CHAPTER 3 METRIC CONVERSIONS

Metric		Imperial Equivalent	
300	mm	12	inches
600	mm	24	inches
1	m	3	feet
15	m	50	feet
30	m	100	feet
30.5	m	100	feet
100	m	330	feet
2	m^2	22	square feet
6	m^2	65	square feet
2,100	m^2	22,600	square feet
3,000	m^2	32,300	square feet
20	kg	44	pounds
50	kg	110	pounds
100	kg	220	pounds
350	kg	770	pounds
700	kg	1540	pounds
700	kg/ha	625	lbs/ac
22	litres	5.8	gallons
45	litres	12	gallons
50	litres	13	gallons
20	MPa	3,000	psi

Conversions in this table are rounded to a convenient number.
See Appendix E for exact conversion factor.

Values from tables and examples are not included in Metric Conversions

CHAPTER 3 TABLE OF CONTENTS

CHAPTER 3

LIVESTOCK

INTRODUCTION

This chapter discusses livestock management practices for protection of the environment. It contains introductory information on the relationship between livestock and the environment. It also contains information on environmental concerns, legislation and beneficial management practices related to:

- Indoor poultry and livestock housing,
- Outdoor livestock areas,
- Manure handling and storage,
- Mortality disposal,
- Livestock and climate change.

LIVESTOCK AND THE ENVIRONMENT

Livestock are primarily raised and managed in farm operations for their value as food or food products, or in the case of horses, for recreational or other uses. Environmental concepts related to livestock activities are listed in alphabetical order below.

Climate Change

Livestock can have significant impacts on greenhouse gas emissions. Ruminants (e.g. cattle, sheep) digest carbohydrates methane is released through the process of enteric fermentation. Livetock manures may also release nitrous oxides. Both are powerful greenhouse gases contributing to climate change. These emissions can be somewhat offset by the positive effects of carbon capture associated with effective grazing management techniques.

Grazing

Livestock that graze on pasture or grass rangelands indirectly provide humans with food from forages, a food source otherwise not useable by humans.

Nutrient Cycle

When livestock graze or are fed grains and forage they become part of the nutrient cycle of a site. Depending on the management practices for a given site, livestock may:

- Remove nutrients by consumption as in grazing (with some retained in body mass).
- Add nutrients by consumption of feed transported to the site (with some deposited as wastes).

Depending on the nutrient requirements of a site, either may be positive or negative to the environment. Evaluate the nutrient status of grazing and feeding areas when deciding on fertilizer or manure application rates.

Vegetation Control

Livestock that graze are used to manage specific undesirable types of vegetation such as weeds and competing vegetation in forests. Livestock grazing can also be managed to remove herbaceous and small-woody vegetation from fire-breaks, lowering the risk of uncontrolled wildfires.

INDOOR POULTRY AND LIVESTOCK HOUSING

INDOOR POULTRY AND LIVESTOCK HOUSING ENVIRONMENTAL CONCERNS

Primary environmental concerns related to indoor livestock areas are:

- Impacts of indoor poultry and livestock housing on water quality:
  - Release of wastes (e.g., manure, milkhouse waste, bedding, spoiled feed) that results in water pollution.
  - Housing located close to a watercourse or well that results in water pollution.
  - Cross connection of "dirty water" lines with clean water lines that results in water pollution.
- Impacts of indoor poultry and livestock housing on air quality:
  - Release of methane (CH_4) from livestock manure contributes to the greenhouse effect and climate change.
  - Release of ammonia (NH_3) that contributes to smog formation.
  - Release of dust particulate matter and ammonia from animal housing can result in human health risks and in visibility reduction.
  - Release of odours associated with ammonia or other noxious gases that are carried by dust to surrounding neighbours.

For information on these concerns:

➔ see Water Quality and Quantity Factors, **page 9-1,** refer to Contaminants, and to Oxygen Demand

➔ see Air Quality Factors, **page 10-1**, refer to Dust and Particulates, and Greenhouse Gases

➔ see Climate Change Factors, **page 12-1**

INDOOR POULTRY AND LIVESTOCK HOUSING LEGISLATION

The following is a brief outline of the main legislation that applies to indoor housing.

➔ see **page A-1** for a summary of these and other Acts and Regulations

Drinking Water Protection Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

- SECTION 23(1): subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

Enviromental Management Act

The *Code of Practice for Agricultural Environmental Management* requires persons to use environmentally responsible and sustainable agricultural practices when carrying out agricutural operations, for the purpose of minimizing the introduction of waste into the environment and preventing adverse impacts to the environment and human health. The AEM Code includes requirements for building setbacks from water sources and property boundaries in Part 4 of the Code.

The *Code of Practice for Agricultural Environmental Management* has specific requirements regarding agricultural by-products.

- SECTION 2: agricultural by-products must be collected, stored, handled, used and disposed of in a manner that prevents pollution
- SECTION 17: a storage facility must be located at least 15 m from any watercourse; at least 30 m from any source of water for domestic purposes

The Code also has a reference to air emissions from forced air ventilation systems:

- SECTION 7: states that emissions of air contaminants from forced air ventilation systems used in the agricultural operation must not enter a watercourse or cross a property boundary

Public Health Act

Administered by the Ministry of Health, this Act has a specific prohibition that "a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard". This prohibition would apply to farm practices that may result in a health hazard, such as when nutrients, contaminants or pathogens are discharged to land, water or air to pose a public health problem. Any situation that entails a health hazard will enable health officers to investigate using their powers under the Act. Under the *Public Health Act*, the local Health Authority must investigate any health hazard and has authority to order that a person prevent or stop a health hazard, or mitigate the harm or prevent further harm from a health hazard amongst other powers. Similar regulatory provisions exist for addressing health hazards to drinking water supplies under the *Drinking Water Protection Act*.

- Part 3, Division 1: Preventing Disease and other Health Hazards.
- SECTION 15: A person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard.

The Act also has conditions under the *Health Hazards Regulation* to regulate the distance of wells from possible source of contamination:

SECTION 8 (1) A person who installs a well, or who controls a well must ensure that the well is located at least

(a) 30 m from any probable source of contamination,

(b) 6 m from any private dwelling, and

(c) Unless contamination of the well would be impossible because of the physical conformation, 120 m from any cemetery or dumping ground.

(2) A person who controls a well must:

(a) Remove any source of contamination within the distances set out in subsection (1), or

(b) Subject to subsection (3), close the well in accordance with section 6 of the Code of Practice under the *Ground Water Protection Regulation, B.C. Reg. 299/2004*.

(3) Subsection (2) (b) does not apply to a well located within 6 m of a private dwelling unless it can be shown that the well should be abandoned for a reason other than proximity to a private dwelling.

(4) A well that does not meet the requirements of this section is prescribed as a health hazard.

Fisheries Act

Administered by both Fisheries and Oceans Canada and Environment and Climate Change Canada, this Act is established to manage Canada's fisheries resources, including fish habitat. The Act can also be administered provincially by FLNRORD and ENV. The Act applies to all Canadian waters that contain fish, including ditches, channelized streams, creeks, rivers, marshes, lakes, estuaries, coastal waters and marine offshore areas. It also applies to seasonally wetted areas that provide fish habitat such as shorelines, stream banks, floodplains, intermittent tributaries and privately owned land. The Act includes provisions for stiff fines and imprisonment to ensure compliance.

The purpose of this Act is to provide a framework for (a) the proper management and control of fisheries; and (b) the conservation and protection of fish and fish habitat, including by preventing pollution.

This Act was updated in 2019 and now empowers the Minister to make regulations for the purposes of the conservation and protection of biodiversity.

The definition of fish habitat is: "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas". The quantity, timing and quality of the water flow that are necessary to sustain fish habitat are also deemed to be a fish habitat. Furthermore, serious harm to fish includes the death of fish or any permanent alteration to, or destruction of, fish habitat.

