, cats and foxes

Dogs, cats and foxes can kill large numbers of birds and spread diseases. Sheds should be constructed to exclude these animals. If carcasses are composted, these animals need to be excluded with appropriate fencing (e.g. electric). If carcass composting is performed correctly with adequate cover of material on the birds, scavenging should not occur.

12.1.6 Chemical spray drift

Volatile components of chemicals sprayed in sheds for disinfection may affect neighbours if not used in accordance with manufacturer and workplace health and safety requirements. Spraying should also be avoided during adverse weather conditions that may impact on neighbours.

12.1.7 Visual impact

The overall appearance of the whole meat chicken farm may influence community attitudes to the operation. A well-planned and maintained farm improves visual impact and aids in reducing disease transmission, rodent infestation, odour emission and dust generation. Methods for improving visual amenity include:

- Screening the operation from the public. If someone cannot see the operation, they are less likely to complain about odour. The planting of appropriate tree buffers around sheds hides the sheds and can reduce the odour and dust impacts of the enterprise.
- Maintaining short green grass close to the sheds will improve ventilation, and pest control, and will enhance shed cooling by reducing reflected heat load on the shed.
- Maintaining buildings (walls, roof, curtains and gutters) will aid appearance, security and building working function.
- Maintaining the overall site (roads, fences, trees, grass, contours, banks, channels, watercourses and dams).

12.1.9 Human health

Studies have shown that the risk of disease transfer from poultry to humans is minimal. By maintaining good hygiene and pest control measures, the risk of human health problems can be minimised. Farms should be operated according to the relevant Occupational Health and Safety Standard Acts for each state. Issues of human health impacts that need to be considered include:

- Controlling ammonia levels in sheds for both bird and human health. By maintaining an optimum environment for the birds, risks associated with high ammonia exposure to workers will be minimised.
- Ensuring litter does not become too dry and dusty. Dust particles may contain moulds, bacteria and endotoxins that may be harmful to humans. Dust may also cause health problems with susceptible members of the population (e.g. asthma sufferers).
- Not applying untreated spent litter to the foliage of crops that are to be consumed by humans. Refer to the *Freshcare Code of Practice – Food Safety and Quality 3rd Edition* (Freshcare 2009) and the *Guidelines for On-Farm Food Safety for Fresh Produce 2nd Edition* (DAFF 2004) for information regarding the safe land application of spent litter.
- The safe use of chemicals, such as formaldehyde for disinfecting sheds, to minimise the risk to workers.

12.2 Surface waters

Surface water contamination can result from the transport of organic matter, nutrients and chemicals to water bodies. There is the potential for surface water contamination from a number of operations on a meat chicken farm, but these can be minimised with good environmental management practices, including:

- Not situating sheds, spent litter stockpiles, dead bird disposal sites on flood prone areas.
- Bunding around spent litter stockpiles, compost and carcass compost sites. Effluent collection ponds may also need to be constructed if there is significant water storage in these bunded areas.
- Bunding around dead bird disposal pits and trenches.
- Careful storage and application of chemicals to avoid spills and contamination of runoff water.

When spreading spent litter onto crop and pasture land, nutrient export can be minimised by:

- Avoiding land immediately adjacent to streams and watercourses. Most separation/buffer guidelines will specify minimum separation distances, but 50 m is recommended as a minimum. The planting of appropriate vegetative buffer strips (grass and trees) can also be useful in intercepting nutrients.
- Avoiding over-application. Matching nutrient application rates to crop uptake, safe storage and allowable losses.
- Avoiding land subject to frequent flooding.
- Avoiding steep slopes with inadequate groundcover. Slopes greater than 10% should be avoided.
- Avoiding rocky, slaking or highly erodible land.
- Avoiding highly impermeable soils.

12.3 Groundwater

Groundwater contamination can occur through the leaching of nutrients, salts and chemicals to underground water supplies. There is potential for groundwater contamination from a number of operations on a meat chicken farm, but these can be minimised with good design and environmental management practices, including:

- Adequate compaction or sealing of shed floors, spent litter stockpiles and dead bird composting area
- Considering the use of concrete or other impervious products for shed floors, carcass composting, and spent litter storage areas on sites with sandy soils.
- Avoiding chemical spills with careful storage and application.
- Avoiding the over-application of spent litter, particularly nitrogen, to land. Matching nutrient application rates to crop uptake, safe soil storage and allowable losses.

12.4 Soil

The application of spent litter (organic matter) can enhance land productivity by improving soil nutrient status, structure and organic carbon levels. However, it can also cause a range of soil degradation problems if poorly managed, including erosion, salinity, sodicity, soil structure decline and chemical contamination.

- Erosion can be minimised by adopting traditional soil conservation measures, such as contour banks and strip cropping. Maintaining adequate groundcover at times of probable high rainfall intensity will also reduce erosion potential.

- Salinity problems can occur when salts accumulate in the soil. The application of spent litter needs to be carefully managed if it has a high salt content. Salinity problems may be reduced if clean irrigation water is used to flush salts through the soil profile.

- Sodicity problems can result if there is surplus sodium in the soil. This causes clay particles to swell and disperse upon wetting, clogging the spaces between the soil aggregates. Sodicity causes surface crusting and sealing and is associated with soil structure decline.

- Chemical contamination may result from the accumulation of heavy metals or residues from chemicals. By matching application rates to crop uptake, safe storage and allowable losses, accumulation of nutrients can be minimised. Potential for heavy metal contamination needs to consider the concentration in the spent litter and long-term soil concentration trends.

- A neutral (7) to slightly acidic (6) pH soil is optimum for plant growth. The spreading of spent litter may alter soil pH. Monitoring soil pH will detect long-term trends in changing soil salinity.

13. Contingency Measures

13.1 Disease outbreaks/catastrophic deaths

Farms need to have a contingency plan for occurrences of high mortalities. The contingency plan may depend on whether the mortalities were due to disease or environmental conditions.

13.1.1 Consultation

- In the event of mass bird deaths, the grower should immediately contact the integrator/processor who will arrange for an inspection by the company technical staff to ascertain the cause of death. State Departments of Agriculture/Primary Industries may need to be advised by the owner of the birds (usually the processor) if it is a notifiable disease. Each state administers its own eradication of animal diseases (EAD) control legislation, which is supported by emergency service arrangements. The Commonwealth has powers under the *Quarantine Act 1908* to support the state and territories where appropriate. Refer to Appendix 2 of the AUSVETPLAN Summary Document (Animal Health Australia 2008b) for applicable legislation.

- If the cause of the deaths is an Emergency Animal Disease (EAD), state agricultural departments will need to be informed in accordance with relevant AUSVETPLAN (Animal Health Australia 2010a) manual procedures. All birds on the farm and adjacent farms may need to be slaughtered, with an extended vacancy time before the reintroduction of birds. A quarantine zone will be enforced and all movements restricted. Disposal and of carcasses, spent litter, feed and the decontamination of equipment, buildings, equipment etc in this instance will be under the direct control of the Chief Veterinary Officer of the state concerned.

- The local government authority may need to be contacted to assist in the disposal of the birds on farm (burial, composting) or off-farm (land fill site).

- If the carcasses are to be rendered, contact will need to be made with local plants.

- If poultry are to be buried on-farm as a requirement of a government agency with an exotic disease outbreak, then ensure:

  – The base of dead poultry disposal pits and trenches is at least 2 m above the ground water table at all times.

  – The base of the pits are sealed with clay to minimise nutrient leaching.

  – Runoff in and out of the pit is avoided with appropriate bunding.

  – The pit will is covered with at least 0.5 m of compacted clay soil once it is full.

13.1.2 Treatment and disposal options

The method of destruction of birds will depend on the site and number of birds involved but usually is by dislocation of the neck or gassing. Refer to AUSVETPLAN Destruction of animals manual (Animal Health Australia 2010c).

The disposal options available for a mass death of birds will depend upon the cause of death. Refer to AUSVETPLAN Disposal Manual (Animal Health Australia 2010b). For diseases such as Newcastle disease, birds may need to be incinerated at high temperature. Other disposal options may include:

- Burial on-farm.

- Disposal in a land-fill site.
- Rendering.
- Composting.
- Incineration.

Carcass composting of mass deaths can be performed using the same principles as described in Section 10.3.3, except long windrows are used instead of bins and piles. The compost material is added the same as the small-scale piles or bins. Windrows should only be one bird depth per layer with a maximum of two layers. Composting can also be a useful option to dispose of contaminated litter. The windrows will need to capped in the same manner as the bins. Windrows are generally 1-2 m wide at the base and can run the length of the shed. When the temperature in the pile drops it needs to be turned into a second row and re-capped. Before commencing composting, consult integrator veterinarians and relevant state government departments.

Infected sheds, equipment, disposal sites and personnel involved in the operation will need to be disinfected and decontaminated to prevent the spread of a disease. Refer to the AUSVETPLAN Decontamination Manual (Animal Health Australia 2008a).

It should be noted that if an EAD is diagnosed all subsequent activities will be decided by State and Federal authorities

13.2 Interruptions to operation

13.2.1 Power supply

Installation of standby generators is essential to manage power supply failures. This is necessary to maintain a constant supply of water, feed delivery, lighting and ventilation (particularly running fans). Mass bird deaths can occur during hot weather with only minimal interruptions to ventilation and cooling equipment.

13.2.2 Water supply

Meat chicken farms must have an adequate and continuous supply of water for drinking and cooling. A back up supply or contingency for at least two days should be available in the case of breakdown or loss of supply. Meat chickens require approximately 2 L of water for every 1 kg of feed consumed. Thus, a 100,000 meat chicken farm would require approximately 32,000 L of water per day when all birds are at 35 days of age (typical first thin-out).

13.2.3 Interruption of feed supplies

Integrators will generally specify a minimum on-farm feed storage capacity. This is typically 1–1.2 t per 1000 birds. Thus, a 100,000 meat chicken farm would require 100 -120 t of feed storage. This will off-set any interruptions in feed supply.

13.2.4 Equipment malfunction

In the case of equipment failure, such as automatic systems used to supply adequate ventilation, manual operation systems need to be supplied.

13.2.5 Fire

A prevention strategy should be developed to manage any potential fire hazards primarily involving careful facility design and management. Precautions that can be taken to reduce the risk of fire include:

- Storing potentially flammable chemicals in sealed containers within an enclosed, locked shed.
- Storing any clean bedding material away from flammable substances.
- Having a fire evacuation plan in place and training staff in evacuation procedures.
- Installing fire extinguishers and water hydrants as per the Administering Authority requirements.

In the event of a fire starting in or approaching the poultry farm facility, the local fire service should be contacted immediately.

13.2.6 Interruption of bird supply to abattoir

Subsequent actions will be determined by the owner of the birds (processor).

13.2.7 Interruption to spent litter pick-up or land application

In situations where spent litter cannot be spread or sold off-site due to climatic conditions or unavailability of contractor, alternate arrangements need to be made to responsibly store the spent litter. If it is required to be stored after shed clean-out, spent litter should be covered to avoid nutrient leaching from rainfall and minimise both dust and odour emissions or properly composted in an area where it will not cause any adverse environmental or bird health impacts. It is important that this contingency be recognised in any environmental authority or Development Application conditions.

13.2.8 Containment and clean up of chemical/fuel leaks and spills

Ensure procedures are in place and equipment available to contain and clean up a spill or leak of any chemicals or combustible liquids (fuel etc) stored and used on-farm. If the event of any spill ensure that immediate action is taken to clean up and dispose of spills or leaks.

13.2.9 Temporary or permanent loss of trained operators

Ensure all staff are trained in the duties and responsibilities applicable to their position. As much as possible, at least one other staff member will be familiar with the duties of the other staff members.

14. Environmental Management Plans

14.1 Need for an environmental management plan

The development of an ***environmental management plan*** (EMP) for an individual enterprise is a formal commitment that all reasonable and practical efforts will be made to operate the meat chicken farm in an environmentally sustainable manner. It provides a system for documenting:

- The environmental risks of the meat chicken farm.
- How these risks will be minimised by design and management.
- Measurement of the effectiveness of these strategies by monitoring (normally qualitative).
- Reporting of monitoring results.

Growers are encouraged to develop an EMP for their enterprise to demonstrate that the farm is managing potential environmental impacts. It also allows for improved management of the farm. The development of an EMP is also a requirement for the licensing or approval of meat chicken farms in some states.

14.2 Components of an environmental management plan

The key components of an EMP are:

- Identification and contact details, with a brief description of the meat chicken farm and a commitment that the farm will be operated in an environmentally sustainable manner.
- Legal requirements of the farm, including applicable consents, approvals and/or licences to operate the enterprise and use water etc.
- Information on the natural resources and amenity issues of the property and surrounding area.
- Description of all the design and management facets of the meat chicken farm.
- Identification of any environmentally vulnerable areas by examining how the location, design and management of the meat chicken farm interact with the environment. Identification of a risk may mean regular monitoring or a change in design and management to minimise the risk.
- Monitoring to measure any environmental impacts. This may include objective assessments of odour, dust or noise or collecting and analysing soil, water or spent litter samples.
- Contingency plans for emergency situations.
- Any environmental training undertaken by staff.
- Periodic review of the EMP to update changes in regulatory requirements, operation, environment, design or management.

As part of the National Environmental Management System an Example and a Generic Environmental Management Plan and supporting tools and information (Nutrient balance spreadsheet) have been developed.

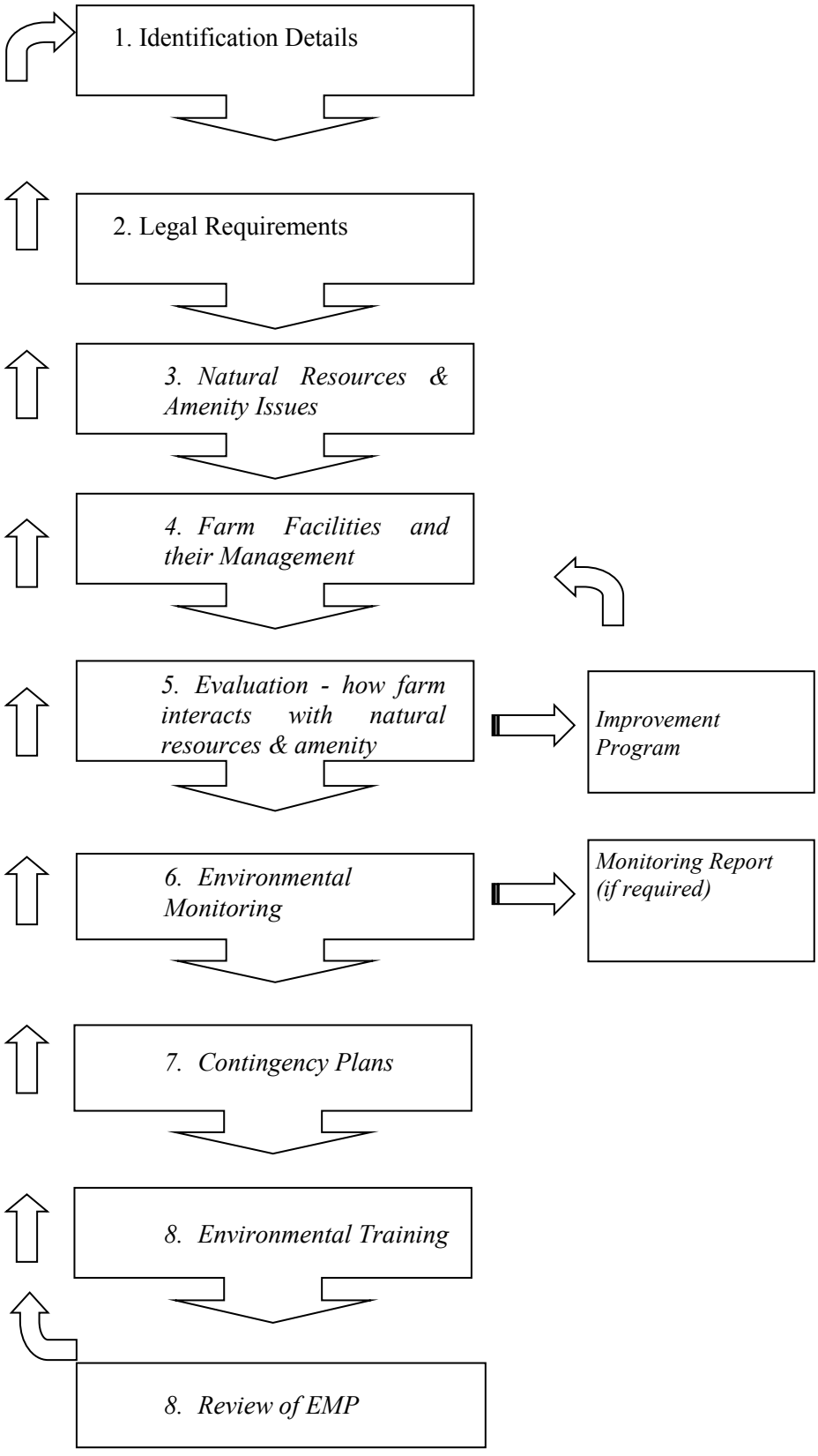

Figure 2. Flow diagram of an EMP for a meat chicken farm.

15. Environmental Monitoring

15.1 Odour

An odour assessment aims to establish whether the poultry facility will have an unreasonable impact at offsite receptors. A receptor is a location where people are likely to live, or spend large amounts of time, including residences, schools, hospitals, offices or public recreational areas. Conducting regular objective self-assessments of odour during different times of the day and different stages of the production cycle will enable producers to determine whether odour may be having an impact and to be proactive in addressing odour issues to limit impacts to community amenity.

15.1.1 Objective self-assessment of odour

The method described below can be undertaken with little training or experience by a staff member of the poultry farm. Firstly, the location of nearby receptors, which could be affected by odour need to, identified. Conduct the odour assessment at a monitoring point near the property boundary that lies between the poultry facility and the receptor.

Odour intensity assessments

The odour intensity at each monitoring point should be assessed during each batch. These assessments are to occur at the most likely time of each batch for maximum odour emissions i.e. one or two days before the first thin-out. Further assessments may need to be conducted in response to validated odour complaints.

The assessment procedure described has been taken from the German Standard VDI 3940 Determination of Odorants in Ambient Air by Field Inspection as a guide (VDI-RICHTLINIEN 1993). An example of the VDI scale and procedure are provided in the Odour Assessment Record (Appendix A). It is important to note that VDI scale and Odour Assessment Record shown should be used as a guide as the format and procedure may change with management and research.

When the assessment is undertaken the assessor must not be desensitised to the odour, therefore the assessor can only make the assessment if they have not been in or around the sheds for a minimum of three hours.