Provisions of the *2019 Fisheries Act* relevant to agricultural operations include:

- Protection for all fish and fish habitats;
- Prohibition against the death of fish or the 'harmful alteration, disruption or destruction of fish habitat';
- A permitting framework and codes of practice to improve management of large and small projects impacting fish and fish habitat;
- Protection of fish and/or fish habitats that are sensitive, highly productive, rare or unique; and
- Consideration for the cumulative effects of development activities on fish and fish habitat.

Specific SECTIONS of the Act include:

SECTION 34.2(1) The Minister may establish standards and codes of practice for:
(a) The avoidance of death to fish and harmful alteration, disruption or destruction of fish habitat;
(b) The conservation and protection of fish or fish habitat; and
(c) The prevention of pollution.

SECTION 34.4(1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

SECTION 35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.

Every person who contravenes subsection 34.4(1) or 35(1) is guilty of an offence and liable.

Notifying authorities about serious harm to fish or deposit of a deleterious substance:

SECTION 38 (4.1) Every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations of a harmful alteration, disruption or destruction of fish habitat that is not authorized under this Act, or of a serious and imminent danger of such an occurrence, if the person at any material time
(a) Owns or has the charge, management or control of the work, undertaking or activity that resulted in the occurrence or the danger of the occurrence; or
(b) Causes or contributes to the occurrence or the danger of the occurrence.

SECTION 38 (5) If there occurs a deposit of a deleterious substance in water frequented by fish that is not authorized under this Act, or if there is a serious and imminent danger of such an occurrence, and detriment to fish habitat or fish or to the use by humans of fish results or may reasonably be expected to result from the occurrence, then every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations.

SECTION 38 (7) As soon as feasible after the occurrence or after learning of the danger of the occurrence, the person shall provide an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations with a written report on the occurrence or danger of the occurrence.

INDOOR POULTRY AND LIVESTOCK HOUSING BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable indoor housing related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Protection of Water Quality

Comply with applicable indoor housing related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

An indoor structure allows for convenient collection and containment of livestock manure and waste feed. However, inappropriate barn location, improper construction practices or improper management can contribute to pollution from wastes or leachate. Implement the following practices for indoor facilities:

- Locate facilities away from yard drain inlets, ditches, wells and watercourses:
  - At least 30 m from wells (*Health Hazards Regulation*);
  - At least 15 m from watercourses (*Code of Practice for Agricultural Environmental Management*);
  - 30 m or more from a water intake used for domestic purposes (suggested).
- Locate facilities so that an adequate buffer can be established and maintained between indoor housing and watercourses.
- Keep wastes or leachate from entering a watercourse.
- Construct floors to contain all wastes.
- Deposit waste feed into manure storages or store separately to prevent leachate generation.
- Place berms around buildings or grade landscapes near structures to keep snow melt or other water flow from entering the indoor facility.

➔ see Buildings and Roads, **page 2-2**

Milkhouse Waste. Collect and deposit milkhouse waste into a manure storage facility for eventual land spreading as a fertilizer. Alternative disposal systems require a permit from ENV.

Building Drains. Buildings are often surrounded by perimeter drains to carry clean roof water and soil moisture away from the foundation. If the barn or barnyard also has drains collecting contaminated water, implement the following practice:

- Test that these drains are not cross connected to the clean water drains.
- Add a ENV-approved dye into the contaminated water drain, and check that the dye does not show up in the clean drain line discharge.

Protection of Air Quality

Air Quality BC website

Indoor poultry and livestock housing can impact air quality by emitting dust, particulate and gaseous compounds. These emissions can be a nuisance as well as impact human and environmental health.

Particulate Emissions Reduction. Implement the following practices to reduce particulates and dust from livestock housing:

- Practice dust suppression techniques and implement dust suppression technology.
- Clean up dust accumulations inside the barn.
- Use clean, low dust litter for bedding.
- When loading bedding into barns, use methods that result in minimal dust production.
- Incorporate a program of washing down both the interior and exterior of barns to remove dust accumulations.
- Clean fans, hoods and screens regularly to avoid dust build up.
- Properly locate ventilation exhaust fans.
- Direct discharge away from other buildings and neighbours.
- Equip fans with hoods that deflect exhausted air towards the ground (the ground cover acts as a filter), or install chimney fans with discharge openings at least 4 m (suggested) above ground level (to maximize dilution).
- Take advantage of prevailing winds to carry particulates away from sensitive areas.
- Maintain foliage or implement vegetative filters near exhaust fan discharges to trap a proportion of dust exiting the barn.

➔ see Buffers, **page 11-4**

Siting and Management of Poultry Barns

Ammonia Emissions Reduction. To reduce ammonia emissions that contribute to the formation of secondary particulate and cause odour concerns, implement the following practices:

- Balance the diet to maximize feed efficiency to minimize excreted nitrogen.
- Use enzymes when possible to enhance feed efficiency and reduce phosphate excretion.

➔ see Manure Gas Emissions Reduction, **page 3-42**, and refer to Nutrition and Ration Management

Odour Reduction. Odours often result from livestock housing due to manure, enteric fermentation, and the release of ammonia, and dust.

➔ see Odours, **page 10-17**

Exhaust Filters. Mechanical air filtration systems trap approximately 45% of fine particulate and 80% of coarse particulate from animal housing areas.

- Install mechanical filters on ventilation exhaust fans.
- Ensure filters are cleaned and maintained at regular intervals.

Biofilters. Biofilters result in approximately an 80% reduction in ammonia and 95% reduction in hydrogen sulphide emissions and can be used as an alternative to mechanical filters. Mechanical filters trap particles and emissions, whereas biofilters trap particles and emissions and also provide an environment for aerobic biological degradation of trapped compounds that results in a reduction of odour emissions.

- Install biofilters to reduce odorous emissions.
- Biofilters are proven effective for use on deep pit manure exhaust; swine, dairy and mushroom facilities; and are minimally effective in poultry facilities.
- **Caution:** dust and dander in certain types of poultry housing can cause exhaust filters and biofilters to backup.

Vegetative Filters. Vegetative buffers trap a portion of dust from barns exhaust fans, reduce the visual impacts of agriculture, and decrease odour. In a vegetative buffer, wind is channelized from the barn exhaust through a planting of trees, allowing particulates to be caught in the vegetation. Vegetative buffers also sequester carbon, offsetting some of the greenhouse gas emissions from other components of the livestock operation.

➔ see Buffers, **page 11-4,**

Vegetative Buffers BC website

Electrostatic Precipitators for Dust Reduction. Reduce dust emissions from indoor livestock facilities by applying a safe electric charge to the air space. Electrostatic precipitators reduce dust in the air by charging the airspace to force particles to come together and fall out of the air. This reduces the impacts to both indoor and outdoor air quality.

- Implement electrostatic precipitators in livestock housing at beginning of the livestock cycle.
- Clean up dust accumulations to ensure the technology remains effective.