Where the odour intensity assessment indicates that odour levels are unacceptable (intensity levels A-D in the Odour Assessment Record), corrective action is required. Potential management strategies to reduce odour are discussed in Section 12.1.1.

Odour measurement

Some conditions on development applications may require odour samples to be taken and analysed if there are verified complaints by neighbours.

The collection of odour samples and analysis will be done in accordance with the Australian Standard *Air Quality – Determination of odour concentration by dynamic olfactometry* (AS/NZS 4323.3 - 2001).

Complaint recording

A complaints register should be kept to record all odour complaints (refer to Appendix A for an example). Details that should be recorded include:

- Date, time and the method by which the complaint was made.

- Any personal details of the complainant or a note about the complainant.
- Nature of the complaint.

Recorded complaints should be reviewed and the following information reported in the farms Complaints Register:

- Management options available to reduce or solve the problem.
- Corrective action taken to eliminate the source of each complaint.
- Effectiveness of method used.
- Response of complainant/s about the level of impact after steps have been put into place to solve the problem.
- Details of further monitoring.

15.1.2 Comprehensive modelling of odour

In some situations, it may be necessary to have a quantitative odour assessment conducted by a suitably qualified consultant (i.e. if the poultry farm receives a large number of complaints or if requested by a local authority). This level of assessment involves a comprehensive risk assessment including site specific (or site representative) odour emission data or a developed odour concentration / odour intensity relationship for the odour sources. The assessment may also include a time-series assessment of the odour impact, which investigates the concentration, frequency and duration of the odour impacts at individual receptors. The modelling incorporates the use of site-specific or site representative emission data, based on system measurements collected to appropriate standards with at least one year's worth of reliable meteorological data representative of the site. This data is modelled in a dispersion model (i.e. AUSPLUME, CALPUFF or AERMOD) to determine the overall impact the poultry facility has on community amenity.

Keep copies of all odour monitoring records for at least 3 years.

15.2 Dust

Dust emissions from the poultry farm should not cause any dust exposure of a serious and persistent nature to any sensitive place located at or beyond the boundaries of the property. Regularly assessing dust levels at the poultry farm will assist in identifying if dust is a potential community issue.

15.2.1 Objective self-assessment of dust

Identify the location of nearby receptors which could be affected by dust and conduct the dust assessment at all monitoring points located near the property boundary that lie between the poultry facility and the receptors. Objective dust assessments should be undertaken:

- At least once during each batch.
- One or two days before first thin-out.
- In response to validated dust complaints.
- More frequently during prolonged dry periods or after a validated complaint.
- When the wind speed is moderate to strong.

- When the wind is blowing from the poultry sheds towards the dust monitoring points.
- During daylight hours.

The results of the visual assessments should be recorded in a Dust Assessment Record. An example of a Dust Assessment Record is provided in Appendix A. Records should be kept for 3 years. Where the visual assessment indicates that dust levels are unacceptable, corrective action is required. Options for reducing dust impacts are discussed in Section 12.1.2.

Complaint recording

A complaints register should be used to record all dust complaints. An example of a complaints record is provided in Appendix A. The following details should be logged immediately and recorded:

- Date, time and the method by which the complaint was made.
- Any personal details of the complainant or a note about the complainant.
- Nature of the complaint.

The Complaints Register should be monitored monthly. Recorded complaints will be reviewed and the following information will be reported in the Complaints Register:

- Management options available to reduce or solve the problem.
- Corrective action taken to eliminate the source of each complaint.
- Effectiveness of method used.
- Response of complainant/s about the level of impact after steps have been put into place to solve the problem.
- Details of further monitoring.

15.3 Noise

The objective of monitoring potential noise impacts from the poultry facility is to minimise noise generation and subsequent noise complaints from significant receptors. Potential sources of noise include vehicle movements and operation of farm equipment including ventilation fans on poultry sheds and farm machinery.

15.3.1 Objective self-assessment of noise

Noise assessments

Identify the location of nearby receptors which could be affected by noise and conduct the noise assessment at monitoring points located near the property boundary that lies between the poultry facility and the receptors. Noise assessment should be conducted during each batch during the following conditions:

- After 6.30 pm.
- When the wind is light to moderate.
- During a period of high activity (e.g. time of poultry removal).
- At least once per winter.

Complaint recording

A complaints register should be used to record all noise complaints (refer to Appendix A for an example). The following should be recorded:

- Date, time and the method by which the complaint was made.
- Any personal details of the complainant or a note about the complainant.
- Nature of the complaint.

Recorded complaints should be reviewed and the following information reported in the Complaints Register:

- Management options available to reduce or solve the problem.
- Corrective action taken to eliminate the source of each complaint.
- Effectiveness of method used.
- Response of complainant/s about the level of impact after steps have been put into place to solve the problem.
- Details of further monitoring.

15.3.2 Comprehensive noise monitoring

It may be necessary to have a quantitative noise assessment conducted by a suitably qualified consultant (i.e. if the poultry farm receives a large number of complaints or if requested by a local authority). This will need to be conducted in accordance with relevant state policies and standards.

All noise monitoring records should be kept for at least 3 years. Options for reducing noise impacts are detailed in Section 12.1.3.

15.4 Sales of spent litter

Meat Chicken Farmers have a duty of care to ensure that their by-product is used sustainably. Information supplied to end users and records of sales should include:

- Fact sheets provided to end users including typical or actual composition. Typical nutrient uptakes of crops or pastures on which spent litter may be used as a fertiliser.
- Recording of off-site sales as per Section 9.1. An example record sheet is provided in Appendix A.

Suggested parameters to monitor in spent litter include:

- Total nitrogen (TN) or total Kjeldahl nitrogen (TKN).
- Ammonium nitrogen (NH4N).
- Nitrate-nitrogen (NO3N).
- Total phosphorus.
- Potassium.
- Copper.

- Zinc.
- Carbon.
- pH.
- Electrical conductivity.

15.5 Complaints

15.5.1 Community liaison

Liaison between the meat chicken farmer and surrounding residents can be helpful in communicating complaint resolution procedures. Open lines of communication are useful in identifying problems, confirming complaints and successfully applying relevant remedies to minimise the impact of the farm operations on neighbours. Establishing and maintaining lines of communication from the beginning is better option than dealing with complaints as they occur. Good community liaison may include:

- Informing neighbours in advance of any unusual events or problems that may cause an unavoidable odour, dust or noise problem, including practices to mitigate the problem and the expected duration of the problem.
- Participation and cooperation in resolving disputes.
- Gathering relevant evidence, and identifying and implementing strategies to remedy the problem.
- Informing the complainant of the outcome of any investigations and any actions taken to avoid future associated problems.

15.5.2 Handling complaints

The main method for measuring the community amenity impact of a meat chicken farm is the amount of complaints received. While this is an imperfect measure, it aids in identifying when receptors perceive that the meat chicken farm is having an unreasonable impact on their enjoyment of life and property. Because many community amenity impacts are closely related to weather conditions, daily monitoring of weather should be considered if complaints are ongoing. It can also help in assessing the validity of complaints.

Details of any complaints received should be recorded, along with results of investigations and corrective actions taken. Surrounding residents should be encouraged to phone the grower directly with complaints.

For large enterprises, or those that have a history of complaints, it may be useful to install an automatic weather station to continuously monitor wind direction and speed, along with other climatic conditions. This data can be very useful for complaint validation.

15.5.3 Complaints register

Full details of complaints received, results of investigations into complaints and corrective actions should be recorded in a “Complaints Register”. An example of a Complaints Register form is shown in Appendix A.

15.6 Soil sampling

If soil monitoring is required as part of a licence condition, analysis parameters will usually be specified. Monitoring should identify changes in soil properties caused by spreading spent litter or from nutrient and salt accumulation in free range areas. The frequency of monitoring for each parameter should depend on the likely rate of change for each parameter. Mobile or soluble parameters (e.g. Nitrate-nitrogen - NO3N) change more quickly and should therefore be monitored more frequently than parameters that change more slowly. Typical monitoring parameters for soils are given in Table 12.

Table 12. Typical soil analysis parameters.

Soil Test	Depth	Frequency
pH	0-0.1 m	Annually
	0.2–0.3 m	3 yearly
	0.5-0.6 m	3 yearly
EC (1:5 soil/water)	0-0.1 m	Annually
	0.2–0.3 m	3 yearly
	0.5-0.6 m	3 yearly
Total Kjeldahl Nitrogen	0-0.1 m	3 yearly
Nitrate-N	0-0.1 m	Annually
	0.2–0.3 m	Annually
	0.5-0.6 m	Annually
Available phosphorus (Colwell, Olsen or Bray)	0-0.1 m	Annually
	0.2–0.3 m	3 yearly
	0.5-0.6 m	3 yearly
Organic Carbon	0-0.1 m	3 yearly
Exchangeable Sodium	0-0.1 m	Annually
	0.2–0.3 m	3 yearly
	0.5-0.6 m	3 yearly
Exchangeable cations & CEC (Calcium, Sodium, Potassium, Magnesium)	0-0.1 m	Annually
	0.2–0.3 m	3 yearly
	0.5-0.6 m	3 yearly

Sampling location

Sampling locations in spent litter reuse areas should be chosen to represent the major soil types and land management practices (including land use and litter application rates). Soil sampling should always occur at the same time of year. The end of the cropping cycle is a good time since nutrients remaining in the soil at this time are vulnerable to leaching. Sampling should not occur immediately after prolonged wet weather.

The following steps will help decide how many sampling locations are needed:

1. Examine the soil type of each reuse area. Soil type may vary across reuse areas and differ soils vary in their capacity to retain nutrients and in their productivity. Dig some holes and compare the soils of each hole. (Recording information as you go is important!).

2. Consider the number and type of land uses across the reuse areas since this affects the sustainable spreading rate. Areas with different land uses should be monitored separately. However, it is not

necessary to provide a monitoring plot in each separate paddock if there are similar land uses between paddocks with the same soil type.

3. Divide each area on the basis of application rate.
   As an example, if there is one (1) soil type across the reuse areas of the farm, two (2) land uses on these areas and spent litter is the only by-product used on farm, the number of soil sampling sites would be 1 x 2 x 1 = 2.

The number of sampling locations in the free range area will be dependent on its size. However, sampling sites should cover range in soil types and intensity of use. For example, some areas of the free range area may frequented by birds more often (i.e. areas under shade, areas closer to shed). Some soil sampling sites below the free range area which may receive surface water runoff should also be sampled.

Monitoring interval

The monitoring interval for sampling soils should be based on the level of environmental risk based on soil test results. Sampling should occur at the end of a cropping cycle or at a time when nutrients are most vulnerable to leaching (before the onset of the wet season).

Sampling equipment

The sampling equipment that may be required is listed below.

- a soil auger, shovel, post hole digger or hydraulic soil sampling rig (these can be hired).
- plastic sample bags. Most laboratories will supply suitable sample bags
- a ruler or tape measure
- a hand trowel
- a plastic sheet
- two clean plastic buckets
- cheap styrofoam eskies
- a waterproof pen to mark sample bags
- waterproof tape to seal eskies
- personal protective clothing
- analysis request forms
- a pen to complete analysis request forms
- an envelope that analysis request forms will fit in.

Sampling procedure

1. Assemble the sample containers and the sample preservatives.
2. With a waterproof pen, label the sample containers with the enterprise name, your telephone number, a unique sample number (new numbers should be used at each sampling), the sampling

location (e.g. Paddock 5) and the date of sampling. Label the container instead of the lid, as lids can be mixed up in the laboratory.

3. Complete as many details of the analysis request forms as possible. This should include: contact details, sample numbers (matching those recorded on the sample bags), sampling location, sampling date and analysis parameters.

4. When labelling the sample bags, remember to include the sampling depth (e.g. 0-10 cm, 30-60 cm).

5. Collect samples. There is a range of acceptable soil sampling methods. These include variations on:

   a. Monitoring plot: a 20 m diameter monitoring plot is selected in a location that is representative of the paddock or the area most at risk (e.g. the area likely to receive the highest by-product application rate). The selected area should be free from stumps, atypical rockiness, tracks, animal camps and other unusual features. The location of the each monitoring plot should be recorded on a property map or GPS so that the same sites can be used in subsequent years. Collection of 25 grab samples of top soil (0-10cm) and at least five samples of subsoil (30-60cm or to bottom of root zone) to produce a topsoil and a subsoil composite sample for each monitoring plot is recommended.

   b. Grid: samples are collected from a series of parallel transects evenly distributed across the paddock. The pattern of sampling across the paddock forms a grid. The number of samples required depends on the area of the paddock. Collection of at least 5-10 topsoil and subsoil grab samples is suggested. These are combined to produce topsoil and subsoil composite samples for each area.

   c. Zigzag: samples are collected in a zigzag pattern across the paddock. The pattern of sampling across the paddock forms a zigzag or "W" shape. The number of samples required depends on the area of the paddock. Collection of at least 5-10 topsoil and subsoil grab samples is suggested. These are combined to produce topsoil and subsoil composite samples for each area.

   d. Random: samples are collected from random locations across the entire paddock. The number of samples required depends on the area of the paddock. Collection of at least 5-10 topsoil and subsoil grab samples is suggested. These are combined to produce topsoil and subsoil composite samples for each area.

In some instances it may be worth monitoring background soil nutrient levels on an area with a similar soil type that has not been used for poultry production or has been spread with by-product s (including spent litter). The sampling method adopted for the reuse areas, or a monitoring plot, can be used. It is recognised that it is not always easy to find a suitable background plot. The location of the each background plot should be recorded on a property map or GPS so that the same sites can be used in subsequent years.

7. As you collect the samples record a description of the soil sampled (one description will generally suffice if the monitoring plots method is used). Combine all of the topsoil samples in a bucket and thoroughly mix using a hand trowel. Combine all the subsoil samples in a separate bucket and thoroughly mix. Remove rock fragments exceeding 2 cm diameter and large roots. Break up large clods. Never bulk (mix) soils of two different soil types. Never mix soil layers (profiles) that are clearly different from each other (e.g. sand and clay loam).

8. Pour the mixed composite topsoil sample into a pile on the plastic sheet. Divide the pile into four quarters. Discard three and thoroughly mix the remaining quarter. Repeat the procedure with the remaining quarter until the sample size is small enough to fill the sample bag (generally about 1 kg

or 2 lb). Fill the sample bag and immediately place it in an esky. Repeat the process for the subsoil samples. Store the esky in the shade.

9. When all of the samples have been added to the esky, seal it with the waterproof tape.

10. Complete the analysis request forms and photocopy for your own records. Place the original forms in an envelope. Clearly address the envelope to the laboratory and add their phone number. In smaller writing, put the sender's address and phone number on the envelope. Firmly tape the envelope to the top of the esky.

11. Deliver the samples or arrange for courier delivery.

12. Contact the laboratory to confirm that the samples were received.

13. While you are in the paddock, it is useful to record any unusual changes in the soils and plants of the reuse areas. These include:

- Free water on the soil surface. This may indicate waterlogging. Other signs include reduced plant growth, growth of weeds (dock, nutgrass) and drooping foliage with pale leaves
- Invasion of an area with nettles or fat hen. This may indicate a surplus of nitrogen
- Yellow or browned off vegetation. This is indicative of toxic nutrient levels or nutrient deficiencies
- Bare patches in paddocks. These may indicate poor germination due to excess salinity, uneven nutrient distribution, inadequate nutrients or nutrient overloading. White crusting on soil surface in dry times may indicate evaporation from a shallow saline water table
- Percentage of vegetative cover in free range areas.

Recording

Original copies of soil analyses should be kept indefinitely, along with records of sampling locations and land use. This assists with long-term farm management.

15.7 Surface water sampling

In some cases, it may be a licence requirement to monitor the water quality of surface water captured in dams or ponds designed to capture surface water runoff from the poultry facility or water that overtops these detention ponds or dams during heavy rainfall events. The water quality of a nearby watercourse may also need to be monitored. If water sampling is required the following procedure should be employed. Recommended analyse parameters are listed in Table 13 but licence requirements should be adhered to.

Table 13. Recommended surface water analysis parameters.

Parameter	Units
pH	-
Electrical Conductivity (EC 1:5)	dS/m
Total Kjeldahl Nitrogen (TKN)	mg N/L
Nitrate – Nitrogen	mg NO3-N/L
Total Phosphorus	mg P/L
Phosphate	mg PO4-P/L

Sampling location

Suitable sites that can be located and accessed for monitoring must be identified. Discuss selected sampling locations with the relevant approved authority before sampling to ensure that the results will be acceptable.

For sampling watercourses: Samples should be taken immediately upstream and approximately 100 m downstream of an area of interest. The downstream sample should be taken some distance from the area of interest to allow for mixing of any runoff with the stream water. However, if the distance between sampling points is too great, inflows from other sources may affect the results. If another watercourse enters the relevant stream between the two sampling points, samples should also be taken from the secondary watercourse close to its junction with the watercourse of interest.

Monitoring interval

Surface water quality monitoring may be done at a set interval (e.g. quarterly, biannually or annually) or may be triggered by specific events (e.g. an overtopping of stormwater detention pond or dam). Water quality varies with time of day, flow rate and recent weather conditions, so these factors should be noted at the time of sampling.

If a pond spill to a watercourse is the trigger for sampling, samples of water should be taken during the spill as well as being from upstream and downstream from where the water enters the watercourse.

Sampling equipment

The sampling equipment that may be required is listed below.

- appropriate sample containers and preservatives. Most laboratories will supply or advise on suitable sample containers and any necessary preservatives. Obtaining sample containers or advice from the laboratory reduces the chance of sample contamination and ensures that the sample size is adequate.
- a sampling rod. A rod with a large clamp for holding the sampling container allows greater reach when sampling liquids. The sample should be taken from upstream of your feet, to ensure that disturbed sediment is not collected.
- a bucket that has been washed several times with clean water and then rinsed several times with the water to be sampled.
- cheap, styrofoam eskies
- plenty of crushed ice to pack around the samples in the eskies
- a waterproof pen to mark sample bottles
- waterproof tape to seal eskies
- personal protective clothing
- analysis request forms
- a pen to complete analysis request forms
- an envelope that analysis request forms will fit in.

Sampling procedure

1. Assemble the sample containers and the sample preservatives. With a waterproof pen, label the sample containers with the enterprise name, your telephone number, a unique sample number (new numbers should be used at each sampling), the sampling location (e.g. detention dam 1) and the date of sampling. Label the container instead of the lid, as lids can get mixed up in the laboratory.