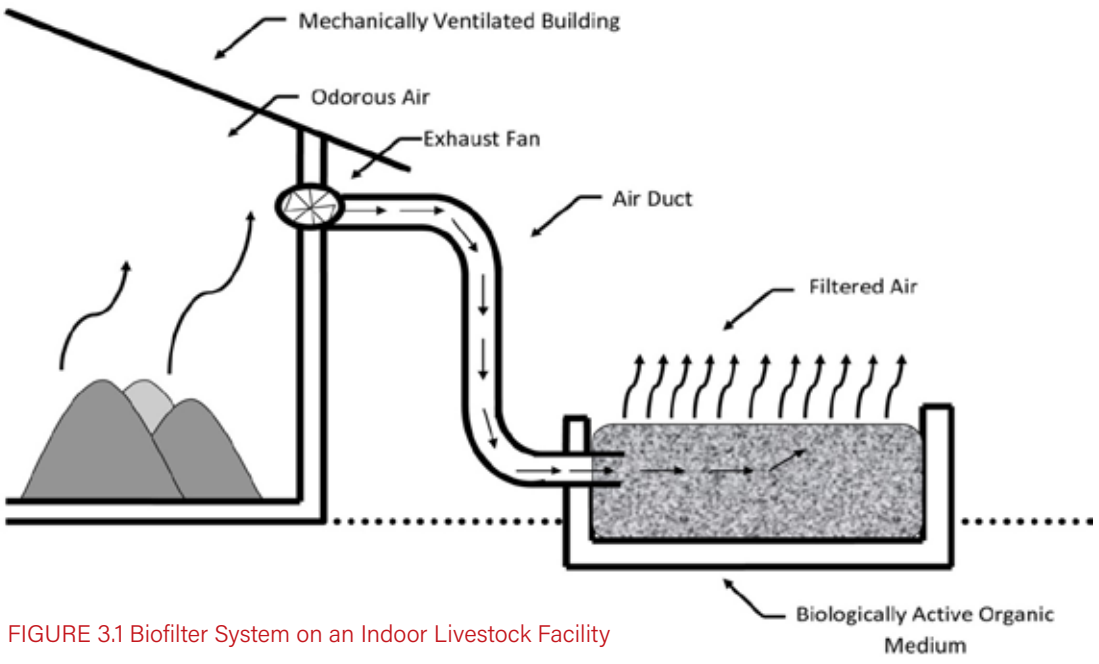


FIGURE 3.1 Biofilter System on an Indoor Livestock Facility

OUTDOOR LIVESTOCK AREAS

OUTDOOR AREA ENVIRONMENTAL CONCERNS

Primary environmental concerns related to outdoor livestock areas are:

- Livestock manure and feed that results in soil, water, air pollution and/or greenhouse gas emissions.
- Livestock grazing that results in loss of wildlife habitat and weed transmission, or results in soil compaction or erosion, or water pollution.
- Livestock grazing practices and manure generation that increase the release of greenhouse gas emissions contributing to climate change, or reduce the resilience of the farm to adapt to a changing climate.

For information on these concerns:

➔ see Impacts on Biodiversity and Habitat, **page 7-7**, and refer to Impacts of Agriculture on Biodiversity and Habitat

➔ see Soil Quality Factors, **page 8-1**, and refer to Compaction, and to Contaminants

➔ see Water Quality and Quantity Factors, **page 9-1**, and refer to Contaminants, and to Oxygen Demand

➔ see Air Quality Factors, **page 10-1**, and refer to Contaminants, and Odours

➔ see Climate Change Factors, **page 12-1**

OUTDOOR AREA LEGISLATION

The following is a brief outline of the main legislation that applies to outdoor livestock areas.

➔ see **page A-1** for a summary of these and other Acts and Regulations

Drinking Water Protection Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

- SECTION 23(1): subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

Animal Health Act

This Act provides the authority for the *Game Farm Regulation*, which lists the farming of bison, fallow deer, and reindeer as a regulated activity. Farm operators working with bison and deer are therefore require licensing. The Act requires producers to take preventive measures to reduce the risk of introducing and spreading disease; ensure employees are trained to prevent and respond to disease; maintain records of animal origin; abide by inspector's orders and report any incidents of disease or unusual illness.

Game Farms. Farming of bison, fallow deer and reindeer have unique management requirements under the *Animal Health Act* and associated *Game Farm Regulations*.

- British Columbia Farm Practices – Game Farms
- British Columbia Game Farm Practices – Bison
- British Columbia Fallow Deer Fact Sheet
- British Columbia Farm Practices - Fur Farms

Environmental Management Act

This Act regulates industrial and municipal waste discharge, pollution, hazardous waste and contaminated site remediation. It provides the authority for introducing wastes into the environment, while protecting public health and the environment.

The *Code of Practice for Agricultural Environmental Management* requires persons to use environmentally responsible and sustainable agricultural practices when carrying out agricutural operations, for the purpose of minimizing the introduction of waste into the environment and preventing adverse impacts to the environment and human health. The AEM Code includes requirements for building setbacks from water sources and property boundaries in Part 4 of the AEM Code.

The *Code of Practice for Agricultural Environmental Management* defines and regulates confined, seasonal feeding and grazing areas.

Confined Livestock Area. This is an outdoor, non-grazing area in which livestock are confined by structures or topography.

SECTION 62:

- Livestock and poultry must not have direct access to a drinking water source or watercourse;
- Contaminated runoff, leachate, solids, and air contaminants do not enter a watercourse, cross a property boundary, or go below the water table;
- Accumulation of manure, animal bedding, and feed within the area must be managed so as to prevent contaminated runoff, leachate, and solids from escaping;
- Any runoff, leachate, or solids that escapes must be collected and contained.

Feedlots. This is an area in which livestock are confined solely for the purpose of growing or finishing and fed other than by grazing.

SECTION 63:

- The self-sealing layer that forms under the feedlot must be maintained so as to prevent leachate from entering groundwater;
- Runoff must be diverted away from the feedlot;
- A feedlot must be decommissioned when no longer in use by removing the manure pack that accumulated over the self-sealing layer and cleaning out the pens in a manner that prevents leachate from entering groundwater or a watercourse and allows nutrients from the manure to be stored and applied to land in accordance with the AEM Code.

Seasonal Feeding Area. This is an area used for both crop production and for seasonal feeding of livestock. Most of the feed is brought to the site and manure nutrients do not usually exceed crop needs.

SECTION 64:

- If the animals have direct access to a watercourse, ensure that effective controls are in place to minimize trampling and erosion of soil into the watercourse and minimize contaminated runoff, leachate, and solids from entering the watercourse.
- Move livestock from areas that are flooded or where flooding is imminent and during the flood season from areas that are prone to annual seasonal flooding.
- Ensure that on-ground feeding locations and mobile feeding bins are not located in areas that are flooded or where flooding is imminent or during the flood season in areas that are prone to annual seasonal flooding. Ensure they are distributed evenly over the feeding area in a manner that prevents the accumulation of manure near feeding locations or bins.
- Livestock or poultry must not be held in a temporary holding area for more than 72 hours.

Grazing Areas. This is pasture that is fenced, or rangeland, where livestock and poultry feed primarily by directly consuming plants growing on the pasture or rangeland.

Fur Farms. SECTION 32 (d) of the *Code of Practice for Agricultural Environmental Management* permits on-ground under-pen storage of manure and bedding from fur bearing animals for up to 7 months.

For information on manure.

➔ see Manure Beneficial Management Practices, **page 3-30**

Public Health Act

Administered by the Ministry of Health, this Act has a specific prohibition that "a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard". This prohibition would apply to farm practices that may result in a health hazard, such as when nutrients, contaminants or pathogens are discharged to land, water or air to pose a public health problem. Any situation that entails a health hazard will enable health officers to investigate using their powers under the Act. Under the *Public Health Act*, the local Health Authority must investigate any health hazard and has authority to order that a person prevent or stop a health hazard, or mitigate the harm or prevent further harm from a health hazard amongst other powers. Similar regulatory provisions exist for addressing health hazards to drinking water supplies under the *Drinking Water Protection Act.*

- Part 3, Division 1: Preventing Disease and other Health Hazards.
- SECTION 15: A person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard.

The Act also has conditions under the *Health Hazards Regulation* to regulate the distance of wells from possible source of contamination:

- SECTION 8 (1) A person who installs a well, or who controls a well installed on or after July 20, 1917, must ensure that the well is located at least
  - (a) 30 m from any probable source of contamination,
  - (b) 6 m from any private dwelling, and
  - (c) Unless contamination of the well would be impossible because of the physical conformation, 120 m from any cemetery or dumping ground.

  (2) A person who controls a well installed before July 20, 1917, must
  - (a) Remove any source of contamination within the distances set out in subsection (1), or
  - (b) Subject to subsection (3), close the well in accordance with SECTION 6 of the Code of Practice under the *Ground Water Protection Regulation, B.C. Reg. 299/2004*.

  (3) Subsection (2) (b) does not apply to a well located within 6 m of a private dwelling unless it can be shown that the well should be abandoned for a reason other than proximity to a private dwelling.