2. Complete as many details of the analysis request forms as possible. This should include: contact details, sample numbers (matching those recorded on the sample bottles), sampling location, sampling date and analysis parameters.

3. Organise bottles and rods for sample collection. Grab samples should be collected directly into sample containers. A grab sample is a single sample collected at a particular time and place that represents the composition of the material being sampled. Composite samples should be collected using a similar bottle and mixed in a clean plastic bucket. A composite sample comprises several grab samples collected over several minutes. Composite samples of five grab samples should be collected if there is little movement in the watercourse or for a dam. Stream samples should be collected midstream, clear of bank edges and other potential contaminant sources. Use a sampling rod to collect samples so that it is not necessary to enter the watercourse. (This can be dangerous and may also stir up sediment that contaminates the samples).

4. Remove the sample bottle lid, taking care not to touch the inside of the lid or bottle. Collect the sample by facing the mouth of the sampling container downwards and plunge into the water. Turn the sampling container to a horizontal position facing the current preferably 0.2 m below the water surface (this avoids sampling surface scum). If necessary, create a current by dragging the container away from yourself. Remove the container as soon as it completely fills and empty it into the sample bottle. If you are taking a composite sample, thoroughly mix the grab samples in a clean plastic bucket before pouring into a sample bottle. Add any required preservative and replace the lid.

5. Immediately place the sample in an esky, pack crushed ice completely around it and replace the esky lid. Store the esky in a cool spot.

6. If samples will take longer than 48 hours to get to the laboratory, they may need to be frozen. Seek advice from the laboratory on this. Do not completely fill the sample bottle if you intend to freeze the sample. Do not freeze samples in a freezer used for food storage.

7. When all other surface water or groundwater samples have been added to the esky, seal it with the waterproof tape.

8. Complete the analysis request forms and photocopy for your own records. Place the original forms in an envelope. Clearly address the envelope to the laboratory and add their phone number. In smaller writing, put the sender's address and phone number on the envelope. Firmly tape the envelope to the top of the esky.

9. Deliver the samples or arrange for courier delivery.

10. Contact the laboratory to confirm that the samples have been received.

15.8 Groundwater sampling

In some cases it may be required by the Administrative Authority to monitor the quality of groundwater especially is spent litter is spread on-farm. The following analyse parameters are recommended.

Table 14. Recommended groundwater analysis parameters.

Parameter	Units
pH	-
Electrical Conductivity (EC 1:5)	dS/m
Total Kjeldahl Nitrogen (TKN)	mg N/L
Nitrate – Nitrogen	mg NO3-N/L
Total Phosphorus	mg P/L
Phosphate	mg PO4-P/L

Sampling location

If groundwater monitoring is to be undertaken, suitable monitoring bores or piezometers must be identified or installed. A piezometer is a non-pumping well, generally of small diameter with a short screen through which groundwater can enter. These must be installed correctly with depth and casing particularly important. Monitoring bores or piezometers may also need to be registered before construction. The approved authority should be consulted.

As groundwater may move extremely slowly, bores or piezometers should be located in close proximity, and downstream, of the area for monitoring. It is also advisable to locate a bore or piezometer above the area of interest, to allow for comparison. Both bores should access water from the same aquifer. While a network of bores provides better information, this can become expensive. Hence, it is worth consulting a hydro-geologist or specialist consultant for advice on the location, installation and sampling of bores.

Monitoring interval

Groundwater quality monitoring is also usually done at a set interval (e.g. quarterly, biannually or annually).

Sampling equipment

The sampling equipment that may be required is listed below.

- appropriate sample containers and preservatives. Most laboratories will supply or advise on suitable sample containers, as well as any necessary preservatives. Obtaining sample containers or advice from the laboratory reduces the chance of sample contamination and ensures that the sample size is adequate.
- a sampling bailer or pump to draw water from the monitoring bores. A bailer is cheap. However, bailing is time consuming and impractical for deep bores. It is also important to ensure the bailer is clean before use. A pump is convenient to use and allows for samples to be quickly collected.
- a tape measure and plopper or fox whistle to determine depth to groundwater
- a bucket that has been washed several times with clean water and then rinsed several times with the water to be sampled

- cheap, styrofoam eskies
- plenty of crushed ice to pack around the samples in the eskies
- a waterproof pen to mark sample bottles
- waterproof tape to seal eskies
- personal protective clothing
- analysis request forms
- a pen to complete analysis request forms
- an envelope that analysis request forms will fit in.

Sampling procedure

1. Assemble the sample containers and the sample preservatives. With a waterproof pen, label the sample containers with the enterprise name, your telephone number, a unique sample number (new numbers should be used at each sampling), the sampling location (e.g. Bore 1) and the date of sampling. Label the container instead of the lid, as lids can get mixed up in the laboratory.

2. Complete as many details of the analysis request forms as possible. This should include: contact details, sample numbers (matching those recorded on the sample bottles), sampling location, sampling date and analysis parameters.

3. *The standing water in the bore may be stratified and interactions between the water and the bore casing and the atmosphere may have influenced water properties. Hence, it is recommended that you pump several bore volumes from the casing to ensure that you are not sampling stagnant water.*

   Bore volume (L) = ((3.14/1000) x (radius m)2) x water depth (m)

   For shallow piezometers, it may be appropriate to empty the piezometer 1-2 days before sampling and then to allow it to refill. Allow bore to recharge with groundwater before sampling. If it is not possible to purge the bore before sampling, the sampling process should not disturb the water within the bore.

4. Measure the depth to groundwater.

5. Collect a grab sample using a bailer or pump.

6. Remove the sample bottle lid, taking care not to touch the inside of the lid or bottle. Rinse the sample bottle with the water to be collected. Fill the bottle directly from the bailer or pump. Remove the bottle from the flow as soon as it completely fills. Add any required preservative and replace the lid.

7. Immediately place the sample in an esky, pack crushed ice completely around it and replace the esky lid.

8. If samples will take longer than 48 hours to get to the laboratory, they may need to be frozen. Seek advice from the laboratory on this. Do not completely fill the sample bottle if you intend to freeze the sample. Do not freeze samples in a freezer used for food storage.

9. When all other surface water or groundwater samples have been added to the esky, seal it with the waterproof tape.

10. Complete the analysis request forms and photocopy for your own records (if you have access to a photocopier or fax machine). Place the original forms in an envelope. Clearly address the envelope to the laboratory and add their phone number. In smaller writing, put the sender's address and phone number on the envelope. Firmly tape the envelope to the top of the esky. Store the esky in the shade.

11. Deliver the samples or arrange for courier delivery.

12. Contact the laboratory to confirm that the samples were received.

Recording

At each sampling site, record:

- the location and name of sampling site (clearly identified location allows return to the same site for future sampling)
- the date and time of day of sampling occurs (water quality varies over time)
- approximate depth of the water in the bore or piezometer.
- weather conditions at the time of sampling, as these may influence water quality
- the method of sampling (grab sample or composite sample)
- the name of the sampler
- the date and time that samples were dispatched to laboratory
- the method of preserving samples (e.g. sample immediately put on ice in esky)
- analysis parameters requested (preferably keep a copy of the original analysis request forms).

15.9 Spent litter sampling

If spent litter is spread on-site or sold off-site it may be worth analysing a sample of litter to establish its nutrient and salt content. This will help establish sustainable application rates for spreading.

Sampling location

Separate samples are needed for each type of solid by-product for reuse. This could include screenings, sediment, sludge, spent bedding and compost. If solids are stored or composted before reuse then only the stored or composted product would generally need to be analysed.

Monitoring interval

The monitoring interval for sampling spent litter depends on soil test results for the reuse area to ensure sustainable nutrient levels. If soil test results are acceptable and monitoring results for the quality of the spent litter over several years indicates similar results, it may be possible to reduce the monitoring frequency. It is recommended that if spent litter is spread off-site or sold off-site directly to consumers that a sample is analysed at least annually.

Sampling equipment

- The sampling equipment that may be required is listed below.
- appropriate sample containers and preservatives. For samples with a fairly low moisture content ziplock plastic bags may be suitable. Wet samples are best stored in wide mouthed bottles that a laboratory can supply. Consulting the laboratory is recommended as this should ensure the containers are suitable and the sample size adequate.
- a sampling rod may be useful if sampling wet products e.g. sludge
- a shovel and trowel if sampling more solid materials
- a clean bucket
- cheap, styrofoam eskies
- plenty of crushed ice to pack around the samples in the eskies
- a waterproof pen to mark sample bottles or bags
- waterproof tape to seal eskies
- personal protective clothing (disposable gloves)
- analysis request forms
- a pen to complete analysis request forms
- an envelope that analysis request forms will fit in.

Sampling procedure

1. Assemble the sample containers or bags and any required sample preservatives. With a waterproof pen, label the sample containers (not the lids) or bags with the enterprise name, your telephone number, a unique sample number (new numbers should be used at each sampling), the sampling location (e.g. compost area 1) and the date of sampling.
2. Complete as many details of the analysis request forms as possible. This should include: contact details, sample numbers (matching those recorded on the sample bottles), sampling location, sampling date and analysis parameters.
3. Put on disposable gloves and dust mask (if sampling dusty products). When sampling, do not eat, drink or smoke; carry out standard hygiene practices.
4. If sampling from a stockpile (spent litter, composted litter), use a clean shovel to collect at least ten one-cup grab samples. Put each sample in the bucket and thoroughly mix with the garden trowel. Place about four cups of the mixed sample into a bag and seal. Put the bag inside another bag and seal well.
5. Immediately place the sample in an esky, pack crushed ice completely around it, replace the esky lid and tape shut. Do not put any clean water samples in the same esky.
6. Thoroughly wash your hands.
7. Complete the analysis request forms and photocopy for your own records. Place the original forms in an envelope. Clearly address the envelope to the laboratory and add their phone number. In

smaller writing, put the sender's address and phone number on the envelope. Firmly tape the envelope to the top of the esky. Store the esky in the shade.

8. Deliver the samples or arrange for courier delivery.

9. Contact the laboratory to confirm that the samples were received.

Recording

At each sampling, record:

- the location and name of sampling site (e.g. compost area)
- the date and time of day that sampling occurs
- weather conditions at the time of sampling
- the name of the sampler
- the date and time of sample dispatch to laboratory
- the method of preserving samples (e.g. sample immediately put on ice in esky)
- analysis parameters requested (preferably keep a copy of the original analysis request forms).

16. Training

Someone from the enterprise should be appointed to handle environmental issues (usually the owner or manager). Formal training in applicable environmental management issues is useful.

Any environmental training performed by the owners, managers and staff should be documented in the EMP. This would also include any in-house training. An example of a Training Record is provided in Appendix A.

17. References and Bibliography

ABARES 2014, *Australian commodities, March quarter 2014*, vol 4, No.1, Australian Bureau of Agricultural and Resource Economics & Sciences, Canberra, viewed 16 September 2014, < www.abares.gov.au >.

ACMF 2014, *Growing meat chickens*, Australian Chicken Meat Federation viewed 13 November 2014, < http://www.chicken.org.au/ >.

ACMF 2010, *National farm biosecurity manual for chicken growers*, February 2010, Australian Chicken Meat Federation Inc, North Sydney, < http://www.chicken.org.au >.

Animal Health Australia 2008a, *Operational procedures manual: Decontamination (Version 3.2)*, Australian Veterinary Emergency Plan (AUSVETPLAN), Edition 3, Primary Industries Ministerial Council, Canberra, ACT, viewed 27 May 2011, < http://www.animalhealthaustralia.com.au/index.php?s=disposal+manual >.

Animal Health Australia 2008b, *Summary Document (Version 3.1)*, Australian Veterinary Emergency Plan (AUSVETPLAN), Edition 3, Primary Industries Ministerial Council, Canberra, ACT, viewed 9 September 2014, < http://www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/AUSVETPLAN-Summary-Document.pdf >.

Animal Health Australia 2010a, *AUSVETPLAN*, (Edition 3), Animal Health Australia, viewed 9 September 2014, < http://www.animalhealthaustralia.com.au/programs/emergency-animal-disease-preparedness/ausvetplan/ >.

Animal Health Australia 2010b, *Operation procedures manual: Disposal (Version 3.1)*, Australian Veterinary Emergency Plan (AUSVETPLAN), Edition 3, Primary Industries Ministerial Council, Canberra, ACT, viewed 9 September 2014, < http://www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/Dest3final.pdf >.

Animal Health Australia 2010c, *Operational procedures manual: Destruction of animals (Version 3.1)*, Australian Veterinary Emergency Plan (AUSVETPLAN), Edition 3, Primary Industries Ministerial Council, Canberra, ACT, viewed 9 September 2014, < http://www.animalhealthaustralia.com.au/wp-content/uploads/2011/04/Dest3final.pdf >.

APEE 2001, *Paddle and recirculating fans - a progress report*, The Alabama Poultry Engineering and Economics Newsletter, Newsletter No. 13, September 2001, Aurburn University, viewed 4 September 2014, < http://www.aces.edu/dept/poultryventilation/FansVentilation.php >.

Auburn University 2001, *Paddle and recirculting fans - a progress report*, The Alabama Poultry Engineering and Enconomics Newsletter, No 13. Sept 2001, viewed 4 September 2014, < http://www.aces.edu/poultryventilation/documents/Nwsltr-13.pdf >.

Blackall, PJ, Chinivasagam, HN & Ristovski, Z 2008, *Evaluating risks posed by pathogen and dust emissions from meat chicken sheds*, RIRDC Publication No. 10/101, Rural Industries Research and Development Corporation, Canberra.

Brown, G 2014, *Reducing costs and energy by replacing inefficient ventilation fans*, Final RIRDC Project No PRJ-008688, Rural Industries Research and Development Corporation, Barton, ACT.

Brown, G & Gallagher, E 2013, *Free range chicken farms – odour emissions and nutrient management*, Final Report on RIRDC Project No. PRJ-005044, Rural Industries Research and Development Corporation, Canberra.

Chan, KY, Van Zwieten, L, Meszaros, I, Downie, A & Joseph, S 2008, 'Using poultry litter biochars as soil amendments', *Australian Journal of Soil Research*, vol. 46, no. 5, pp. 437-444.

Craddock, T & Hollitt, J 2010, *Piloting chicken litter usage in broadacre cropping - Setting research directions*, Final Report on RIRDC Project PRJ-000226, Rural Industries Research and Development Corporation, Rural Industries Research and Development Corporation, Canberra.

Czarick, M 2003, *Poultry Housing Tips: Fan performance laws*, vol 15, No. 4, May 2003, College of Agriculture and Environmental Science Cooperative Extension Service, The Universilty of Georgia, < www.poultryventilation.com >.

Czarick, M 2004, *Poultry Housing Tips: Static pressure testing*, vol 16, No. 12, November 2004, College of Agriculture and Environmental Science Cooperative Extension Service, The Universilty of Georgia, < www.poultryventilation.com >.

Czarick, M 2005, *Poultry Housing Tips: The best performing tunnel fans*, vol 18, No. 5, College of Agriculture and Environmental Science Cooperative Extension Service, The Universilty of Georgia <www.poultryventilation.com >.

Czarick, M & Fairchild, B 2009, *Poultry Housing Tips: How much water does a broiler house use?*, vol 21, No. 5, College of Agriculture and Environmental Sciences, Cooperative Extension The University of Georgia, viewed 4 September 2014, < https://www.poultryventilation.com/tips/vol21/n5 >.

DAFF 2004, *Guidelines for on-farm food safety for fresh produce*, Second Edn, Department of Agriculture, Fisheries and Forestry, Canberra, ACT, viewed 4 September 2014, < http://www.daff.gov.au/__data/assets/pdf_file/0003/183171/guidelines_onfarm_food_safety_fresh_produce_2004.pdf >.

DAFF 2009, *National Farm Biosecurity Manual: Poultry Production*, May 2009, Department of Agriculture, Fisheries and Forestry, Orange, NSW, < http://www.daff.gov.au/__data/assets/pdf_file/0009/1147554/poultry-biosecurity-manual.pdf >.

Department of Sustainability Environment Water Population and Communities 2012, *National Pollutant Inventory Guide – Version 5.3*, Department of Sustainability, Environment, Water, Population and Communities, May 2012, Canberra, viewed 15/10/2014, < http://www.npi.gov.au/system/files/resources/2e4b4a22-ae4f-4254-55a2-e0098b016897/files/npiguide.pdf >.

Department of Sustainability Environment Water Populations and Communities 2013, *National Polloutant Inventory. Emission estimation technique manual for intensive livestock - poultry raising*, Version 3.0, Department of Sustainability Environment Water Populations and Communities,, Australian Government, Canberra, ACT, viewed 9 September 2014, < http://www.npi.gov.au/resource/emission-estimation-technique-manual-intensive-livestock-poultry-raising-version-30 >.

DEPI Victoria 2014, *On farm pesticide storage (minor storage)*, Agnote No. AG1367, Published September 2008, Updated September 2009, Updated 7 July 2014, Department of Environment and Primary Industries, State Government of Victoria, viewed 9 September 2014, < http://www.depi.vic.gov.au/agriculture-and-food/farm-management/chemical-use/agricultural-chemical-use/storage/on-farm-pesticide-storage-minor-storage >.

Donald, J 1997, *Answers to your questions about: Tunnel house air deflectors/baffles*, Poultry Ventilation Pointers, September 1997, Albama Cooperative Extension System, Auburn University, viewed 4 September 2014, < http://www.aces.edu/dept/poultryventilation/FansVentilation.php >.

Dorahy, CG & Dorahy, CM 2008, *Understanding the fertiliser value of poultry litter*, RIRDC Project No. PRJ-2752, July 2008, ableblue Enviro Agri Business, Rural Industries Research and Development Corporation, Barton, ACT.

DPIW 2004, *On farm pesticide storage (minor storage)*, Getting Results. A special supplement in chemical storage May 2004, Department of Primary Industries, Water and Environment, viewed 9 September 2014, < http://www.nrmnorth.org.au/client-assets/documents/small-farm-living/Chemical%20Use%20Safety/Chemical%20Storage%20Disposal/On%20Farm%20Chemical%20Storage_SHMP.pdf >.

Dunlop, M & Grant, B 2012, *Review of fan efficiency in meat chicken sheds*, Final RIRDC Project No PRJ-005038, Rural Industries Research and Development Corporation., Barton, ACT.

EPA & QCGA 2004a, *Efficient lighting in poultry farms*, Eco-efficiency in the poultry industy factsheet, Queensland Environmental Protection Agency and Queensland Chicken Growers Association, viewed 24 August 2010, < ww2.gpem.uq.edu.au/CleanProd/poultry/lighting.pdf >.