  (4) A well that does not meet the requirements of this section is prescribed as a health hazard.

Water Sustainability Act

The right to divert and use surface water or groundwater is authorized by a licence or approval. Licences and approvals are granted in accordance with the statutory requirements of the *Water Sustainability Act*. For example, cattle drinking out of a stream would be considered "diverting" water. If you use surface water or groundwater for any non-domestic purpose, you require a water licence under the *Water Sustainability Act*. The requirement for groundwater licensing came into force on February 29, 2016 and applies to new groundwater users as well as those who began using groundwater prior to February 29, 2016. Apply for a water licence at FrontCounter BC.

Approval is also required for any work in or about a stream.

Apply for a Water Licence website

Wildlife Act

The provincial *Wildlife Act* protects wildlife designated under the Act from direct harm, except as allowed by regulation (e.g., hunting or trapping), or under permit. Legal designation as Endangered or Threatened under the Act increases the penalties for harming a species. The Act also enables the protection of habitat in a Critical Wildlife Management Area.

Riparian Areas Act

This Act establishes directives regarding the protection and enhancement of riparian areas that may be subject to residential, commercial or industrial development through the associated *Riparian Areas Regulation*. RAR requires local governments to include in its zoning and land use bylaws riparian area protection provisions and ensure that the bylaws provide a level of protection to the riparian area such that it can provide natural features, functions and conditions that support fish life processes.

Fisheries Act

Administered by both Fisheries and Oceans Canada and Environment and Climate Change Canada, this Act is established to manage Canada's fisheries resources, including fish habitat. The Act can also be administered provincially by FLNRORD and ENV. The Act applies to all Canadian waters that contain fish, including ditches, channelized streams, creeks, rivers, marshes, lakes, estuaries, coastal waters and marine offshore areas. It also applies to seasonally wetted areas that provide fish habitat such as shorelines, stream banks, floodplains, intermittent tributaries and privately owned land. The Act includes provisions for stiff fines and imprisonment to ensure compliance.

The purpose of this Act is to provide a framework for (a) the proper management and control of fisheries; and (b) the conservation and protection of fish and fish habitat, including by preventing pollution.

This Act was updated in 2019 and now empowers the Minister to make regulations for the purposes of the conservation and protection of biodiversity.

The definition of fish habitat is: "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas". The quantity, timing and quality of the water flow that are necessary to sustain fish habitat are also deemed to be a fish habitat. Furthermore, serious harm to fish includes the death of fish or any permanent alteration to, or destruction of, fish habitat.

Provisions of the *2019 Fisheries Act* relevant to agricultural operations include:

- Protection for all fish and fish habitats;
- Prohibition against the death of fish or the 'harmful alteration, disruption or destruction of fish habitat';
- A permitting framework and codes of practice to improve management of large and small projects impacting fish and fish habitat;
- Protection of fish and/or fish habitats that are sensitive, highly productive, rare or unique; and
- Consideration for the cumulative effects of development activities on fish and fish habitat.

Specific sections of the Act include:

SECTION 34.2(1) The Minister may establish standards and codes of practice for:

(a) The avoidance of death to fish and harmful alteration, disruption or destruction of fish habitat;

(b) The conservation and protection of fish or fish habitat; and

(c) The prevention of pollution.

SECTION 34.4(1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

SECTION 35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.

Every person who contravenes subsection 34.4(1) or 35(1) is guilty of an offence and liable.

Notifying authorities about serious harm to fish or deposit of a deleterious substance:

SECTION 38 (4.1) Every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations of a harmful alteration, disruption or destruction of fish habitat that is not authorized under this Act, or of a serious and imminent danger of such an occurrence, if the person at any material time:

(a) Owns or has the charge, management or control of the work, undertaking or activity that resulted in the occurrence or the danger of the occurrence; or

(b) Causes or contributes to the occurrence or the danger of the occurrence.

SECTION 38 (5) If there occurs a deposit of a deleterious substance in water frequented by fish that is not authorized under this Act, or if there is a serious and imminent danger of such an occurrence, and detriment to fish habitat or fish or to the use by humans of fish results or may reasonably be expected to result from the occurrence, then every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations.

SECTION 38 (7) As soon as feasible after the occurrence or after learning of the danger of the occurrence, the person shall provide an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations with a written report on the occurrence or danger of the occurrence.

Species at Risk Act

The purposes of this Act are to prevent wildlife species from becoming extirpated or extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity and to manage species of special concern to prevent them from becoming endangered or threatened. Once a species is legally listed, the Act requires that recovery strategies be developed for extirpated, endangered and threatened species, and that action plans be developed where recovery is feasible.

Schedule 1 of the Act sets out the legal list of species at risk (extirpated, endangered, threatened and special concern) in Canada.

Where the Act applies, it makes it illegal to kill, harm, harass, capture or take a species at risk, or to possess, collect, buy, sell or trade any individual or parts of an individual that is at risk. The Act also prohibits the damage or destruction of either the residence (for example, the nest or den) or the critical habitat of any species at risk. Critical habitat is legally identified in a posted recovery strategy or action plan.

While the Act applies to all land and waters in Canada, these prohibitions only apply to areas of federal jurisdiction including migratory birds, all waters (sea and fresh) in Canada, as well as to all federal lands, including Indian reserves and national parks, and the airspace above them.

On private land, unless an order is made by the government, the SARA prohibitions apply only to:

- Aquatic species at risk; and
- Migratory birds listed in the *Migratory Birds Convention Act*, 1994 and also listed as endangered, threatened or extirpated in Schedule 1 of the Act.

The provisions of the *Species at Risk Act* (known as the 'safety net') could be invoked on BC crown and private lands using a federal order under the Act if provincial action is not sufficient to protect listed species.

While SARA prohibitions do not apply to species of special concern, the Act does require management plans to be developed for these species.

More information about how the Act applies on private land can be found on the

Species at Risk Public Registry

OUTDOOR AREA BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable outdoor area related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Broad environmental concerns of outdoor livestock areas are expressed in this rule-of-thumb:

Keep clean water away from manure;
Keep manure away from clean water

The *Code of Practice for Agricultural Environmental Management* defines three outdoor livestock areas. Common terms used for these areas are outlined in Table 3.1.

TABLE 3.1 Typical Outdoor Area Terms for Livestock Groupings

Livestock Type	Outdoor Areas (as defined by the *Code of Practice for Agriculture Environment Management*)		
	Confined	Seasonal	Grazing
Beef Cattle	feedlot handling corral calving pen	overwintering calving areas	pasture range
Bison	feedlot handling corral calving pen	overwintering calving areas	pasture
Chickens & Turkeys	free range	free range	—
Dairy Cattle	yard	—	pasture
Fallow Deer & Reindeer	—	overwintering fawning areas	pasture
Fur farms	—	—	—
Game Birds (e.g., pheasant)	free range	free range	—
Goats	yard	—	pasture
Horses	arena paddock	overwintering foaling areas	pasture range
Laying Hens	free range	free range	—
Llamas & Alpacas	pen	—	pasture
Ostriches & Emus	pen	—	—
Hogs	yard	—	pasture
Rabbits	—	—	—
Sheep	handling corral lambing pen	overwintering lambing areas	pasture range - cut blocks
Water Fowl	free range	free range	—

Horse Riding Arenas

Horse riding arenas are considered to be confined livestock areas and must be managed as such. Ideal arena footing materials should have a low potential for producing leachate, for instance sand is better than wood residue. If wood residue is used its leachate must be managed.

➔ see Wood Residue, **page 2-40**.

Dry areas with good drainage will provide a more serviceable, easily maintained facility regardless of the type of footing chosen. Do not locate arenas in wet areas, that by nature pose the highest pollution potential when wood residue, manure, or urine are in contact with water. Divert water around the arena to ditches or streams to minimize pollution.

Building an Environmentally Sound Outdoor Riding Ring

Horse Farm Best Practices BC

Outdoor Calving Areas

Cattle calving areas can be either confined livestock areas or seasonal feeding areas. Where contaminated runoff is at risk of reaching watercourses, give special attention to runoff control. Calf manure often contains *Cryptosporidium parvum*, a protozoan pathogen that can cause illness in humans if ingested in drinking water.

Confined Livestock and Outdoor Poultry Areas

Commonly called pens, yards, loafing areas, free range, or exercise areas, confined livestock areas may be used either for many months to house livestock or for short periods of time to give indoor-housed livestock fresh air and sunshine. They may be used for feeding, watering or confinement purposes.

There are a number of ways to manage confined livestock areas to reduce the likelihood of depositing deleterious substances into water frequented by fish or of causing water pollution. Implement the following practices:

- Locate facilities away from yard drain inlets, ditches, wells and watercourses.
- At least 30 m from wells (*Health Hazards Regulation*).
- At least 30 m from a drinking water source. 5-30 m from a watercourse (depending on the number of animal units and if they are being fed) and 1.5 m from a property boundary *(Code of Practice for Agricultural Environmental Management*).
- Install a hard surface (e.g., concrete, asphalt) around water supply systems and feed bunks, as well as in soil based yards, as indicated by **Worksheet #1**, next page.
- Install a water supply system as watercourse access is not permitted from confined livestock areas (a conditional exception is allowed for a rangeland holding area).

➔ see Livestock Watering, **page 9-16**

- Establish and maintain an adequate buffer between the outdoor area and any watercourse to keep wastes, or leachate from the wastes, from entering a watercourse.

➔ see Buffers, **page 11-4**

- Handle, process, and store feed properly.

➔ see Crop Processing, and Forage Crop Storage, **page 4-13**

- Divert upland area "clean water" away from confined livestock areas.
- Collect confined livestock area contaminated runoff ("dirty water") or use sites where contaminated runoff is prevented from reaching watercourses.

➔ see Runoff, **page 9-50**

- If contaminated runoff is collected;
  - Estimate the volume to be collected using **Worksheet #11**, **page 9-56.**
  - Use the water appropriately.

    ➔ see Contaminated Water Collection, Storage and Use , **page 9-55**
  - Prevent the escape of manure from the area and collect and spread it as a fertilizer (*Code of Practice for Agricultural Environmental Management* requirement).

WORKSHEET #1
Determining Suitability and Size

Workbook Question 96

Question: **Is a soil-based yard suitable and what is the minimum yard space required for continuous use?**

Information:

Precipitation from Oct 1 to April 30 (indicate site)	Merritt	280	1	mm
Risk of leachate movement in soil (refer to table 8.1) ☐ low ☐ high		Low	2	risk
Number of livestock		100	3	head
Average weight of livestock		350	4	kg

Minimum space for soil-based yards

continuous use	6m² per 100 kg	5
day use only	2m² per 100 kg	6

Calculation: Step 1 **Determine if a soil-based yard is suitable.**

Is Box 1 less than 600 mm, and is Box 2 low risk?

If YES, continue to step 2 or 3

If NO, Soil-based yard is generally not suitable. Outside yards should be hard-surfaced.

Step 2 **Determine the size of the soil-based yard if it is continuous use.**
(A soil-based yard area of 6 m² /100 kg or greater is suitable for continuous use)

EQUATION: Soil-Based Space Yard Size

Number of Livestock		Average Weight		Minimum Space 6 m²/100 kg		Soil-based Yard Size
100 [3] head	x	350 [4] kg	x	0.06 [5]	=	2100 [7] m²

Step 3 **Determine the size of the soil-based yard if it is day use only.**

EQUATION: Soil-Based Space Yard Size

Number of Livestock		Average Weight		Minimum Space 2 m²/100 kg		Soil-based Yard Size
100 [3] head	x	350 [4] kg	x	0.02 [6]	=	700 [8] m²

Answer: For this Merritt farm example, a soil-based confined livestock area is suitable, with a continuous use yard for 100 cattle averaging 350 kg requiring a minimum area of 2,100 m²

Question. Is a soil-based yard suitable and what is the minimum yard space required for continuous use?

Sample Outcome. Yes

Note: 1 m² = 10.76 ft² 350 kg = 1 head

Soil-Based vs. Hard-Surfaced Yards. In general, extensive use for more than 72 hours continuously of soil-based, confined livestock area is best suited to sites that have **all** of the following:

- Are located in low precipitation climates, less than 600 mm October 1st to April 30th inclusive.

  ➔ see Appendix **Figure B.1**, **page B-2**

- **And** have soil with a low risk of contaminant movement.

  ➔ see **Table 8.1**, **page 8-16**

- **And** have low-density livestock use, requiring the following minimum areas:
  - For **continuous use**, an area of 6 m^2 or greater per 100 kg of livestock.
  - For **day-only use**, an area of 2 m^2 or greater per 100 kg of livestock.

Use hard surface confined livestock areas if **any one of the above conditions are not met**. Refer to **Worksheet #1**, previous page, for an example of determining suitability and sizing a soil-based confined livestock area.

Confined Soil-Based Yards. Heavy traffic and sustained use of soil-based confined livestock areas, especially in wet conditions, either destroys plant cover totally or leaves a cover that is sparse and weedy. In addition, soil compaction prevents precipitation from infiltrating the soil, causing ponding and increased runoff flow that could cause erosion.

Non-vegetated, wet and muddy confined livestock areas do not provide many of the benefits for which they are intended. High moisture conditions contribute detrimentally to the health of animals. Mud can increase the breeding of flies, reduce the ability to dissipate excess heat, and also create challenges in detecting lameness. As well, excessive amounts of manure and other waste accumulate, increasing the risk of contaminated runoff.

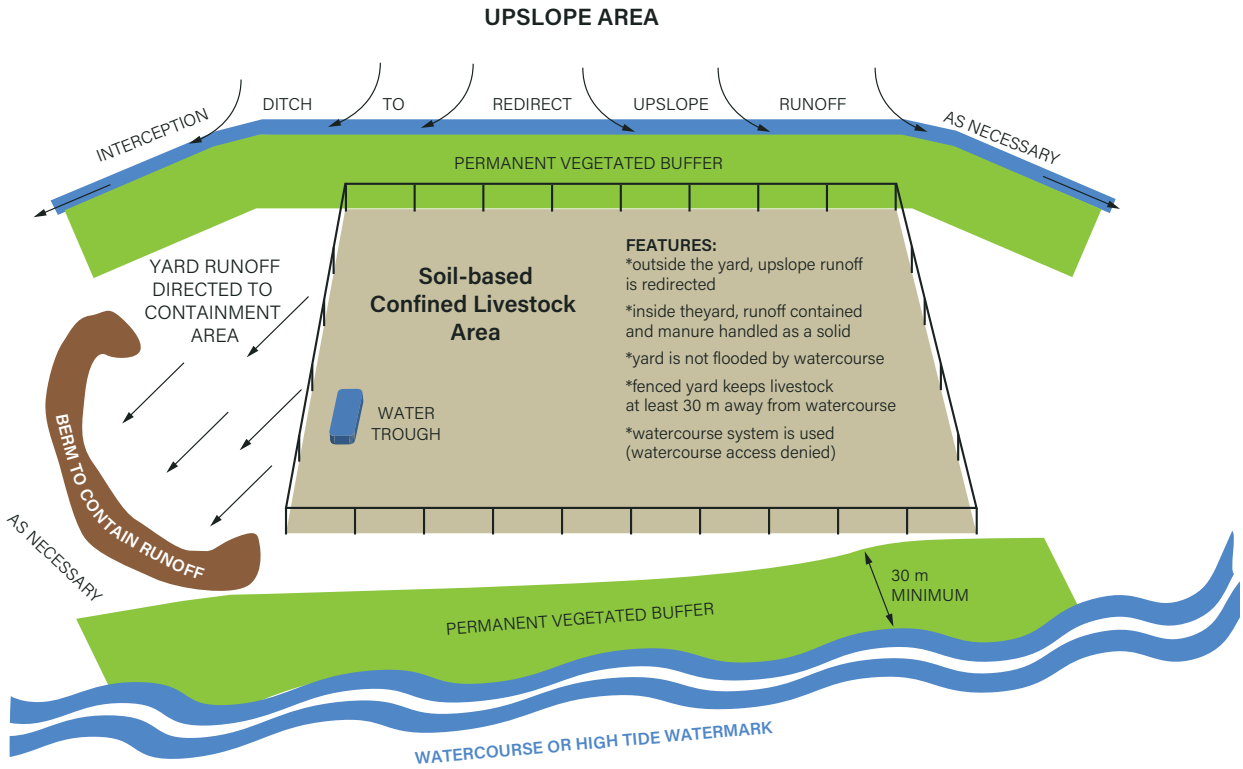


FIGURE 3.2 An Environmentally-Sound Confined Livestock Area – Soil-Based Yard

For soil-based yards, shown in **Figure 3.2**, previous page, include the general confined area beneficial management practices, and implement the following practices:

- Align bedded mounds to drain runoff to collection areas, then use the water appropriately.