EPA & QCGA 2004b, *Efficient ventilation in poultry sheds*, Eco-efficiency in the poultry industy factsheet, Queensland Environmental Protection Agency and Queensland Chicken Growers Association, viewed 9 September 2014, < http://ww2.gpem.uq.edu.au/CleanProd/poultry/ventilation.pdf >.

FREPA 2012, *FREPA Free Range Meat Bird Standards*, Published 2009, Updated 2012 Edn, Free Range Egg and Poultry Australia, viewed 9 September 2014, < http://www.frepa.com.au/wp-content/uploads/2010/04/Revised-FREPA-Free-Range-MEAT-BIRD-Standard-GM-20-March-2012.pdf >.

Freshcare 2009, *Freshcare code of practice - Food safety and quality*, 3rd Edn, The national on-farm assurance program for Australian growers, July 2009, Freshcare Limited, viewed 4 September 2014, < http://www.freshcare.com.au/ >.

Griffiths, N 2011, *Best practice guidelines for using poultry litter on pastures*, 2 Edn, Primefact 534, May 2011, Department of Primary Industries, New South Wales Government, viewed 16 September 2014, < ww.dpi.nsw.gov.au/publications >.

Grimes, JL, Smith, J & Williams, CM 2002, Some alternative litter materials used for growing broilers and turkeys, World's Poultry Science Journal, 58:515-526.

Nicholas, PJ, Hewitt, S, Blackall, PJ, Chinivasagam, HN, Runge, GA, Klepper, K *et al*. 2007a, *Literature review and risk assessment for the safe and sustainable utilisation of spent litter from meat chicken sheds*, Publication No. 06/xx, Rural Industries Research and Development Corporation, Kingston ACT.

Nicholas, PJ, Hewitt, S, Blackall, PJ, Chinivasagam, HN, Runge, GA, Klepper, K *et al*. 2007b, *Literature review and risk assessment for the safe and sustainable utilisation of spent litter from meat chicken sheds*, RIRDC Project No. FSE-3A, Rural Industries Research and Development Corporation, Barton, ACT.

NSW Agriculture 2004, *NSW meat chicken farming guidelines*, Managing planning, development and environmental issues, February 2004, NSW Department of Agriculture.

PIRSA 2007, *Storage of agricultural and veterinary chemicals*, Factsheet No. 11/07, November 2007, Primary Industries and Resources SA, viewed 26 May 2011, < http://www.pir.sa.gov.au/pirsa/more/factsheets/fact_sheets/farm_chemicals/storage_of_agricultural_and_veterinary_chemicals >.

PIRSA 2013, *Storage of agricultural and veterinary chemicals*, Rural Chemicals Operations, Factsheet No. 011-2013RCO, Biosecurity SA, Primary Industries & Reources SA, viewed 9 September 2014, < http://www.pir.sa.gov.au/pirsa/more/factsheets/fact_sheets/farm_chemicals/storage_of_agricultural_and_veterinary_chemicals >.

PISC 2002, *Model Code of Practice for the Welfare of Animals - Domestic Poultry*, 4th Edn, SCARM Report 83, Primary Industries Standing Committee, CSIRO Publishing, Collingwood, Vic.

Runge, G, Blackall, P & Casey, K 2007, *Chicken Litter – issues associated with sourcing and use*, Publication No 07/035, Rural Industries Research and Development Corporation, Kingston, ACT.

Rutherford, P 2005, *Code of practice for the use of agricultural and veterinary chemicals in Western Australia*, 3rd Edn, Bulletin 4648, February 2005 (reviewed 2007), Department of Agriculture Western Australia, South Perth, viewed 4 September 2014, < http://www.agric.wa.gov.au/objtwr/imported_assets/content/pw/chem/cop_bulletin.pdf >.

Standards Australia 1998, *The storage and handling of agricultural and veterinary chemicals*, (AS 2507-1998), Standards Australia, Homebush, Sydney.

Standards Australia 2009, *Organic and biodynamic products*, (AS 6000-2009), Standards Australia, Sydney, NSW.

Standards Australia 2012, *Composts, soil conditioners and mulches, AS 4454-2012*, SA Ltd (ed.), Standards Australia Limited, Sydney, NSW.

Standards Australia/Standards New Zealand 2001, *Stationary source emissions Part 3: Determination of odour concentration by dynamic olfactometry*, (AS/NZ 4323.3-2001), Standards Australia International Ltd., Strathfield NSW and Standards New Zealand, Wellington.

Stapleton, G, Milne, G, Neill, S & O'Regan, M 2013a, *Renewable energy*, Fourth Edn, Technical Manual, Australian Government, viewed 1 November 2010, < http://www.yourhome.gov.au/sites/yourhome.gov.au/files/pdf/YOURHOME-4-Energy-8-RenewableEnergy-(4Dec13).pdf >.

Stapleton, G, Milne, G, Reardon, C & Riedy, C 2013b, *Photovoltaic systems* Fourth Edn, Technical Manual, Updated 4 December 2014, Australian Government, viewed 4 September 2014, < http://www.yourhome.gov.au/sites/yourhome.gov.au/files/pdf/YOURHOME-4-Energy-9-PhotovoltaicSystems-(4Dec13).pdf> >.

University of Kentucky, CoA 2010, *Poultry production manual: part of the poultry housing service*, University of Kentucky, College of Agriculture, Kentucky, viewed 4 September 2014, < http://www.ca.uky.edu/poultryprofitability/production_manual.html >.

VDI-RICHTLINIEN 1993, *Determination of Odourants in Ambient Air by Field Inspections* (VDI 3940), Kommission Reinhaltung der Luft im VDI and DIN, Dusseldorf.

Wiedemann, SG, McGahan, EJ, Runge, G & Chinivasagam, N 2008, *Composting every day mortality and other wastes from layer farms*, August 2008, Australian Egg Corporation Ltd

Wiedemann, S, McGahan, E & Poad, G 2012, *Using Life Cycle Assessment to Quantify the Environmental Impact of Chicken Meat Production*, Final Report, RIRDC Project No PRJ-004596, Rural Industries Research and Development Corporation., Barton, ACT.

Woods, N 2005, *Agricultural chemical users' manual*, Guidelines and principles for responsiple agricultural chemical use, G Cowles, *et al*. (eds.), Department of Primary Industries and Fisheries, Queensland, viewed 14 September 2014, < https://www.daff.qld.gov.au/__data/assets/pdf_file/0009/54738/AgChem-UsersManual.pdf >.

WorkCover NSW 2006, *Code of Practice for the safe use and storage of chemicals (including pesticides and herbicides) in agriculture*, Revised 2nd Edn, WorkCover NSW, Lisarow NSW, viewed 4 September 2014, < http://www.workcover.nsw.gov.au/formspublications/publications/Pages/WC00422_Safeuseandstorageofchemicalsincludingpes_.aspx >.

Appendix A. Example Record Sheets

Example Complaints Register

The complaint registration form below is to be used to record all complaints received at the farm. Further details may be provided on pages to be attached.

Date	Complainant's name	Complaint	Complaint recorded by	Source of problem	Comment / Action taken	Does complainant believe impact has declined?	Further action taken?	Signature of responding officer

Spent Litter Removal Records

Date	Amount sold (t and/or m3)	Transporter / Destination / Intended Use

NOTE: This record sheet maintained for at least 3 years.

Noise Assessment Record

Date	Noise Monitoring Points (Level of Noise Nuisance)				
	MP 1	**MP 2**	**MP 3**	**MP 4**	**MP 5**

Noise Levels and characteristics to assess when determining noise levels:

0	Not Audible
1	Definitely not annoying
2	Very little annoyance
3	Some annoyance
4	Annoying
5	Quite annoying
6	Very annoying
7	Extremely annoying

A	Sound pressure level
B	Its duration
C	The rate at which it happens
D	It's audibility
E	Whether it is continuous at a steady level or whether it has a fluctuating, intermittent, tonal or impulsive nature
F	Whether it has vibration components

NOTE: characteristics as described in Part 1 of the Environmental Protection (Noise) Policy 1997(QLD)

Dust Assessment Record

	Name	Date & Time	Wind direction	Wind speed	Dust from poultry farm	
					Absent	Present
MP 1 MP 2 MP 3 MP 4 MP 5						

Odour Assessment Record

STEP 1: Using the German VDI 3882 (VDI-RICHTLINIEN 1993) odour intensity scale provided, record the odour intensity every 30 seconds over a 10 minute period.

STEP 2: Enter the highest intensity level experienced during the 10 minute period into the record below.

STEP 3: When an odour intensity of A-D is experienced, corrective action is required.

GERMAN VDI 3882 odour intensity scale

Odour intensity	Intensity level
Extremely strong	A
Very strong	B
Strong	C
Distinct	D
Weak	E
Very weak	F
Not perceptive	G

Name	**Date**	**Time**	**Wind direction**	**Wind strength**	**Odour Monitoring Point**				
					MP 1	**MP 2**	**MP 3**	**MP 4**	**MP 5**

Australian Government

Rural Industries Research and Development Corporation

National Environmental Management System for the Meat Chicken Industry

Version 2

Part B – Example Environmental Management Plan

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Contents

1. Introduction

The purpose of this ***Environmental Management Plan*** (EMP) is to provide a framework for the environmentally sustainable operation of the meat chicken farm. The EMP reflects the day-to-day operation of the farm, while also recognising the needs of the industry, government and the community. It should document practical management procedures and technologies that will ensure a balanced relationship between the farm, the environment and the surrounding community. Documenting the interaction between the farm and the natural resources and amenity issues also helps to demonstrate sound environmental performance.

The development of an EMP for an individual enterprise is a formal commitment that all reasonable and practical efforts will be made to operate the meat chicken farm in an environmentally sustainable manner. It provides a system for documenting:

- Natural resources and amenity issues that are vulnerable to the operation of the meat chicken farm.
- How these risks will be minimised through design and management.
- Measurement of the effectiveness of these design and management strategies through monitoring.
- Reporting of monitoring results.

Growers are encouraged to develop an EMP for their enterprise to demonstrate that the farm is minimising potential environmental impacts. The development of an EMP is also a requirement for the licensing or approval of meat chicken farms in some states.

The key components of an EMP are:

- Identification and contact details, with a brief description of the meat chicken farm and a commitment that the farm will be operated in an environmentally sustainable manner.
- Legal requirements of the farm, including applicable consents, approvals and/or licenses to operate the enterprise and use water etc.
- Information on the natural resources and amenity issues of the property and surrounding area.
- Description of all the design and management facets of the meat chicken farm.
- Identification of any environmentally vulnerable resources by examining how the location, design and management of the farm interact with the environment. Identification of vulnerable resources may trigger regular monitoring or a change in design and management to minimise the risk.
- Monitoring to measure any environmental impacts. This may be soil sampling if spent litter is spread on-farm or analysis of spent litter sold off-farm.
- Contingency plans for emergency situations.
- Any environmental training undertaken by staff.
- Periodic review of the EMP to update changes in regulatory requirements, operation, environment, design or management.

This document provides an example of an environmental management plan (EMP) for a meat chicken farm. Other generic environmental management plans have also been developed for the meat chicken industry and may be useful references when completing individual EMP's. These include:

- ***Best Practice Management for Meat Chicken Production in NSW Manual 2 - Meat Chicken Growing Management***, developed by the New South Wales Department of Primary Industries and the Poultry Meat Industry Committee. Available from: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0020/448211/BPM-for-meat-chicken-production-in-NSW-manual-2.pdf (NSW DPI 2012).

- ***Generic Environmental Management Plan for Ongoing Operations Management of New or Expanded Victorian Broiler Chicken Farms***. In accordance with the Victorian Code for Broiler Farms. Recommended by the Broiler Code Committee, which oversees the Victorian Code for Broiler Farms. Available from: https://www.dpi.vic.gov.au/__data/assets/pdf_file/0016/36061/Generic-EMP.pdf (DPI 2001).

Generic EMP's have also been developed for other intensive animal industries and may also provide useful examples for developing an individual EMP.

Some of the components of an EMP listed above may have been addressed in the initial application to develop the meat chicken farm and thus may either be simply referred to in the EMP or included in an appendix. This may reduce the overall content of the EMP for a farm that has previously documented this information. It is important however that each issue is addressed. For completeness it may also be useful to repeat the information in the EMP, so it is a stand-alone document.

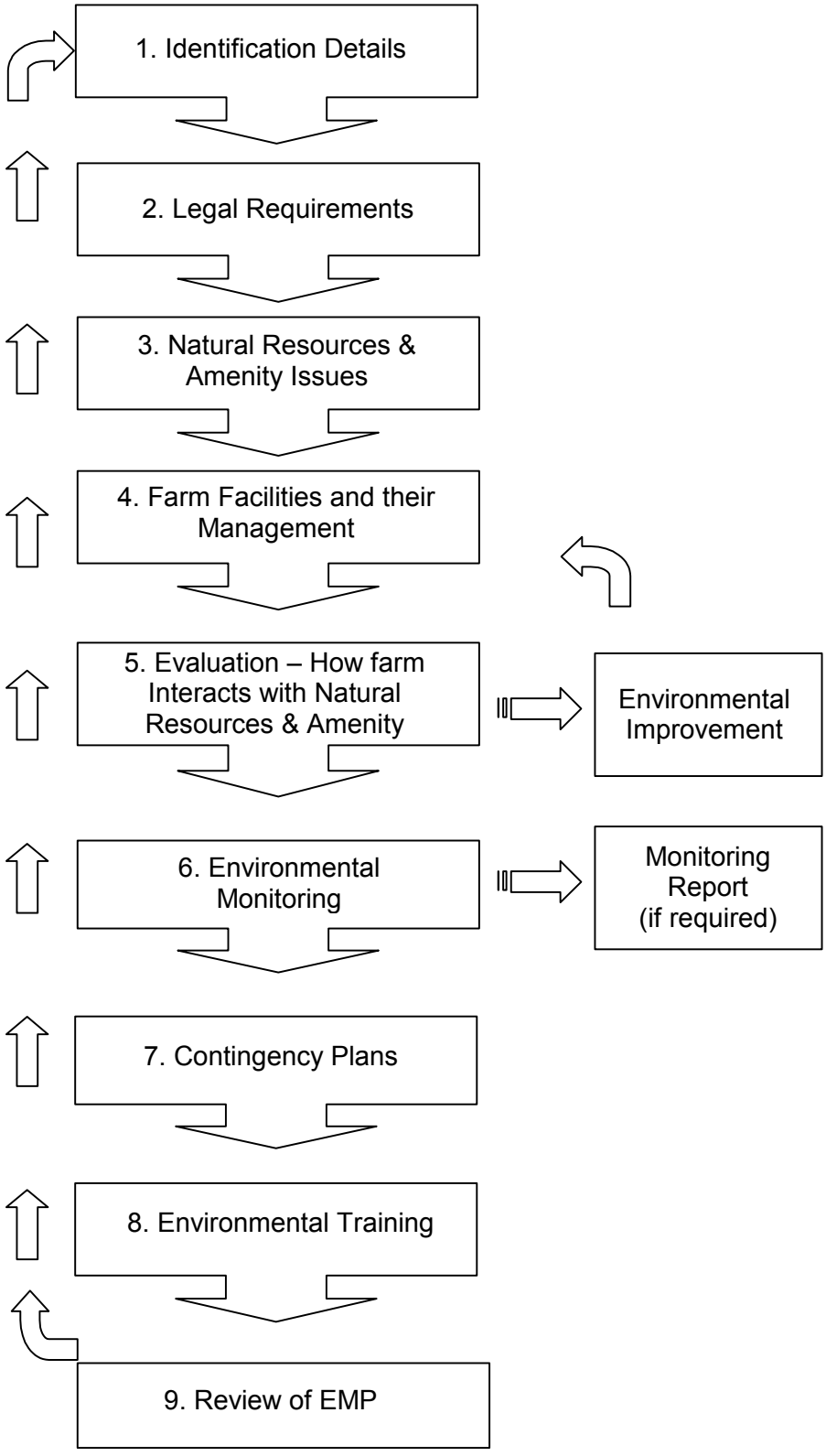


Figure 3. Flow diagram of an EMP for a meat chicken farm.

2. Farm Details

This needs to include information on who owns the farm and the relevant staff to contact. It should also describe or show on a map how to find the farm.

2.1 Ownership and contact details

Farm Owner:	Joe Buzzard
Farm Manager:	As Above
Processor:	Chickens Australia Pty Ltd
Name of Farm:	Chicken Ranch
Postal Address:	PO Box 99999
	Chickenville, Queensland 4999
Telephone Number:	07 9999 9999
Mobile Number:	04 9999 9999
Facsimile Number:	07 9999 9999
Email Address:	joe.buzzard@chickenranch.net
Real Property Description:	Lot 1 and Lot 2 RP 99999
	Parish of Dire
	County of Straits
	Shire of Chickens
Land Area (Ha):	100 Ha
Tenure:	Freehold
Actual Location:	5 km South West of Nobodyville on Jimmys Road
(show on a regional map)	on Jimmys Road

2.2 Farm description

Provide a brief description of the operation, including sheds, birds/batch, batches/year. Include a plan of the meat chicken operation on-farm and a map showing farm in relation to neighbours/towns/public places etc. Include entry requirements (days since last contact with other poultry).

Number of sheds:	4
Total area of shed floors (m2)	7,040
Number of birds:	100,000
Annual farm capacity:	550,000
Entry Requirements:	Not to enter farm unless 4 days free from contact with any other poultry. No entry without prior permission of management.

General Description:

The operation grows day old chicks out to market weight. On average the farm receives 5.5 batches per year, comprising approximately 100,000 birds per batch. Thin-outs occur at around 35 days when 25,000 to 35,000 birds are generally removed for processing. The remainder of the birds are removed for processing at around 49 days. Sheds remain empty of birds for about 14 days (sometimes up to 21 days) between batches). Litter cleanout occurs after every batch of birds.

3. Environmental and Legal Responsibilities of Suppliers and Growers

3.1 Commitment to sound environmental management

An Environmental Management Plan will only be successful if there is a genuine commitment by the grower and the integrator to operate the meat chicken farm in an environmentally sustainable manner.

The commitment to sound environmental management should emphasise the value of sound environmental management to the owners and reflect what is to be achieved by the EMP. It need not be lengthy or detailed, but must be realistic and written to suit the operation.

A commitment to sound environmental management typically includes: a description of the activities to be undertaken on-site; a commitment to environmental protection, a commitment to improving environmental performance; and plans for ongoing environmental education and training.

e.g.

We Joe Buzzard (Grower) and Chickens Australia Pty Ltd (Processor), aim to minimise the environmental impact of the farm by ensuring all design and management practices comply with the conditions of development consent, license conditions, relevant State Department Acts (e.g. Environment and Planning) and follow the principles of sound environmental management.

We have set in place this system to evaluate, monitor, record, manage and review environmental impacts. We agree to review the plan at least every two years or more frequently if circumstances require. We will ensure all staff involved in the operation of the farm are adequately trained in environmental issues and relevant training and education is undertaken.

I the grower agree to abide by the requirements outlined in the plan and all staff members employed by me have signed a statement which identifies they understand and agree with these requirements.

Where a legitimate problem exists or arises, we will consult with the relevant authorities (e.g. Local Council) to devise an adequate solution, bearing in mind commercial realities.

Signed JJ Buzzard (Grower)

Date: 01/08/2010

Signed CC Slayer (Processor)

Date: 01/08/2010

As a staff member employed by the grower, I understand and agree with the requirements outlined in this environmental management plan.

Staff Member (Full Name)	Signature	Date
Joe Buzzard Jnr	J Buzzard	01/08/2010
Johnny Cleaver	J Cleaver	01/08/2010

3.2 Legal requirements

It is important to identify the legal constraints for the farm and to confirm that there is compliance with these obligations. Arguably, the most important legal constraints for any meat chicken farm are consents, approvals or licenses to operate; and water supply instruments.

List legal requirements and legislation for the farm.

Local Govt. Authority:	Shire of Chickens
Local Govt. Consent No.:	CL 444444
Consent Capacity:	120,000 birds
Date of Approval:	04/01/1990
State Govt License No.:	QGCL 42813
License Capacity:	120,000 birds
Date of Approval:	09/08/1997
Action Needed:	Nil, all necessary licenses and approvals have been obtained.
Water Source:	Bore Water
License/Allocation No.:	QDNR 439678
License/Allocation Quantity:	20 ML

4. Natural Resources and Amenity Issues

4.1 Water

4.1.1 Surface water

Surface water resources include water found in: watercourses (e.g. rivers and creeks), overland flow (stormwater runoff) and water storages (e.g. reservoirs, lakes and dams). If nutrients from a meat chicken farm enter surface waters, the quality of the water may be reduced.

Describe the surface water resources both on the farm and nearby:

An intermittent gully runs through the center of the property. A 25 ML gully dam has been constructed at the northern end of the property. About 2 km past the southern boundary of the property the gully runs into Platypus Creek. Platypus Creek flows into Boo Boo River, 10 km west.

(Show the surface water resources on the farm plan map and the regional map).

4.1.2 Groundwater

Groundwater is any water resource below the ground surface that can freely move under the influence of gravity. Groundwater stored in an aquifer is available for transmission to a bore, spring or watercourse. Meat chicken farms may affect groundwater resources through contamination with nutrients.

Describe the groundwater resources both on the farm and nearby:

A good supply of groundwater is available on the farm via 2 bores. One is beside the meat chicken sheds and the other is on the southern side of the property. Groundwater is drawn from approximately 25 m at both sites.

4.1.3 Water supply

Water supply relates to the water that is used on the farm to operate the meat chicken operation.

Describe the source/s of water, and the types and amounts used.

Water is sourced from a bore beside the meat chicken sheds. There is another bore on the southern side of the property and a gully dam on the Northern side. These have not been required for the meat chicken operation. Water use is approximately 5 ML/yr.

4.2 Wind direction

Basic wind direction data is part of an EMP since it influences odour dispersion. It may affect the location, design and management of a meat chicken farm. This data can often be obtained from post office weather records, Bureau of Meteorology or local department of agriculture/primary industries/natural resources. Record the dominant wind direction (8 point) for each month of the year.

Record the dominant wind direction (8 point) for each month of the year.

Month	**Dominant Wind Direction (8 pt)**	**Comment**
January	Easterly	Some hot/humid weather
February	Easterly	
March	North Easterly	
April	South Westerly	
May	South Westerly	
June	Westerly	
July	Westerly	
August	South Westerly	
September	South Westerly	
October	South Easterly	Some hot/humid weather
November	South Easterly	
December	South Easterly	

4.3 Community amenity

Community amenity is the ability of the community to comfortably enjoy their lifestyles. When a meat chicken farm interferes with another person's enjoyment of their land it causes nuisance.

Potential sources of impact to community amenity include:

- Odour
- Dust
- Noise
- Pests and diseases
- Road use issues
- Human health
- Visual

Community amenity impacts are mainly an issue if the meat chicken farm is located close to houses or residential areas or on busy roads. Where a meat chicken farm is located on a poor standard or low traffic volume road, road use issues may arise. Pest and disease concerns may occur if the meat chicken farm is located in close proximity to other poultry farms or processing plants.

Describe the location of the meat chicken farm in relation to neighbours. Also describe the topography, vegetation and other buffers.

There are two neighbours situated to the north of the meat chicken sheds One is approximately 250 m from the sheds and the other is approximately 350 m from the sheds. A tree buffer has been planted on the northern side of the sheds to screen the farm from these neighbours. The closest neighbour to the west is approximately 800 m from the sheds. They are situated over the hill. The closest neighbour to the east is approximately 1200 m from the sheds. To the south of the property is a rural residential development (1000 m). These blocks are about 2 Ha each. There are about 12 houses currently in this development.

4.4 Soils

The information on soil type is not as relevant for small sized farms that do not land apply spent litter. Often there are multiple soil types on a property. Different soil types suit different purposes. For instance, soils with a reasonable clay content and a low dispersion ratio are well suited for sealing spent litter storage areas; firm soils are well suited for building construction; and loam to clay soils are most suitable for spent litter application. To allow you to better manage your farm, it is important to understand the different soil types that are present.

For each soil type and layer on your farm, provide a brief description of the depth (cm); colour (yellow, brown, red, grey, black); texture (e.g. sand, loam, clay); structure (e.g. crumb, hard-setting, structureless); drainage (e.g. well drained, imperfectly drained, poorly drained); degradation (e.g. prone to erosion, waterlogged, saline, sodic).

The soil on the upper slopes in a grey clay-loam, overlying a grey clay. The depth of the topsoil on these slopes is about 30 cm. The subsoil has a depth of about 1 m, before the parent material. The topsoil is relatively crumbly, Easy to cultivate and is excellent for crop production. Because of the undulating slope of the ground, it is well drained. Contour banks and grassed waterways have been constructed on this land to minimise erosion. The soil on the lower slopes (running through the centre of the property) is a grey loam, overlying a grey clay-loam. The depth of the topsoil here is about 50 cm. The subsoil has a depth of about 1.5 m. This soil is well drained and is excellent for irrigated crop production.

4.5 Gaseous emissions

4.5.1 NPI Reporting (ammonia emissions)

If your farm has more than 87,600 birds you are required to report your ammonia emissions to the relevant state or territory National Pollutant Inventory office by the 30th of September each year. Your ammonia emissions can be calculated using the following default emission factor:

0.114 kg ammonia/animal/yr.

Calculate your shed emissions below:

120,000 birds x 0.114 kg ammonia / bird / year

= 13,680 kg ammonia / year

= 13.7 tonnes ammonia / year

If the meat chicken farm uses other ammonia-containing materials, the ammonia component of these materials will also need to be included in your ammonia emissions calculations.

4.5.2 NPI reporting (fuel usage emissions)

Some larger facilities may also trip fuel usage thresholds (category 2 threshold) and would be required to report a range of gaseous emissions.

To calculate your farms fuel usage emissions refer to the Emission Estimation Technique manual for Intensive Livestock – Poultry Raising Version 3.0 (Department of Sustainability Environment Water Populations and Communities for the steps involved in calculating fuel usage thresholds. This is available from the NPI website: http://www.npi.gov.au/resource/emission-estimation-technique-manual-intensive-livestock-poultry-raising-version-30

5. Operation, Design and Management

5.1 Road, traffic and machinery management

Describe road, traffic and machinery management in relation to speed limits on the farm; covering of loads; maintenance of road surfaces; maintenance of equipment and machinery. Describe methods for reducing dust, noise and light impacts associated with road, traffic and machinery management.

Bird pick-up occurs at about 7 pm in winter and at about 9 pm in summer.

Pickup is via Jimmy's road, which has been recently sealed.

Upon request from council I assisted in providing a slip lane on entry to the property. The main entrance to the rural residential development is 100m past the entrance point to the farm. At peak production, feed deliveries occur every 2 days, via a B-double. The road into the farm has been formed up 0.5m 0.5 m and graveled to provide all weather access.

During very dry periods we wet the first 200 m of the road to reduce dust impacts on the rural residential development. A speed limit of 40 km/hr is is enforced on this road and all drivers are asked to comply.

Most spent litter is used on the farm, with only 1 load/batch leaving the farm. This is always covered. Sheds are cleaned out with our own equipment that is regularly maintained.

5.2 Siting and design

Appropriate siting and design of meat chicken farms is essential for a sustainable operation and to minimise environmental conflicts and impacts. Factors to consider in terms of siting and design include:

- Floor type (e.g compacted clay or concrete)
- Shed ventilation type (e.g. mechanical or tunnel ventilated)
- Odour reduction strategies (including impact walls, earthen mounds, vegetative screens, short stacks)
- Road access
- Free-range areas (if applicable)

Ensure relevant siting and design features are included on the farm plan.

Describe the siting and design of the sheds and farm in relation to the above points:

All floors are constructed of compacted clay. This material was sourced from the farm. All 4 sheds have been converted to tunnel ventilation, after originally being naturally ventilated.

The sheds face north-south, with the fans situated on the northern side of the buildings. Earthen mounds have been constructed on the fan end of these sheds, since the two new houses were constructed to the north of the farm 4 4 years ago. A 25 m vegetative screen has also been established on the northern boundary of the farm. Road access is via Jimmy's Road on the southern side of the property.

5.3 Shed management

Wet litter in sheds can be a major source of odour. Management of ventilation, sheds and equipment, nutrition and bird health are essential for maintaining optimum litter moisture levels (15-30%) and managing odours from the sheds.

Factors to consider in terms of shed management are:

- Litter type and amount used.
- Drainage around sheds to avoid extraneous water entering the sheds.
- Bird health and changes in dropping moisture.
- Waterers need to be carefully adjusted in terms of height and water depths to reduce spillage.
- Inspection of shed walls and roof for leaks and repaired as soon as possible.
- Drinkers and foggers should be inspected regularly to ensure they are working effectively. If necessary, these should immediately be repaired and replaced.
- The ventilation system needs to be regularly checked to ensure that air movement is at the design level.
- The compacted layer at the base of the shed needs to be retained after each clean-out and repaired when necessary.
- Current metering and recording system for monitoring electricity, gas and water use.

Describe shed management in relation to above points.

The sheds operate on single batch litter, with about 75 mm of fresh bedding added after each batch. A contour bank has been constructed on the northern side of the sheds to prevent surface water entering the shed area. Sheds and equipment are inspected daily to ensure birds are healthy, equipment is functioning correctly and litter is at an optimum moisture content. The sheds are now all fitted with "Maxchick" environmental controls. This is linked to a computer in the office in the house to enable 24 hour surveillance. Alarms signal equipment malfunction. After every 12 months small sections of the shed floors that have been damaged by "Darkling" Beetles are repaired by recompacting the area with clay. An electricity meter is installed in each shed and daily usage is recorded in a ledger. When the gas tank is refueled, the volume of gas used to refill the tank is recorded. A meter is installed on the pipeline from the on-site bore at the storage tank. The volume of water pumped is recorded monthly.

5.4 Litter clean-out and removal

During shed clean-out there is an increased risk of odour, dust and noise emissions from the farm. Thus, shed clean-out needs to be carefully managed to avoid these risks.

Describe the management of spent litter on the farm. This may include whether the farm uses single batch, partial reuse or multi-batch. Whether the spent litter is immediately removed from the farm, stored and then removed or applied on-farm. If the spent litter is stored or composted on-farm, describe where and how this is done.

The single use litter is cleaned out the day after the last birds are collected from the sheds. This spent litter is generally spread immediately on the farm after clean-out. If the spent litter cannot be spread immediately it is stored in an area approximately 300 m to the south-west of the sheds. This area has a compacted clay base and is bunded on all sides to prevent runoff in or out of the area. When the spent litter is spread it is generally incorporated immediately afterwards via discing.

Some spent litter is spread on improved pastures and is not incorporated.

Application finishes before 3 pm to avoid any odour problems in the early evening with neighbours. Any spent litter leaving the farm is immediately loaded onto a tipper and covered before leaving the farm.

5.5 On-site spent litter application

This section is only relevant when spent litter is spread on-farm or if farm is free-range.

- Describe the application of spent litter on-farm in relation to:
- The area used for spreading.
- How it is spread (manure spreader etc).
- The type of crops grown (are they cut and carted or grazed).
- How often it is applied to each paddock (annually, biannually etc).
- Application rates.

If your farm has free-range areas describe the management practices employed to minimise nutrient loading in the free-range areas (i.e. growing and harvesting rotational crops).

Spent litter is spread on approximately 70 Ha of the farm with a "Keenan" manure spreader. The upper slopes are mostly planted with winter cereal crops (barley and oats) and maize in summer time.

Some perennial pasture is also grown in a small area. A variety of vegetable crops are grown on the flatter areas through the center of the property (10 Ha). This area is irrigated with hand-shift irrigators.

Spent litter is applied in a rotational basis, with each area receiving litter every 3 years. By monitoring crop yields and spent litter composition, application is matched to crop uptake. Soil sampling is performed every two years in 5 separate farm areas to ascertain the amount of inorganic fertiliser that is required.

On the farm plan show areas where spent litter is applied on-farm.

5.6 Dead bird management

Dead birds need to be managed correctly to avoid the risk of odour generation and disease transmission. There are many alternatives for handling dead birds, but the system employed on the farm needs to be approved by the relevant authorities.

Describe the dead bird management system used on the farm, including how often they are collected and where they are stored, disposed and/or removed:

Dead birds are generally collected daily from the sheds. During periods of extremely hot weather this often occurs twice per day. These birds are taken to a carcass composting facility located in the same area as the temporary spent litter storage area. Here they are composted in static bays, with a combination of spent litter and straw.

These bays are constructed of large round bales. Every 6 months the composted material is spread onto the cropping land with the manure spreader.

5.7 Chemical storage and use

Chemicals should be stored, handled, applied and disposed of appropriately. Material Safety Data Sheets (MSDS) should be available for all chemicals stored and used.

Describe the storage, handling and application of chemicals (including application rates) on the farm. Also describe how empty containers are disposed of.

Chemicals used for weed control, pest control and shed disinfectant are stored in a separate locked shed inside the machinery shed. This shed has a concrete floor and a drain outside the shed runs to a 200L tank in case of spills. A MSDS is kept for all chemicals stored and used on the farm. JJ Buzzard ,JJ Buzzard Jnr and J Cleaner use these chemicals and all have attended a chemical handling course at TAFE in the last 2 years. Containers are taken to the local waste disposal site for recycling.

Under the recording section of the EMP, you need to record any chemical incident that could potentially cause environmental harm and the corrective action taken.

5.8 Contingency measures

Identify all possible emergency situations and contingency plans for each. Possible emergency situations may include:

- Disease outbreaks/Catastrophic deaths.
- Interruptions to power supply.
- Interruptions to water supply.
- Equipment malfunction.
- Fire
- Interruption to bird supply to abattoir.
- Interruption to spent litter pick-up or land application.
- Chemical spills.

Describe any emergency situations that may occur on the farm and the contingency plans to deal with these.

Emergency Situation	**Contingency Plan**
Catastrophic deaths	In the event of catastrophic deaths from natural causes, all birds can be composted in the designated area. If from disease, the processor and relevant State departments will be consulted on the course of action.
Water supply	A backup bore and surface water are available on the farm. The surface water will need to be treated before use. Equipment and chemicals to do this are not available on the farm.
Power supply	A back-up diesel generator is available and is wired to immediately kick in during power failure. This is essential for the tunnel ventilated sheds.
Feed supply	Silos on farm hold sufficient emergency feed to allow the procuring of an alternative feed source. To ensure continuity of feed supply, feed will be ordered well before the silos are empty. If the regular feed mill is unable to supply feed, an order will be placed with an alternative supplier.
Equipment malfunction	The farm manager and farm staff have the skills required to fix most minor equipment malfunctions. Commonly needed spare parts will be kept on-site.
Chemical spill	A tank is installed to catch any chemicals spills from the storage. Procedures and equipment are available to clean-up fuel and chemical spills and leaks.
Bird pick-up	Bird pick-up at the 35 day stage needs to be done within a couple of days. The processor is aware of this. In cases of extreme emergency birds would be humanely destroyed and composted.

Fire	A fire prevention strategy has been developed to minimise the risk of fire through good design and management. Potentially flammable chemicals are stored in an enclosed locked shed. Water hydrants and hoses as well as fire extinguishers are stationed around the sheds. Staff are trained in the fire evacuation procedure and the Rural Fire Brigade will be contacted in the event of a fire approaching the poultry farm.
Spent litter pickup	In situations where spent litter cannot be taken off-site, it will be temporarily stored on the compacted pad around the sheds. The spent litter will be covered to exclude rainfall entering the pile.
Loss of trained operators	At all times, staff will be trained in the duties and responsibilities applicable to their position. As much as possible, at least one other staff member will be familiar with the duties of the other staff members

5.9 Chemical spills

Record chemical incidents that could potentially cause environmental harm and the corrective action taken.

Chemical Incident	Corrective Action
30/4/2010 – 5L of Roundup spilt on Chemical Storage Shed floor by J. Buzzard.	Spill mopped up with litter from spill kit, then swept up into heavy duty plastic bag. Plastic bag was placed in sealed plastic container before being stored in wheelie bin for disposal in a landfill site approved for pesticide disposal. Floor was scrubbed with industrial strength disinfectant and rinsed with clean water.

6. Monitoring, Recording and Reviewing

6.1 Subjective monitoring and community liaison

Meat chicken farm operators should perform regular subjective checks to monitor potential sources of noise, odour and dust. These are required to provide an indication of whether the performance of their operation is acceptable.

Liaison between the meat chicken farmer and surrounding residents can be helpful in communicating information for the purposes of managing and resolving complaints. Open lines of communication are useful in identifying problems, confirming complaints and successfully applying relevant remedies to minimise the impact of the farm operations on neighbours.

Describe the subjective monitoring and community liaison methods used on the farm and the process of dealing with complaints.

The boundary of the property is regularly checked (at least twice weekly) for any excessive levels of odour, dust and noise. This is done more often at times of bird removal and litter clean-out.