➔ see Contaminated Water Collection, Storage and Use , **page 9-55**

- Install hard surfacing to heavy livestock traffic areas and to areas along feed bunks (feeding apron) and adjacent to waterers.
  - A concrete or shale packed apron should be 3.5 to 4 m next to feedbunks.
  - A concrete pad or wood should be 3 m around waterers.
- Make sure the soil base is maintained by ensuring there is a gleyed layer in place. A gleyed layer is also referred to as a protective base or "self-sealing layer", this is a layer of soil, or soil mixed with manure that forms between the manure pack and the underlying soil that acts as a barrier for liquids to pass through.
- Moderate pen density to adjust moisture content, odour and dust.
- Manage pen slope to ensure rapid pen drying after rainfall and to minimize mud and odour generation provide windbreaks.
- When cleaning yards, ensure that the self-sealing layer is not removed by scraping the area too deeply, maintaining this layer will restrict the liquid from the yard from passing into the soil under the yards and reaching the water table.
- Management methods to reduce mud are:
  - Appropriate pen slope and removing potholes,
  - Lowering stock density and
  - Insuring adequate mounds.
- Poor drainage and wet conditions can double space requirements
- Management methods for controlling dust are:
  - Increasing stock density,
  - Using sprinklers,
  - Scraping off the top few cm of dry layer manure from the pen surface.

Confined Concrete or Hard-Surfaced Yards. For concrete or hard-surfaced yards, shown in **Figure 3.3,** below, include the general confined area points on **page 3-11**, and implement the following practices:

- Minimize the yard area to reduce the amount of precipitation that mixes with manure, and to reduce the labour needed to keep the area clean.
- Divert roof water and clean water from surrounding areas to prevent mixing with contaminated water within the yard.
- Regularly clean the open yard area by scraping wastes to storage structures suitable for either semi-solid or liquid manure.

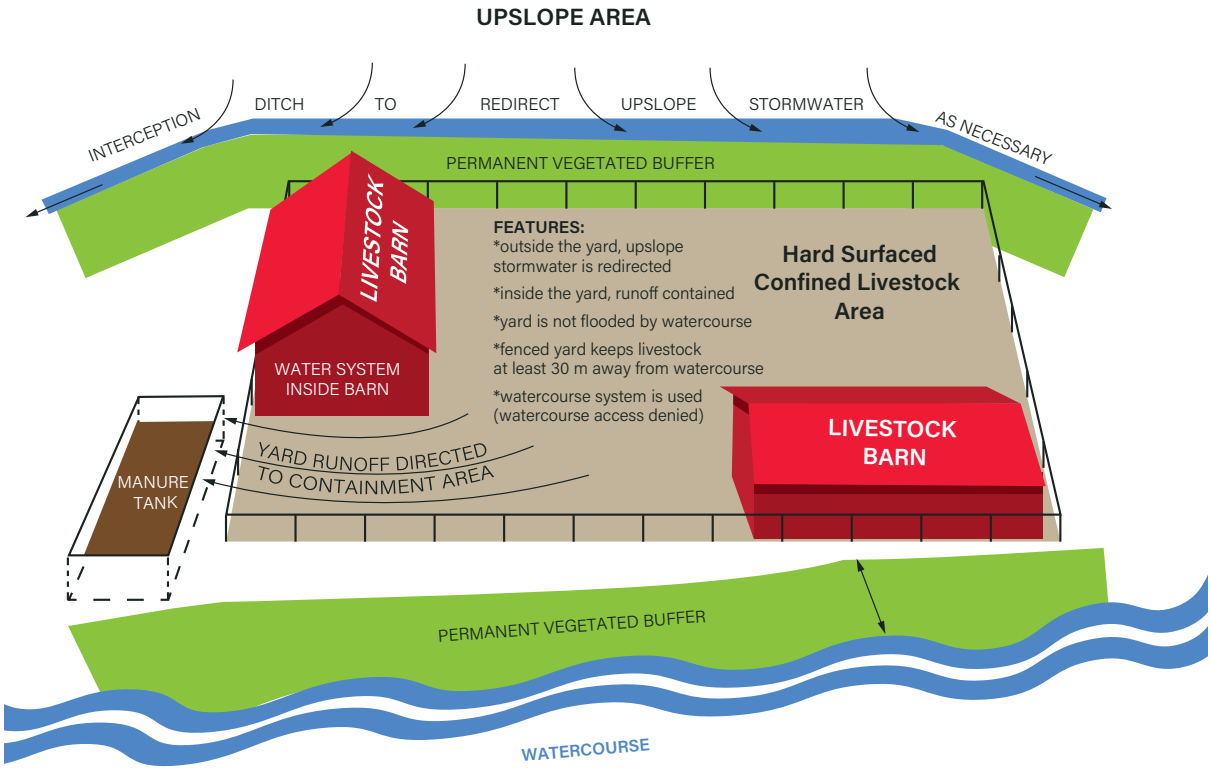


FIGURE 3.3 An Environmentally-Sound Confined Livestock Area – Hard-Surfaced Yard

Estimating Confined Livestock Area Runoff Volume. Use Worksheet #11, **page 9-56**, to estimate runoff volume:

- The formula uses a design storage capacity based on the most winter precipitation expected in 25 years (recommended by ENV).
- The winter storage period (either 6 or 7 months) depends on when the storage can be emptied in the spring.
- During the cropping season (May to October) any contaminated runoff can be directly applied to cropland for utilization.

Seasonal Feeding Areas

Seasonal feeding areas are unique for two reasons:

- They are used for crop production and
- For feeding livestock.

As seasonal feeding areas are used during the non-growing season, (not a preferred time to be spreading manure), the risk of runoff causing pollution is high.

Runoff protection measures will be required for:

- High precipitation climates (precipitation is greater than 600 mm from Oct 1st to April 30th inclusive).
- Areas where snow melting on frozen ground causes runoff.

Distinguishing between Confined Feeding Operations and Seasonal Feeding & Bedding Sites for Cattle Operations

Managing Seasonal Feeding Areas

Selecting Seasonal Feeding Areas

Wintering Site Assessment Tool

General Considerations. Implement the following practices:

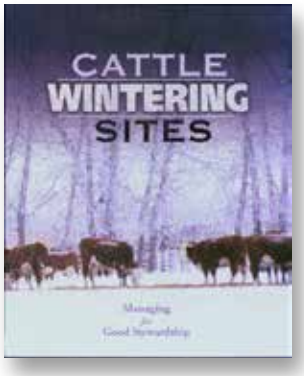
- Have stocking densities that do not cause soil compaction.
- Handle, store, and process feed properly.