The two neighbours to the north of the property are closest to the sheds and are regularly consulted (twice during the grow-out period) to ascertain if they are bothered by odour. Odour reduction strategies were put in place before these houses were constructed. A resident in the rural residential development is consulted to ascertain if there are any problems with odour, dust, noise or traffic. A complaints register is kept for the farm (See attached).

Full details of complaints received, results of investigations into complaints and corrective actions should be recorded in a "Complaints Register". Refer to the following page for an example of a complaints register.

Example Complaints Register

The complaint registration form below is to be used to record all complaints received at the farm. Further details may be provided on pages to be attached.

Date	Complainant's name	Complaint	Complaint recorded by	Source of problem	Comment / Action taken	Does complainant believe impact has declined?	Further action taken?	Signature of responding officer
15/10/09	Jimmy Williams	Feed delivery driver was speeding along Jimmys Rd and up access road to sheds. Almost hit school bus and created excessive dust.	JJ Buzzard	Feed Delivery truck	Spoke to processor who employed the driver and then spoke to driver about speed limits and safety along roads. Advised complainant of discussions with driver and assured him excessive speeding would not be tolerated and processor would sack driver if there were further indiscretions.	No more complaints have been recorded in last 3 months	None	JJ Buzzard

6.1.1 Odour, dust and noise monitoring

Fill in the following monitoring sheets to record the results of subjective odour, dust and noise monitoring assessments conducted at monitoring points situated on the property boundary between significant receptors.

Noise Assessment Record

Date	Noise Monitoring Points (Level of Noise Nuisance)				
	MP 1	MP 2	MP 3	MP 4	MP 5
5/1/10	1	2	3	1	1
15/2/10	0	1	2	1	1

Noise Levels and characteristics to assess when determining noise levels:

0	Not Audible
1	Definitely not annoying
2	Very little annoyance
3	Some annoyance
4	Annoying
5	Quite annoying
6	Very annoying
7	Extremely annoying

A	Sound pressure level
B	Its duration
C	The rate at which it happens
D	It's audibility
E	Whether it is continuous at a steady level; or whether it has a fluctuating, intermittent, tonal; or impulsive nature
F	Whether it has vibration components

NOTE: characteristics as described in Part 1 of the *Environmental Protection (Noise) Policy 1997*

Dust Assessment Record

	Name	Date & Time	Wind direction	Wind speed	Dust from poultry farm	
					Absent	Present
MP 1	JJ Buzzard	5/10/10 (9.30am)	SW	10 km/h	absent	
MP 2	JJ Buzzard	5/10/10 (9.45 am)	SW	12 km/h	absent	
MP 3	JJ Buzzard	5/10/10 (9.55 am)	W	5 km/h		present
MP 4	JJ Buzzard	5/10/10 (10.11 am)	W	10 km/h	absent	
MP 5	JJ Buzzard	5/10/10 (10.25 am)	N	15 km/h		present

Odour Assessment Record

STEP 1: Using the German VDI 3882 (VDI-RICHTLINIEN 1993) odour intensity scale provided, record the odour intensity every 30 seconds over a 10 minute period.

STEP 2: Enter the highest intensity level experienced during the 10 minute period into the record below.

STEP 3: When an odour intensity of A-D is experienced, corrective action is required.

GERMAN VDI 3882 odour intensity scale

Odour intensity	Intensity level
Extremely strong	A
Very strong	B
Strong	C
Distinct	D
Weak	E
Very weak	F
Not perceptive	G

Name	Date	Time	Wind direction	Wind strength	Odour Monitoring Point				
					MP 1	MP 2	MP 3	MP 4	MP 5
JJ Buzzard	5/1/2010	10am	SW	10 km/hr	F	E	G	E	E

6.2 Measured spent litter composition and sales

The composition of spent litter should be determined regularly. This allows sustainable spreading rates to be calculated for spreading spent litter on-farm or off-farm (by others).

Suggested parameters:

- Total nitrogen (TN) or total Kjeldahl nitrogen (TKN)
- Ammonium nitrogen (NH4N)
- Nitrate-nitrogen (NO3N)
- Total phosphorus (TP)
- Potassium (K)
- Carbon (C)
- pH
- Electrical conductivity

Include chemical analysis of the spent litter as it is conducted.

Record the amount of spent litter sold or removed from the farm and its destination. The amount of spent litter removed can be weighed over a weighbridge or estimated from truckloads.

Spent Litter Removal Records

Date	Amount Sold (t and/or m3)	Transporter / Destination / Intended Use
01/05/2008	10 m3	AJ Transporters / Bill Broc Vegetable Supplies / Compost mix
12/11/2008	18 m3	AJ Transporters / Bill Broc Vegetable Supplies / Compost mix
15/04/2009	12 m3	AJ Transporters / Bill Broc Vegetable Supplies / Compost mix
14/09/2009	10 m3	AJ Transporters / Bill Broc Vegetable Supplies / Compost mix
16/12/2009	30 m3	Chickenville Top Transport / John Hermits Turf Farm, Mullet Rd, Chickenville / turf production
11/05/2010	12 m3	AJ Transporters / Bill Broc Vegetable Supplies / Compost mix
12/12/2010	15 m3	AJ Transporters / Bill Broc Vegetable Supplies / Compost mix

6.3 Application of spent litter on-farm

Record when spent litter was used on farm, where it was applied (area), the application rate and how it was applied. Keep the records of any spent litter or composted spent litter analysis results.

Date Applied	Where Applied (Paddock I.D and area)	Application Rate (t/ha)	Application Method
01/05/2009	Area 1 – 5 Ha	20 t/ha	Manure Spreader
29/07/2009	Area 2 – 5 Ha	20 t/ha	Manure Spreader
04/11/2009	Area 3 - 5 Ha	20 t/ha	Manure Spreader
02/02/2010	Area 4– 10 Ha	10 t/ha	Manure Spreader
16/05/2010	Area 5 – 5 Ha	30 t/ha	Manure Spreader
12/07/2010	Area 1 – 10 Ha	10 t/ha	Manure Spreader
26/10/2010	Area 2 – 5 Ha	10 t/ha	Manure Spreader

6.4 Soil monitoring

Record the location and soil sampling depths of any soil sampling locations within spent litter reuse areas or areas that receive contaminated surface water runoff. Also, record any soil analysis results here.

6.5 Surface water and ground water monitoring

Record any water analysis results here.

6.6 Environmental improvement or monitoring

Document which areas of the meat chicken farm require improvement or monitoring and when these actions will be undertaken.

Date	What requires Environmental Improvement or Monitoring
3/5/2009	Need to install electricity meters on each shed to monitor peak periods of electricity usage.
30/11/2010	Review litter application rates based on high P results in last soil tests.

7. Training

Training can assist owners, managers, contractors and staff involved in meat chicken production in understanding how their operation may affect the environment and how they can minimise any impacts. All personnel have a responsibility to exercise a general environmental duty of care for the environment.

Undertaking relevant training is one way to demonstrate that environmental obligations are being taken seriously. Training can take place formally (workshops, seminars, conferences or study courses) or on-the-job.

Detail all relevant environmental training undertaken by owners, managers and staff.

Training Register

The following is a record of formal environmental training/information programs undertaken.

Date	Name of participant	Training Course
1/6/1997	JJ Buzzard and JJ Buzzard Jnr	EMP training
1/6/2000	JJ Buzzard	Chemicals handling TAFE course
1/6/2001	JJ Buzzard and J Cleaner	Chemicals handling TAFE course

8. Reviewing the EMP

Several circumstances may trigger the need for a review of your EMP. These include:

- Issue of new consent, approval or license.
- Construction of a house close to the meat chicken farm.
- Major changes to design or management of the meat chicken farm.
- Changes to applicable legislation or policy.

Even if none of the situations arises, a review every two years of the EMP is recommended. The purpose of this review is to ensure that the EMP still meets your needs and is being carefully followed.

Describe when and under what circumstances the EMP will be reviewed.

I will review this EMP every two years or in the event of any circumstances requiring the update of the document. This may include the expansion of the enterprise, further sub-division of land near the farm, construction of additional houses, changes in the manure handling practices or modifications to community liaison practices.

The spent litter removal records, Noise assessment record, dust assessment record, odour assessment record complaints register sheet, chemical spill sheet, training sheet, spent litter application sheet and will all need regularly upgraded as required. Any soil or water monitoring data will also be inserted into this EMP.

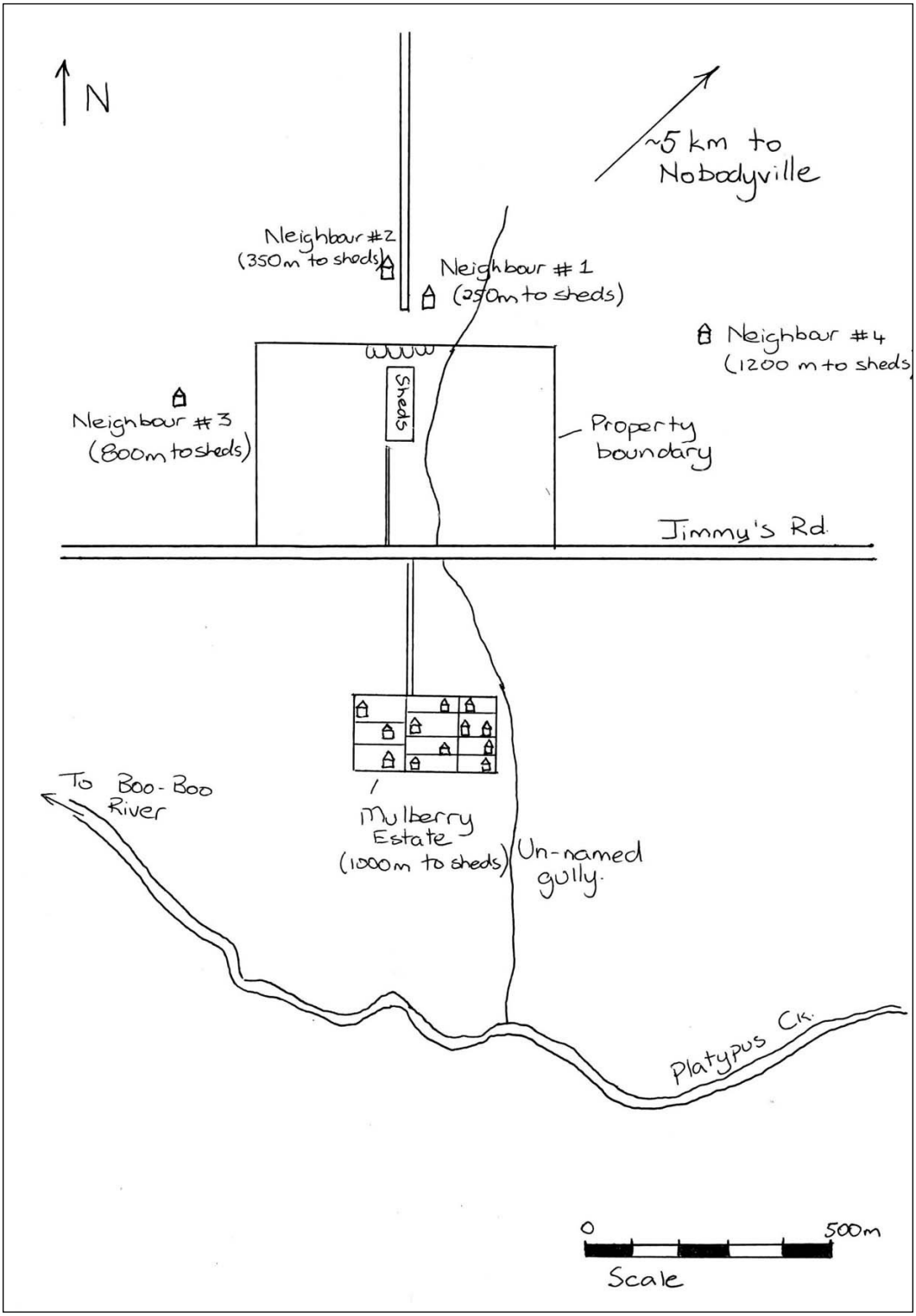
Document Status Record

Amend the document status record whenever changes are made to the EMP, including amendments made.

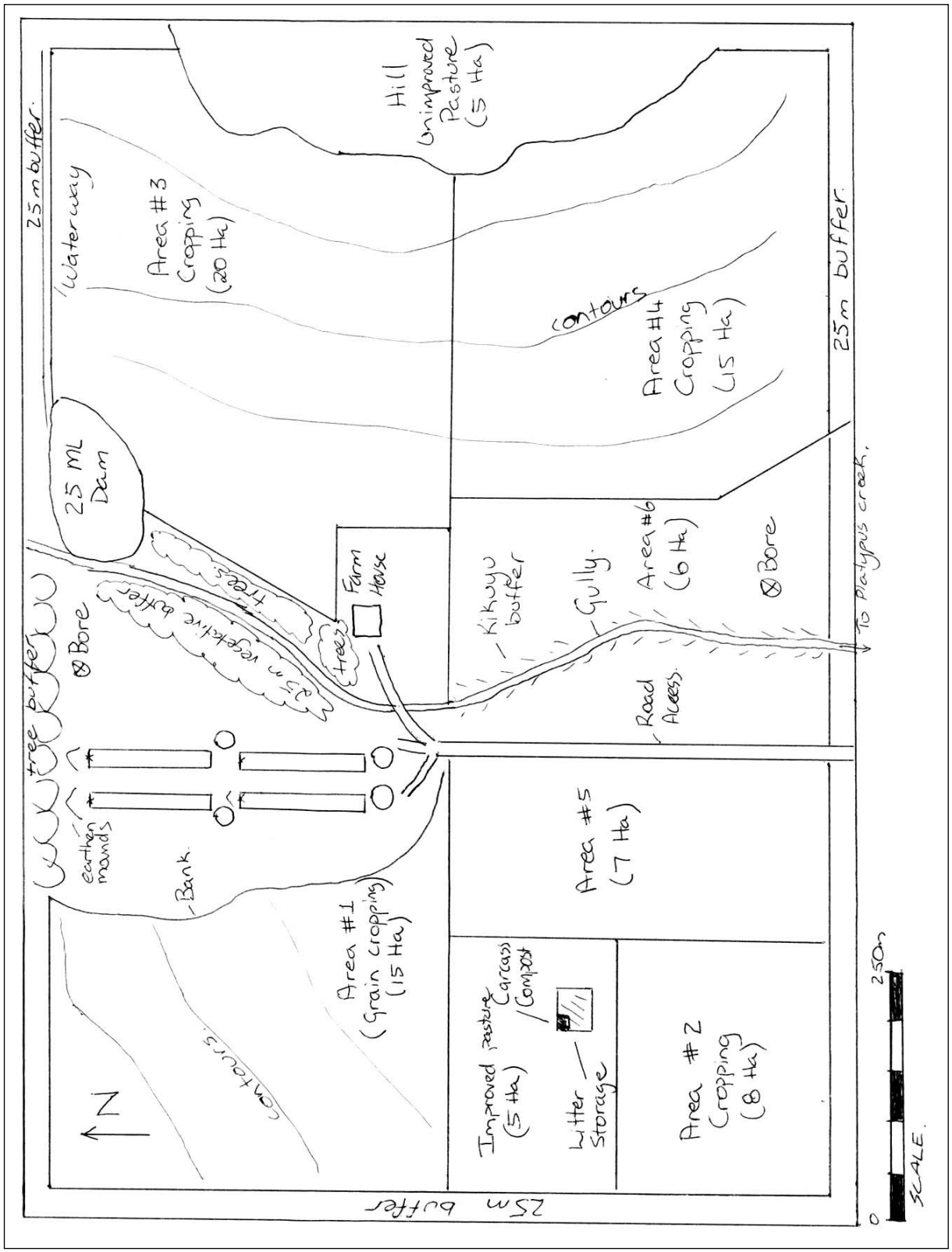
Date Amended	Amendment Made
01/10/2003	Developed draft EMP in training course..
15/11/2003	Completed final EMP.
10/08/2004	Changed sheds to mechanical ventilation
9/12/2009	New residence built on adjoining land.
25/07/2010	Updated EMP

9. Maps and Plans

9.1 Regional map



9.2 Farm plan


25m buffer
Waterway
Area #3 Cropping (20 Ha)
Hill Unimproved Pasture (5 Ha)
contours
Area #4 Cropping (15 Ha)
25m buffer
25 ML Dam
Bore
tree buffer
35m vegetative buffer
trees
Farm House
Kikuyu buffer
Gully
Area #6 (6 Ha)
Bore
To platypus creek
Road Access
earthen mounds
Bank
Area #1 (Grain cropping) (15 Ha)
Area #5 (7 Ha)
Improved pasture (5 Ha)
Carcass Compost
Litter storage
Area #2 Cropping (8 Ha)
contours
N
25m buffer
250m
0
SCALE

10. References

Department of Sustainability Environment Water Populations and Communities, 2013, *National Polloutant Inventory. Emission estimation technique manual for intensive livestock - poultry raising*, Version 3.0, Department of Sustainability Environment Water Populations and Communities,, Australian Government, Canberra, ACT, viewed 9 September 2014, < http://www.npi.gov.au/resource/emission-estimation-technique-manual-intensive-livestock-poultry-raising-version-30 >.

DPI 2001, *Generic Environmental Management Plan*, Recommended by: Broiler Code Committee which oversees the Victorian Code for Broiler Farms, Department of Primary Industries, Victoria, viewed 20 June 2011, < http://new.dpi.vic.gov.au/agriculture/about-agriculture/legislation-regulation/all-acts/code-broiler-farms/generic-emp >.

NSW Agriculture 2004, *NSW meat chicken farming guidelines*, Managing planning, development and environmental issues, February 2004, NSW Department of Agriculture.

NSW DPI 2012, *Best Practice Management for Meat Chicken Production in NSW*, Manual 2 - Meat Chicken Growing Management, September 2012, NSW Department of Primary Industries, Orange, NSW, < www.dpi.nsw.gov.au >.

VDI-RICHTLINIEN 1993, *Determination of Odourants in Ambient Air by Field Inspections* (VDI 3940), Kommission Reinhaltung der Luft im VDI and DIN, Dusseldorf.

Australian Government

Rural Industries Research and Development Corporation

National Environmental Management System for the Meat Chicken Industry

Version 2

Part C – Generic Environmental Management Plan

December 2014

Contents

1. Introduction

The purpose of this ***Environmental Management Plan*** (EMP) is to provide a framework for the environmentally sustainable operation of the meat chicken farm. The EMP reflects the day-to-day operation of the farm, while also recognising the needs of the industry, government and the community.

2. Identification Details

This section should identify who owns the farm and the relevant staff to contact. It should also describe or show on a map how to find the farm.

2.1 Ownership and contact details

Farm Owner: _____

Farm Manager: _____

Processor: _____

Name of Farm: _____

Postal Address: _____

_____

_____

Telephone Number: _____

Mobile Number: _____

Facsimile Number: _____

Email Address: _____

Real Property Description: _____

_____

_____

Land Area (Ha): _____

Tenure: _____

Actual Location: _____

(show on a regional map) _____

_____

2.2 Farm description

Provide a brief description of the operation, including sheds, birds/batch, batches/year. Include a plan of the meat chicken operation on-farm and a map showing farm in relation to neighbours/towns/public places etc. Include entry requirements (days since last contact with other poultry).

Number of sheds:

Total area of shed floors (m2)

Number of birds:

Annual farm capacity:

Entry Requirements:

General description:

3. Legal Requirements

3.1 Commitment to sound environmental management

A commitment to sound environmental management typically includes: a description of the activities to be undertaken on-site; a commitment to environmental protection, a commitment to improving environmental performance; and plans for ongoing environmental education and training.

e.g.

We …….. (Grower) and …….. (Processor), aim to minimise the environmental impact of the farm by ensuring all design and management practices comply with the conditions of development consent, license conditions, relevant State Department Acts (e.g. Environment and Planning) and follow the principles of sound environmental management.

We have set in place this system to evaluate, monitor, record, manage and review environmental impacts. We agree to review the plan at least every two years or more frequently if circumstances require. We will ensure all staff involved in the operation of the farm are adequately trained in environmental issues and relevant training and education is undertaken.

I the grower agree to abide by the requirements outlined in the plan and all staff members employed by me have signed a statement which identifies they understand and agree with these requirements.

Where a legitimate problem exists or arises, we will consult with the relevant authorities (e.g. Local Council) to devise an adequate solution, bearing in mind commercial realities.

Signed (Grower) Signed (Processor)

Date: Date:

As a staff member employed by the grower, I understand and agree with the requirements outlined in this environmental management plan.

Staff Member (Full Name)	**Signature**	**Date**

3.2 Legal requirements

List legal requirements and legislation for the farm.

Local Govt. Authority: _____

Local Govt. Consent No.: _____

Consent Capacity: _____

Date of Approval: _____

State Govt License No.: _____

License Capacity: _____

Date of Approval: _____

Action Needed: _____

_____

_____

_____

_____

_____

Water Source: _____

License/Allocation No.: _____

License/Allocation Quantity: _____

4. Natural Resources and Amenity Issues

4.1 Water

4.1.1 Surface water

Describe the surface water resources both on the farm and nearby:

4.1.2 Groundwater

Describe the groundwater resources both on the farm and nearby:

4.1.3 Water supply

Describe the source/s of water, and the types and amounts used.

4.2 Wind direction

Record the dominant wind direction (8 point) for each month of the year.

Month	Dominant Wind Direction (8 pt)	Comment
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

4.3 Community amenity

Describe the location of the meat chicken farm in relation to neighbours. Also describe the topography, vegetation and other buffers.

4.4 Soils

The information on soil type is not as relevant for small sized farms that do not land apply spent litter.

For each soil type and layer on your farm, provide a brief description of the depth (cm); colour (yellow, brown, red, grey, black); texture (e.g. sand, loam, clay); structure (e.g. crumb, hard-setting, structureless); drainage (e.g. well drained, imperfectly drained, poorly drained); degradation (e.g. prone to erosion, waterlogged, saline, sodic)

4.5 Gaseous emissions

4.5 1 NPI reporting (ammonia emissions)

If your farm has more than 87,600 birds you are required to report your ammonia emissions to the relevant state or territory National Pollutant Inventory office by the 30th of September each year. Your ammonia emissions can be calculated using the following default emission factor:

0.114 kg ammonia/animal/yr.

Calculate your shed emissions below:

_____birds x 0.114 kg ammonia / bird / year

= _____ kg ammonia / year

= _____ tonnes ammonia / year

If the meat chicken farm uses other ammonia-containing materials, the ammonia component of these materials needs to be included in your ammonia emissions calculations.

4.5.2 NPI reporting (fuel usage emissions)

Some larger facilities may also trip fuel usage thresholds (category 2 threshold) and would be required to report a range of gaseous emissions.

To calculate your farms fuel usage emissions refer to the Emission Estimation Technique manual for Intensive Livestock – Poultry Raising Version 1.0 (Environment Australia 2002) for the steps involved in calculating fuel usage thresholds. This is available from the NPI website: http://www.npi.gov.au/publications/emission-estimation-technique/poultry.html.

5. Operation, Design and Management

5.1 Road, traffic and machinery management

Describe road, traffic and machinery management in relation to speed limits on the farm; covering of loads; maintenance of road surfaces; maintenance of equipment and machinery. Describe methods for reducing dust, noise and light impacts associated with road, traffic and machinery management.

5.2 Siting and design

Describe the siting and design of the sheds and farm in relation to floor type; shed ventilation type; odour reduction strategies, road access and free-range areas (if applicable). Ensure relevant siting and design features are included on the farm plan.

5.3 Shed management

Describe the management of the sheds in relation to litter types and amount used; drainage infrastructure to avoid water entering sheds and free-range areas; bird health and changes in dropping moisture; adjustment of drinkers; inspection of shed walls and roofs for leaks; inspection, repair and replacement of drinkers and foggers; checking of ventilation system; inspection and repair of the base of the sheds; current metering and recording system for monitoring electricity, gas and water use; current measures in place for reducing energy and water usage and any new measures that you would like to adopt to improve your energy and water use efficiency.

5.4 Litter clean-out and removal

Describe the management of spent litter during clean-out and removal from the sheds. Is it stored on-farm for any period before removal?

5.5 On-site spent litter spreading & management of free-range areas

This section is only relevant when spent litter is spread on-farm or if farm is free-range. Describe the land application of spent litter on-farm in relation to the area it is spread on; how it is spread; type of crops grown (are they cut and carted or grazed); how often spent litter is applied to each paddock (annually, biannually etc); application rates. If your farm has free-range areas describe the management practices employed to minimise nutrient loading in the free-range areas (i.e. growing and harvesting rotational crops).

On the farm plan show areas where spent litter is applied on-farm.

5.6 Dead bird management

Describe the dead bird management system used on the farm, including how often they are collected and where they are stored, disposed and/or removed:

5.7 Chemical storage and use

Describe the storage, handling and application of chemicals (including application rates) on farm. Also describe how empty containers are disposed of.

Under the recording section of the EMP you need to record any chemical incidents.

5.8 Contingency measures

Describe any emergency situations that may occur on the farm and the contingency plans to deal with these.

Emergency Situation	Contingency Plan

5.9 Chemical spills

Record chemical incidents that could potentially cause environmental harm and the corrective action taken.

Chemical Incident	Corrective Action

6. Monitoring, Recording and Reviewing

6.1 Subjective monitoring and community liaison

Describe the subjective monitoring and community liaison methods used on the farm and the process of dealing with complaints. Full details of complaints received, results of investigations into complaints and corrective actions should be recorded in a "Complaints Register".

Example Complaints Register

The complaint registration form below is to be used to record all complaints received at the farm. Further details may be provided on pages to be attached.

Date	Complainant's name	Complaint	Complaint recorded by	Source of problem	Comment / Action taken	Does complainant believe impact has declined?	Further action taken?	Signature of responding officer

6.1.1 Odour, dust and noise monitoring

Fill in the following monitoring sheets to record the results of subjective odour, dust and noise monitoring assessments conducted at monitoring points situated on the property boundary between significant receptors.

Noise Assessment Record

Date	Noise Monitoring Points (Level of Noise Nuisance)				
	MP 1	**MP 2**	**MP 3**	**MP 4**	**MP 5**

Noise Levels and characteristics to assess when determining noise levels:

0	Not Audible
1	Definitely not annoying
2	Very little annoyance
3	Some annoyance
4	Annoying
5	Quite annoying
6	Very annoying
7	Extremely annoying

A	Sound pressure level
B	Its duration
C	The rate at which it happens
D	It's audibility
E	Whether it is continuous at a steady level; or whether it has a fluctuating, intermittent, tonal; or impulsive nature
F	Whether it has vibration components

NOTE: characteristics as described in Part 1 of the *Environmental Protection (Noise) Policy 1997*

Dust Assessment Record

	Name	Date & Time	Wind direction	Wind speed	Dust from poultry farm	
					Absent	Present
MP 1 **MP 2** **MP 3** **MP 4** **MP 5**						

Odour Assessment Record

STEP 1: Using the German VDI 3882 (VDI-RICHTLINIEN 1993) odour intensity scale provided, record the odour intensity every 30 seconds over a 10 minute period.

STEP 2: Enter the highest intensity level experienced during the 10 minute period into the record below.

STEP 3: When an odour intensity of A-D is experienced, corrective action is required.

GERMAN VDI 3882 odour intensity scale

Odour intensity	Intensity level
Extremely strong	A
Very strong	B
Strong	C
Distinct	D
Weak	E
Very weak	F
Not perceptive	G

Name	Date	Time	Wind direction	Wind strength	Odour Monitoring Point				
					MP 1	MP 2	MP 3	MP 4	OMP 5

6.2 Measured spent litter composition and sales

Include chemical analysis of the spent litter as it is conducted.

Spent Litter Removal Records

Date	Amount Sold (t and/or m3)	Transporter / Destination / Intended Use

6.3 Application of spent litter on-farm

Record when spent litter was used on farm, where it was applied (area), the application rate and how it was applied.

Date Applied	Where Applied (Paddock I.D and area)	Application Rate (t/ha)	Application Method

6.4 Soil monitoring

Record the location and soil sampling depths of any soil sampling locations within spent litter reuse areas or areas that receive contaminated surface water runoff. Also, record any soil analysis results here.

6.5 Surface water and ground water monitoring

Record any water analysis results here.

6.6 Environmental improvement or monitoring

Document which areas of the meat chicken farm require improvement or monitoring and when these actions will be undertaken.

Date	What requires Environmental Improvement or Monitoring

7. Training

Detail all relevant environmental training undertaken by owners, managers and staff.

Training Register

The following is a record of formal environmental training/information programs undertaken.

Date	Name of participant	Training Course

8. Reviewing the EMP

Several circumstances may trigger the need for a review of your EMP. Describe when and under what circumstances the EMP will be reviewed.

I will review this EMP

Document status record

Amend the document status record whenever changes are made to the EMP, including amendments made.

Date Amended	Amendment Made

9. Maps and Plans

9.1 Regional map

9.2 Farm plan

10. References

Department of Sustainability, E, Water, Populations and Communities, 2013, *National Polloutant Inventory. Emission estimation technique manual for intensive livestock - poultry raising*, Version 3.0, 13 June 2002, Environment Australia, Australian Government, Canberra, ACT, viewed 9 September 2014, < http://www.npi.gov.au/resource/emission-estimation-technique-manual-intensive-livestock-poultry-raising-version-30 >.

VDI-RICHTLINIEN 1993, *Determination of Odourants in Ambient Air by Field Inspections* (VDI 3940), Kommission Reinhaltung der Luft im VDI and DIN, Dusseldorf.

Australian Government

Rural Industries Research and Development Corporation

National Environmental Management System for the Meat Chicken Industry

Version 2

Part D – Environmental Risk Assessment Workbook for the Meat Chicken Industry

December 2014

Contents

1. Introduction

The risk of a meat chicken farm causing adverse environmental impacts depends upon the vulnerability of the natural resources or amenity, and on the standard of design or management of the operation. For instance, if a resource is vulnerable, design and management can prevent impacts. However, with lower design and management standards, an environmental impact is likely. This document will assist individuals to self-assess their farm to identify the risk of causing environmental harm and highlight areas requiring environmental improvement or monitoring.

Section 2 of the environmental risk assessment requires the placement of a vulnerability rating (1-4, where 1 = low vulnerability and 4 = very high vulnerability) on each of the major natural resources or amenities associated with the meat chicken farm, including:

- Surface water quality.
- Groundwater quality.
- Community amenity – odour, noise, dust and light.
- Soils (If reusing litter on-farm or free-range production system).

To assist in deciding what vulnerability rating to use, tables containing some parameters applicable to each rating are supplied. It is likely that parameters from more than one rating will apply to most farms. Hence, it is necessary to use some discretion when deciding on a vulnerability rating.

Section 3 of the environmental risk assessment requires the placement of a risk assessment rating (1-4, where 1 = low risk and 4 = very high risk) on each of the major design and operation features of the meat chicken farm, including:

- Siting and design.
- Road, traffic and machinery management.
- Shed management.
- Spent litter cleanout and removal.
- On-site spent litter spreading.
- Dead bird management.
- Chemical storage and use.
- Contingency measures.
- Subjective monitoring and community liaison.

Not all of the factors will be applicable to all enterprises. For example, on-site spent litter application will not be widely applicable. Where factors are irrelevant for a given situation, they do not require evaluation.

To assist in deciding what risk rating to use, tables containing some parameters applicable to each rating are supplied. It is likely that parameters from more than one rating will apply to most farms. Hence, it is necessary to use some discretion when deciding on a risk rating.

Factors that are likely to be most important or critical are **highlighted bold**. These should be viewed as a determining parameter.

To evaluate the likelihood of an environmental impact it is necessary to assess each of the design and operation ratings (Section 2) against each of the natural resource and amenity vulnerabilities (Section 3). This is done using a two dimensional matrix (Section 4.1) to give an overall assessment of risk.

Because the vulnerability rating for resources ranges from 1-4 and the risk ratings range from 1-4, the combined weighting can be 1-16, with:

- 1 –4 means a low overall rating and would not trigger any action.
- 5 –11 means a medium overall rating and may trigger some action.
- 12 –16 means a high overall rating and would trigger some action.

Actions would take the form of Environmental Improvement or Monitoring.

An additional table containing options to improve energy and water use efficiency to be reviewed for your farm is included in Sections 4.2 and 4.3. This is not a risk assessment tool but is designed to get you thinking about possible improvements you could make to your existing system to reduce your energy and water usage. These improvements may represent significant cost savings as well as reducing your environmental footprint.

2. Natural Resources and Amenity (Vulnerability Ratings)

2.1 Vulnerability rating – surface water quality

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Meat chicken operation is at least 100 m from surface water bodies (rivers, creeks, wetlands etc) and vegetative filter strips exist. There is minimal possibility of runoff water being contaminated with manure or chemicals. All spent litter storage and compost areas are bunded to prevent entry or exit of runoff. Meat chicken operation is located above the 1 in 100-year flood line.	Meat chicken operation is at least 50 m from surface water bodies (rivers, creeks, wetlands etc) and vegetative filter strips exist. Any runoff that may be contaminated with manure or chemicals is contained on farm. Spent litter storage and compost areas are bunded to prevent entry or exit of runoff for amounts >2 m^3. Meat chicken operation is located above the 1 in 100-year flood line.	Meat chicken operation is at least 25 m from surface water bodies (rivers, creeks, wetlands etc) and vegetative filter strips exist. Any runoff that may be contaminated with manure or chemicals is directed through vegetative filter strips. Some bunding exists around spent litter storage and compost areas for amounts >2 m^3. Meat chicken operation located within the 1 in 100-year flood line.	Meat chicken operation is within 25 m of surface water bodies and there are no vegetative filter strips existing. Meat chicken operation is located in a declared catchment area. Contaminated runoff water is allowed to leave the farm. Spent litter storage and compost areas are not bunded. Meat chicken operation is located within the 1 in 100-year flood line.

Rating:	Comments:

2.2 Vulnerability rating – groundwater quality

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Groundwater is at least 20 m from surface. Soils overlying groundwater are thick clays. Nearby groundwater sources only used for irrigation.	Groundwater is at least 10 m from surface. Soils overlying groundwater are thick clays.	Groundwater is at least 5 m from surface, with medium permeable soils. Soils overlying groundwater are clay-loam. Nearby groundwater sources only used for stock.	Meat chicken operation located in a groundwater recharge area. Groundwater is less than 5 m from surface. Sandy soils overlying groundwater. Nearby groundwater sources used for human consumption.

Rating:	Comments:

*Groundwater is defined as subsurface water contained in a saturated zone of soil or a geological stratum.

2.3 Vulnerability rating – community amenity (odour)

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Meat chicken sheds separated from sensitive receptors* by: >600 m (average farm)** >400 m (small farm)** >700 m (large farm)** Significant hills and valleys between farm and neighbours. Vegetative screens of at least 30 m exist on all sides of the meat chicken operation.	Meat chicken sheds separated from sensitive receptors by at least: 400 m (average farm) 300 m (small farm) 500 m (large farm) Some hills and valleys between farm and neighbours. Vegetative screens exist that screen the meat chicken operation from roads and neighbours.	Meat chicken sheds separated from sensitive receptor by at least: 200 m (average farm) 150 m (small farm) 250 m (large farm) Generally flat open terrain between farm neighbours. Minimal vegetative screens exist on the farm.	Meat chicken sheds located on a small property and is separated from sensitive receptors by at least: <200 m (average farm) <150 m (small farm) <250 m (large farm) Rural residential and/or urban development surrounding property, with less than 150 m buffer. Flat open terrain between farm and receptors. There are no vegetative screens on the farm.

Rating:	Comments:

*A sensitive receptor is defined as any residence, residential development, town or public facility (e.g. school, public hall, recreation area).

**An average farm is designated as 150,000 – 300,000 birds/batch, a small farm is designated as less than 150,000 birds/batch and a large farm is designated as -300,000 – 400,000 birds/batch.

2.4 Vulnerability rating – community amenity (noise, dust and light)

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Meat chicken sheds situated from sensitive receptors by 400 m. Significant hills and valleys between farm and neighbours. Vegetative screens of at least 30 m exist on all sides of the meat chicken operation.	Meat chicken sheds situated from sensitive receptors by 200 m. Some hills and valleys between farm and neighbours. Vegetative screens exist on the sides of the meat chicken operation that can be seen from the road and by neighbours.	Meat chicken sheds situated from sensitive receptors by 100 m. Generally flat open terrain between farm neighbours. Minimal vegetative screens exist on the farm.	Meat chicken sheds located on a small property and is situated from sensitive receptors by <100 m. Rural residential and urban development surrounding property, with less than 200 m buffer. Flat open terrain between farm and neighbours. There are no vegetative screens on the farm.