➔see Forage Crop Storage, **page 4-14**

- Harrow manured areas in the spring to break manure clods.
- Collect and spread manure that is generated near fixed feed bunks as a fertilizer.
- Monitor watercourses for impacts from livestock watering and bedding by:
  - Checking visually for channel instability caused by hoof action from livestock having access to watercourses.
  - Lab testing for chemical and bacteriological contamination of watercourses caused by runoff or direct livestock access.
- Maintain runoff controls (e.g., ditches, berms, etc...).
- Before using a feeding area, and where practical and appropriate, remove snow to reduce contaminated runoff.
- Limit livestock use of wet pastures to prevent soil compaction by keeping livestock in confined areas.
- Limit access to riparian areas by using fencing and off-stream watering.
- When used as cow calving areas, give special attention to runoff flows.

➔see Outdoor Calving Areas, **page 3-14**

Cattle Wintering Sites: Managing for Good Stewardship and Site Risk Evaluation Sheet



Site Considerations. For seasonal feeding areas, shown in **Figure 3.4**, next page, implement the following practices:

- Locate facilities away from yard drain inlets, ditches, wells and watercourses:
  - At least 30 m from wells (*Health Hazards Regulation*);
  - At least 30 m from a watercourse (*Code of Practice for Agricultural Environmental Management*).
- Locate such that contaminated runoff cannot reach adjacent watercourses.
- Locate where feeding site leachate cannot reach groundwater.
- Do not choose sites where groundwater is near the surface or that have soils that will allow leachate to easily move to groundwater.
- Locate in areas that are not subject to flooding nor receive significant runoff.
- Locate in such a way that upslope water can be diverted away from the feeding area:
  - This will minimize the volume of contaminated water to contain;
  - Livestock may also benefit by having a drier site.
- Locate in such a way that all contaminated runoff can be contained.
- Implement downslope diversion to direct contaminated water onto adjacent established perennial forage for containment to allow nutrients to be used by the crop in the next growing season.
- For small volumes, berm to direct or contain contaminated water onsite.
- For large volumes, construct an impervious pond to contain the contaminated water.

Watering. When watering livestock outdoors, implement the following practices:

- Use an off-stream watering system to ensure low risk (**A in Figure 3.4**).

➔ see Livestock Watering, **page 9-16**

- Where an off-stream watering system is not feasible, use an access to a watercourse that is low impact. **(B in Figure 3.4)**

➔ see Watering Livestock Directly from Watercourses, **page 9-17**

Remote Winter Watering

Bedding. When bedding livestock outdoors, implement the following practices:

- Situate bedding sites to keep manure accumulations away from surface water and riparian areas.
- Provide windbreaks that lure livestock away from treed riparian areas.
- Locate water and feed sites to minimize the use of problem bedding areas.
- If used, collect wood residue bedding at least once a year (preferably in the spring) and handle appropriately.

➔ see Wood Residue, **page 2-41**

Feeding. When feeding outdoors, implement the following practices:

- Clean up wasted or spilled feed before it becomes a pollution risk.
- Locate feeders to ensure that manure build up around feeders does not pollute watercourses.
- Meet crop needs by moving feeding locations or portable feeders around the site as required to provide good manure distribution.
- Get approval for location of permanent feeders from ENV.

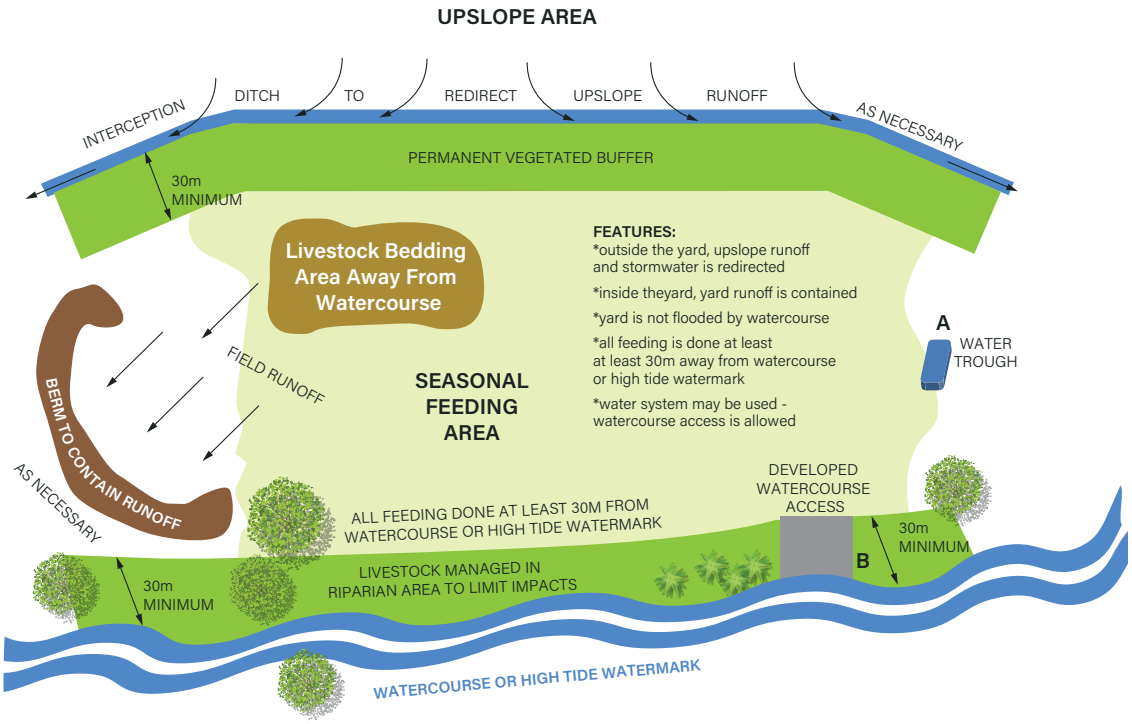


FIGURE 3.4 An Environmentally-Sound Seasonal Feeding Area

Perennial vs. Annual Crops on Seasonal Feeding Areas.

For seasonal feeding areas with perennial forage crops, feeding intensity is normally low to prevent damage to the crop. Generally, the practices suggested above provide appropriate environmental protection. However, where a perennial crop is going to be plowed under the following year and feeding intensity is to be high, treat the feeding site as an annual crop site (see below).

For seasonal feeding areas with **annual** forage crops, feeding intensity may not be governed by crop damage concerns. It is possible for these sites to take on some characteristics of confined feeding areas (e.g., dense manure pack, bare soil). In these cases, manage the areas similar to confined areas.

➔ see Confined Livestock Areas, **page 3-14**

BC Rangeland Seeding Manual

Grazing

Grazing areas vary from intensively-managed pastures to rangelands. Maintain the health of grazing areas by following the practices outlined in the:

Grazing Management Guide publication

The following factsheets can be found through the Grazing Management Guide:

- Improving Livestock Distribution,
- Grazing Frequency and Utilization,
- Seasonal Considerations for Grazing,
- Pasture Design,
- Riparian Pasture Design,
- Watering Livestock Directly from Watercourses,
- Monitoring Grazing Levels,
- Managing Grazing Lands During Drought,
- Pasture Management.

Grazing Management Guide is a publication that forms a part of the Environmental Farm Plan series on Beneficial Management Practices. Its purpose is to provide a checklist and guidelines for protecting pasture and range health. Is recommended to be used by producers having either pastures or private rangelands or who graze Crown land under a grazing lease. **Table 3.3** gives four basic pasture and range assessment questions that direct producers to the use of this publication

Manure Nutrients. If rainfall is adequate or if irrigation is used, pastures may have high productivity, and could support high stocking rates for long periods. Because grazing animals do not excrete more nutrients than they consume, manure nutrients produced during grazing will not exceed amount needed by the crop being grazed. As a result, collection and storage of manure will not be required and effective management will move livestock to distribute manure evenly over the grazed area. Manage sites experiencing contaminated runoff to ensure that nutrients stay on the pasture.

If manure distribution is uneven, as is possible around supplemental feeding areas, manure may have to be redistributed. If fertilizer is applied in addition to manure excreted during grazing, care must be used to not exceed crop needs.