Rating:	Comments:

2.5 Vulnerability rating – soils (if applying spent litter on-farm or operating a free-range production system)

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Meat chicken sheds and/or spent litter application area on relatively flat land. Spent litter reuse areas and/or free-range areas are at least 100 m from surface water bodies (rivers, creeks, wetlands etc) and vegetative filter strips exist as well. Soils are: • Deep. • Loam or clay. • Not subject to erosion, salinity, sodicity, soil structural decline, water logging or chemical contamination. • Reuse areas are mostly cropped. Free-range areas are managed to limit nutrient accumulation in the soil (i.e. rotationally cropped, manure is scraped from runs) and soil erosion.	Spent litter reuse areas and/or free-range areas are at least 50 m from surface water bodies (rivers, creeks, wetlands etc) and vegetative filter strips exist as well. Soils are: • Moderately deep. • Clay-loam. • Reuse areas are suited to a range of crop production. Free-range areas are managed to limit soil erosion (i.e. well vegetated, surface runoff is diverted away, contour banks installed if necessary).	Spent litter reuse areas and/or free-range areas are at least 25 m from surface water bodies (rivers, creeks, wetlands etc) and some vegetative filter strips exist as well. Mostly flat open terrain between farm neighbours. If applying spent litter on-farm, soils are: • Shallow. • Sandy. • Suited to some crop production. Free-range areas are denuded and prone to erosion.	Spent litter reuse areas and/or free-range areas are located within 25 m of surface water bodies and there are no vegetative filter strips existing. Meat chicken sheds, free-range areas or spent litter reuse areas on steep land (e.g. >10%). If applying spent litter on-farm, soils are: • Very shallow • Very sandy. • Only suited to grazing or forestry. Free-range areas are badly denuded and prone to erosion.

Rating:	Comments:

3. Design and Operation (Risk Assessment)

3.1 Risk assessment – road, traffic and machinery management

Rating 1	Rating 2	Rating 3	Rating4
As much as practical traffic movements (excluding bird pick-up) occurs between 7 a.m. and 6 p.m. Truck exhaust brakes not used on-farm or on roads near the farm. Machinery used on-farm fitted with manufacturer specified exhaust equipment. 30 km/hr speed limit enforced on Driveway and 10 km/hr around sheds. Entrance point to farm has at least 285 m good visibility in both directions.	As much as practical traffic movements (excluding bird pick-up) occurs between 6 a.m. and 9 p.m. Truck exhaust brakes not used on-farm or near entrance. Machinery used on-farm fitted with appropriate echaust equipment. 30 km/hr speed limit signs posted on-farm driveways and 10 km/hr around sheds. Entrance point to farm has at least 200 m good visibility in both directions.	As much as practical traffic movements (excluding bird pick-up) occurs between 5 a.m. and 10 p.m. Entrance point to farm has at least 150 m good visibility in both directions.	Traffic movements (excluding bird pick-up) occurs anytime within the day. Entrance point to farm has less than 150 m visibility in either or both directions.

Rating:	Comments:

3.2 Risk assessment – siting and design

Rating 1	Rating 2	Rating 3	Rating 4
Base of shed is compacted clay or impermeable. Meat chicken sheds separated at least 1 km from all other poultry operations. Bunding provided to prevent the ingress or outflow of water from areas containing manure (sheds, free-range areas, stockpiles, carcasses etc). All surrounding land is designated rural and is not marked for future development. Advanced technologies installed to reduce odour emissions.	Base of shed is compacted clay or impermeable. Meat chicken sheds separated at least 1 km from all other poultry operations. Bunding provided to prevent the ingress or outflow of water from areas containing manure (sheds, free-range areas, stockpiles, carcasses etc). All surrounding land is designated rural but may be planned for future development.	Base of shed is either not compacted or impermeable. Meat chicken sheds separated <1 km from all other poultry operations. Bunding provided to prevent the ingress or outflow of water from areas containing manure (sheds, free-range areas, stockpiles, carcasses etc). Surrounding land is designated rural, but is planned for future development.	Base of shed is either not compacted or impermeable. Meat chicken sheds separated less than 1 km from another poultry operation. Inadequate bunding provided on-farm. Surrounding land is not designated rural.

Rating:	Comments:

3.3 Risk assessment – shed management

Rating 1	**Rating2**	**Rating 3**	**Rating 4**
Litter moisture is maintained between 20 and 30%. Integrity of floor is checked and maintained after each cleanout. Have regular supply of clean bedding and have sourced backup supply. No extraneous water can enter the shed. Nipple drinkers with evaporative trays are used. Cooling/ventilation equipment (e.g. pads and foggers) are checked and maintained at least twice daily to avoid litter becoming wet during use. Rodent population monitored daily and appropriately treated.	Litter moisture is maintained between 15 and 40%. Integrity of floor is checked and maintained after each cleanout. Have regular supply of clean bedding and have sourced backup supply. Litter in shed is only rarely wet from extraneous water. Nipple drinkers with no evaporative trays are used. Cooling/ventilation equipment (e.g. pads and foggers) are checked and maintained daily to avoid litter becoming wet during use. Rodent population monitored weekly and appropriately treated.	Litter moisture is sometimes < 10% and/or > 40%. Integrity of floor is only checked once per year, with little maintenance. Have regular supply of clean bedding, but do not have a backup supply. Litter in shed is sometimes wet from extraneous water. Cup type drinkers are used. Cooling/ventilation equipment (e.g. pads and foggers) are only checked and maintained weekly during use. Regular infestations of rodents on-farm and irregularly treated.	Litter moisture is regularly < 10% and/or > 40%. Integrity of floor is never checked and maintained. Do not have a regular supply of clean bedding. Litter in shed is regularly wet from extraneous water. Bell type drinkers are used. Cooling/ventilation equipment (e.g. pads and foggers) are not checked and maintained during use. Regular infestations of rodents on-farm and not treated.
Rating:	Comments:		

3.4 Risk assessment – litter cleanout and removal

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Litter moisture is between 20 and 30% at cleanout. Ventilation at cleanout is reduced to a low level that is still safe for workers. Spent litter* immediately removed from farm at cleanout. Spent litter covered before truck leaves farm. Chemical analysis of spent litter and application rates supplied to end-user at cleanout. Sheds cleaned out between 6 a.m. and 6 p.m.	Litter moisture is between 15 and 40% at cleanout. Spent litter sometimes stored on farm for a short period, but bunded and covered and on a sealed base. Spent litter covered before truck leaves farm. Chemical analysis of spent litter and application rates supplied to end-user. Sheds cleaned out between 6 a.m. and 6 p.m.	Litter moisture is between 10 and 50% at cleanout. Spent litter stockpiled or composted on-farm in piles that are bunded and have a sealed base. Spent litter covered before truck leaves farm. Chemical analysis of spent litter and application rates not supplied to end-user. Sheds cleaned before 6 a.m. and after 6 p.m.	Litter is very wet (>50%) or very dry (<10%) at cleanout. Spent litter stored on-farm in piles that are anaerobic, not bunded or on a sealed based. Spent litter not covered before truck leaves farm. Chemical analysis of spent litter and application rates not supplied to end-user. Sheds cleaned before 6 a.m. and after 6 p.m.
Rating:	Comments:		

* Spent litter is defined as litter that is no longer used as bedding. For multi-batch use, used litter may not be spent litter.

3.5 Risk assessment – on-site spent litter spreading & management of nutrients in free-range areas

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Spent litter only spread when moisture is between 20 and 30%. Spent litter spread and immediately incorporated. Application rate matched to nutrient uptake and acceptable losses. Spent litter composition always measured. Facility has no free-range areas.	Spent litter moisture is between 15 and 40% during spreading. Spent litter only spread after 9:00 a.m. when atmosphere is unstable. Application rate matched to uptake and acceptable losses. Spent litter composition regularly measured. Facility has no free-range areas.	Spent litter moisture is between 10 and 50% during spreading. Spent litter spread occasionally late in the afternoon and early in the morning when the atmosphere is stable. Application rate regularly exceeds uptake and acceptable losses. Spent litter composition occasionally measured. Management practices are employed to limit nutrient accumulation from manure deposition in free-range areas.	Spent litter is very wet (>50%) or very dry (<10%) during spreading. Spent litter spread regularly late in the afternoon and early in the morning when the atmosphere is stable. Application rate exceeds uptake and acceptable losses or is unknown. Spent litter composition never measured. No management practices employed to limit nutrient accumulation in free-range areas.
Rating:	Comments:		

3.6 Risk assessment – dead bird management

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Dead birds collected from sheds daily. Contingency plan in place for catastrophic bird deaths and all relevant parties informed. Dead birds are immediately placed in collection/disposal system. Dead birds are collected daily for rendering.	Dead birds collected from sheds daily. Contingency plan in place for catastrophic bird deaths and all relevant parties informed. Dead birds are composted in a sealed compost bin. Dead birds removed from farm at least 5 out of 7 days.	Dead birds collected from sheds daily. Contingency plan in place for catastrophic bird deaths, but not all relevant parties informed. Dead birds are buried or composted on-farm.	Dead birds not collected daily. No contingency plan in place for catastrophic bird deaths. If using burial or composting the site is not sufficiently lined or sealed. Dead birds dumped in the bush. Dead birds are burnt in a non-compliance incinerator. Runoff can enter or leave carcass disposal area.

Rating:	Comments:

3.7 Risk assessment – chemical storage and use

Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Material Safety Data Sheets (MSDS) provided for all chemicals used on farm. Approved contractor is used to apply chemicals, with minimal storage of chemicals on-farm. All chemicals applied at concentrations that strictly adhere to the manufacturer's instructions or to state agricultural department's specifications. All staff trained in the correct handling and use of chemicals. Empty containers disposed of as per manufacturer's instructions	MSDS provided for all chemicals stored and used on farm. All chemicals and fuels stored and used in accordance with workplace health and safety codes of practice. All chemicals applied at concentrations that strictly adhere to the manufacturer's instructions or to state agricultural department's specifications. All staff trained in the correct handling and use of chemicals. Empty containers disposed of as per manufacturer's instructions	Some MSDS provided for chemicals stored and used on farm. Chemicals application not always adhered to manufacturer's instructions or to state agricultural department's specifications. Empty containers not immediately disposed of as per manufacturer's instructions. Only manager trained in the correct handling and use of chemicals. . Chemicals sometimes stored outside.	No MSDS provided. Chemicals stored or used on farm not approved by the National Registration Authority for Agricultural and Veterinary Chemicals. . Chemicals application does not follow manufacturer's instructions or to state agricultural department's specifications. No staff trained in the correct handing and use of chemicals. Empty chemical containers lying around farm. Chemicals stored outside.

Rating:	Comments:

3.8 Risk assessment – contingency measures

Rating 1	Rating 2	Rating 3	Rating 4
Contingency plan in place for all of the following: • Catastrophic deaths • Backup power supply • Backup water supply • Equipment malfunction • Fire • Interruption of bird supply to abattoir. • Interruption to spent litter pick-up or application. • Containment and clean up of chemical/fuel leaks and spills. • Loss of trained operators.	Contingency plan in place for the following: • Catastrophic deaths • Backup power supply • Backup water supply • Interruption of bird supply to abattoir. • Interruption to spent litter pick-up or application.	Contingency plan in place for the following: • Catastrophic deaths • Backup power supply • Backup water supply	No contingency plans in place for any of the following: • Catastrophic deaths • Backup power supply

Rating:	Comments:

3.9 Subjective monitoring and community liaison

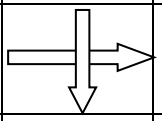
Rating 1	**Rating 2**	**Rating 3**	**Rating 4**
Regular checks are made at the property boundary for unacceptable levels of odour, dust and noise. Maintain complaints register, with full details of complaints received, results of investigations into complaints and corrective actions. Always advise neighbours of any unusual events or problems that may cause an unavoidable odour, dust or noise problem, including what is being done to mitigate the problem and the expected duration of the (determining parameter). Participate in mediation with unresolved disputes.	Some checks are made at the property boundary for unacceptable levels of odour, dust and noise. Keep record of complaints, but not always investigate or have follow up action. Infrequently inform neighbours of any unusual events or problems that may cause an unavoidable odour, dust or noise problem. Sometimes participate in mediation with unresolved disputes.	Irregular checks are made at the property boundary for unacceptable levels of odour, dust and noise. Irregularly keep complaints register. Rarely inform neighbours of any unusual events or problems that may cause an unavoidable odour, dust or noise problem. Rarely participate in mediation with unresolved disputes.	No checks are made at the property boundary for unacceptable levels of odour, dust and noise. No complaints register kept. No contact ever made with neighbours when there may be potential problems (e.g. excessive odour generation). No dispute resolution performed.

Rating:	Comments:

4. Environmental Improvement / Monitoring

4.1 Risk assessment matrix

Complete the Environmental Improvement / Monitoring matrix by multiplying the rating designated for each natural resource and amenity by the rating designated for each design and operation factor. Note: shaded areas do not require completion.

	Design & Operation Rating (1-4)	**Surface Water Quality**	**Ground Water Quality**	**Community Amenity – Odour**	**Community Amenity – Noise, Dust & Light**	**Soil (Applic. Area)**
Natural Resources & Amenity Rating (1-4)		*Number from 2.1.*	*Number from 2.2.*	*Number from 2.3.*	*Number from 2.4.*	*Number from 2.5.*
Siting & Design	*Number from 3.1.*					
Road Traffic and Machinery Management	*Number from 3.2.*					
Shed Management	*Number from 3.3.*					
Litter Cleanout and Removal	*Number from 3.4.*					
On-site Spent Litter Applic. & Management of Nutrients in Free-Range Areas.	*Number from 3.5.*					
Dead Bird Management	*Number from 3.6.*					
Chemical Storage & Use	*Number from 3.7.*					
Contingency Measures	*Number from 3.8.*					
Subjective Monitoring & Community Liaison	*Number from 3.9.*					

Number of 1 –4 means a low rating and would not trigger any action.

Number of 5 –11 means a medium rating and may trigger explanation or action.

Number of 12 –16 means a high rating and would trigger explanation or action.

Actions would take the form of an Environmental Improvement Program (EIP) or monitoring.

4.2 Energy efficiency rating

The following energy use efficiency checklist identifies options for increasing farm energy use efficiency. Go through the list and mark "Yes", "No" or "N/A" for each option in relation to your current farm set-up or management practices. The purpose of this checklist is to identify what you are already doing to minimise your energy consumption and possible areas for improvement.

Option for saving energy	**Yes/No or N/A**
All fan shutters on sheds are maintained correctly to open and close freely and seal tightly.	
All fan shutters, fan blades and fan motors are regularly cleaned to remove dust build up.	
Regularly undertake maintenance on fan belts and pulleys. Fan belts are properly seated in pulleys and correctly tensioned.	
Regularly conduct static pressure testing in sheds to ensure they are properly sealed. Any leaks are repaired immediately.	
Vents including mini-vents are regularly checked to make sure they open and close correctly.	
Control system sensors located inside and outside the shed are in good working order and regularly calibrated. External sensors should be mounted in a vented cabinet, protected from the weather and not located in the sealed electrical control room.	
The automatic control system is in good working order and the control systems and alarms are checked regularly.	
The control system set points or targets are checked regularly to make sure that they have been set up correctly.	
Sheds roofs are leak proof and insulated.	
Shed walls are leak-proof and insulated.	
Have installed internal heat circulation fans inside sheds to circulate heated air.	
Have installed energy saving light bulbs.	
You have contacted your electricity supplier company and asked them to supply a power meter that provides information of daily use.	
You have installed power meters on the main power supply to each shed, record the electricity (kWh) use of each shed and monitor peak periods of use. Monitoring power consumption can provide you with a way to measure if real improvements are achieved from upgrading equipment (i.e. installing energy efficient light bulbs).	

Option for saving energy	**Yes/No or N/A**
Regularly read the main electrical meter and keep records of total farm electricity use for each batch (from bird in date to birds out date). You compare energy consumption between each batch and each sheds to monitor energy use trends.	
You keep records of gas usage and monitor peak periods of use. Monitoring gas usage can provide a way of measuring the impact of improvements or modifications to the sheds (i.e. value of installing better insulation, fixing air leaks or installing heat circulation fans).	
The brood area is constrained to one end of the shed using curtains as partitions to reduce the required heating area and therefore gas consumption.	
Gas heaters and fans are regularly maintained.	
Water supply pumps are regularly maintained and operate correctly. If on, the pressure switch that controls the pumps should not run continuously. For larger pumps consider installing a variable speed drive to run the pump at constant pressure. This arrangement will minimise power consumption if set up correctly.	
If using a cooling pad system, cooling pads are regularly cleaned to ensure that air flow is not restricted. Cooling pad pumps are run continuously, rather than stop and start, to help keep the pads clean and to maximise pad life and performance.	
High efficiency fans are installed which feature single internal shutters and external fan cowlings with removable fabric covers to prevent leaks. (The covers blow off when first started and are then stored until the next batch starts).	
The electrical system is regularly checked by a licensed electrician for loose connections and switches in cabinets, shed wiring and any equipment that runs hot. Any faulty equipment is repaired or replaced to prevent future equipment failures.	
You have a good understanding of your farms peak electricity and gas usage, (often middle of summer towards end of batch). If the costs of peak energy usage are excessive you have considered using alternative energy sources for peak power usage periods. Alternative options could include installing solar panels to provide enough electricity for peak electricity use periods, which are often charged at higher rates.	

4.3 Water efficiency rating

The following water use efficiency checklist options for increasing farm water use efficiency. Mark "Yes", "No" or "N/A" for each option in relation to your current farm set-up or management practices. The purpose of this checklist is to identify what you are already doing to minimise your water consumption and possible areas for improvement.

Option for saving water	**Yes / No or N/A**
The water pipe system outside and inside the sheds is regularly checked for leaks and leaks repaired immediately.	
The cooling pad sump level control is regularly checked and the sump does not overflow. Any leaks are immediately repaired.	
If situated in a frost prone area, any external water pipes that are above ground are insulated to prevent freezing.	
Install nipple drinkers with drip trays to minimise drinking water wastage.	
Collect and store rain water from the shed roof and reuse water on farm or for irrigation.	
Replace foggers with cooling pads.	
Meter and record total shed fresh water use for the farm. If possible meter and record drinking water usage and cooling water usage for each shed. This will help identify any inefficiency in the system.	
Check that shed water pressure is not excessive as this increases pumping costs. The shed water pressure should meet the manufactures requirements for the drinking water system installed (check pressure at the far end of the pipe line).	
Install high pressure, low water usage hoses for shed cleaning operations. Minimise hosing length time to conserve water and minimize waste water generated.	

4.4 Areas for environmental improvement or monitoring

Document which areas of the meat chicken farm require improvement or monitoring and when these actions will be undertaken.

Date	What requires Environmental Improvement or Monitoring

National Environmental Management System for the Meat Chicken Industry – Version 2

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