With intensively-managed pastures, such as grazing livestock on irrigated pastures, implement the following practices:

- Use livestock waterers where feasible.
- Although access to watercourses is allowed, it is recommended that livestock waterers be installed on intensively managed pastures and that accessible portions of the watercourse be fenced off where appropriate.

  Watering Livestock Directly From Watercourses
- Prevent stream banks from being trampled upon to protect fish habitat and stream banks from erosion.

  ➔ see Watering Livestock Directly from Watercourses, **page 9-17**
- Ensure that contaminated pasture runoff does not enter any watercourse.

  ➔ see Runoff, **page 9-50**
- Ensure no leachate is allowed to reach groundwater.
- Do not graze livestock on saturated soils because they are easily compacted and manure deposited on wet soil release higher levels of nitrous oxide, a powerful greenhouse gas contributing to climate change.
- Manage grazing to maintain a crop stubble that will filter runoff and hold soils in place.
- Place salt and mineral blocks or sources to lure livestock away from watercourses and sensitive areas.
- Harrow pastures regularly to break up manure clods, particularly in drier regions.

For information on rangelands, refer to:

- Rangeland Handbook for BC (printed book only)
- Grassland Monitoring Manual for British Columbia: A Tool for Ranchers
- Managing BC Grasslands: An Overview
- Rangeland Health Brochure 13: The Four Principles of Range Management
- Rangeland Health Brochure 14: A Different Form of R&R
- Best Management Practices on Crown Range in Community Watersheds
- Water Quality and Livestock Grazing on Crown Rangeland in BC
- Land Management Guide for Horse Owners and Small Lot Farmers

Invasive Species and Weeds. Invasive species and weeds may be spread by grazing livestock. Control weeds before they become a problem.

➔ see Weeds, **page 5-12**

TABLE 3.2 Basic Pasture and Range Assessment Questions ★

1. Do Desirable Plants Make Up More Than One-half of the Vegetation Cover or Weight?

Desirable plants are those that contribute positively to the management objectives of your site, plants that:

- Are readily consumed and persistent;
- Provide consistent amounts of forage (high tonnage);
- Are perennial, except in tame pastures that are specifically being managed for annual species;
- Prohibit the introduction or spread of invasive plants; and
- Provide enough litter and residue to conserve soil moisture and maintain soil stability.

Undesirable plants can include those that are invasive, poisonous and those that crowd out desirable species. In tame pasture, undesirables may include woody invaders (rose, aspen, snowberry etc.) and those that are typically not eaten by most livestock or cause undesirable side effects when eaten.

Examples of Desired Plant Communities

A Southern Interior grassland composed primarily of low growing, relatively non-productive and non-desirable grasses.

A Southern Interior grassland composed of more than one-half highly productive and desirable large bunchgrasses.

An example of a Peace River aspen stand showing the removal of desirable tall forbs, grasses and shrubs. All that remains are low growing forbs that provide little forage value.

Peace River aspen stand with an abundance of desirable plants including highly productive grasses, forbs and shrubs.

2. Does Leaf Length, Seed Production, Colour, and Overall Productivity of Desirable Plants Indicate Strong Vigour?

Plant vigour is reflected primarily by the size of a plant and its parts in relation to its age and the environment in which it is growing. However, periodic drought in dry land environments will lower the apparent vigour and annual productivity of desired plants. Plants with low vigour have a greater potential to be replaced by weedy invasive and low quality or poisonous plants.

Examples of Plant Vigour

Peace River aspen stand showing poor vigour, productivity and a loss of desirable tall forbs and shrubs.

Peace River aspen stand showing excellent vigour, productivity and a mixture of desirable tall forbs, grasses and shrubs.

Southern Interior bunchgrass grassland showing poor vigour, productivity and a lack of desirable large bunchgrasses.

Southern Interior bunchgrass grassland showing excellent vigour, productivity and a dominance of large, more robust bunchgrasses.

3. Is Litter and Plant Residue Fairly Abundant and is Some of it Composed of Desirable Plants?

Litter and standing plant residue (dead material), in various states of decay, provides additional surface cover that:

- Promotes nutrient cycling by providing organic matter to the soil.
- Reduces soil erosion by wind and water including reducing raindrop impact.
- Increases water infiltration into the soil by slowing runoff and providing a pathway into the soil profile.
- Promotes moisture retention by reducing evaporation.

In order for litter and plant residue to be rated as fairly abundant, approximately 25 percent of the standing forage mass should either be dead or consist of dying leaves and stems:

- On tame pastures, less than 25 percent should either be dead or consist of dying leaves and stems.
- Anything greater than 25 percent may be excessive – too much litter and standing plant residue dead material will reduce the feed of the forage consumed and animal intake, as well as inhibits new plant shoot growth and seedling emergence.

Examples of Plant Litter

Southern Interior grassland with relatively little litter.

Southern Interior bunchgrass grassland with fairly abundant litter and plant residue (>25%), some of which is composed of desirable plants.

Is the Area Free of Evidence Indicating Soil Movement or Loss?

When managing your grazing lands it is extremely important to prevent human caused soil movement or loss by maintaining adequate plant cover and minimizing the amount of exposed (bare) soil. Any loss of soil will lower the productivity of a site by removing finer soil particles like clays, silts and organic matter all of which are integral in maintaining soil fertility and a sites moisture holding capacity.

- Soil compaction should be minimized as it decreases the amount of water available to plants by reducing water infiltration into the soil profile.

Evidence of soil compaction:

- Push a metal rod, pencil, or knife into the soil and interpret the ease of penetration.
- Compare in-field resistance to penetration with resistance found at a grazed fenceline.
- Compacted soil layers will increase the amount of resistance encountered.
- The more noticeable the difference in resistance, the greater the compaction is in that pasture.

Evidence of soil movement or loss includes:

- The presence of debris dams of plant residue that build up at obstructions or span between obstructions (sheet erosion).
- The presence of rills, which are small incised channels that run parallel to one another down a slope, indicate that serious soil loss is occurring.
- The deposition of heavier soil particles downwind of obstructions such as fencelines, buildings and vegetation.

Examples of Soil Movement or Loss - Rills and Gullies

Example of rills on a Southern Interior grassland.

Example of a gully on a Peace River pasture.

★ Pastures and ranges that do not have these features should refer to the Grazing Management Guide publication for assistance in more detailed assessment and management ideas to improve conditions.

MANURE HANDLING AND STORAGE

Manure is a valuable by-product of livestock operations. However, to realize its potential value and to avoid pollution problems, well-planned manure handling and storage systems are essential.

MANURE HANDLING AND STORAGE ENVIRONMENTAL CONCERNS

Primary environmental concerns related to manure handling and storage are:

- Manure handling, spillage, storage facility leakage, or overtopping that results in soil or water pollution, or impacts to habitat.
- Insufficient storage that requires manure spreading during high-risk seasons that results in water pollution.
- Inappropriate field storage that results in water pollution.
- Release of methane (CH_4) and nitrous oxide (N_2O), greenhouse gases that contribute to climate change.
- Release of ammonia (NH_3), volatile organic compounds (VOC) and nitrogen oxides (NO_x) which can chemically produce secondary particulate that results in pollution, human health concerns and visibility reduction.
- Release of odours associated with ammonia and other contaminants.
- Release of hydrogen sulphide and other air contaminants that result in air pollution.

➔ see **Chapter 6**, Nutrient Application, regarding manure application to land

For information on these concerns:

➔ see Impacts on Biodiversity and Habitat, **page 7-7**, refer to Farm Activities and Impacts

➔ see Soil Quality Factors, **page 8-2**, refer to Contaminants, to Micronutrients and Metals, and to Salts

➔ see Water Quality and Quantity Factors, **page 9-1,** refer to Contaminants, and to Oxygen Demand

➔ see Air Contaminants, **page 10-1**, refer to Dust and Particulates

➔ see Climate Change Factors, **page 12-1**

MANURE HANDLING AND STORAGE LEGISLATION

The following is a brief outline of the main legislation that applies to manure handling and storage.

➔ see **page A-1** for a summary of these and other Acts and Regulations

Drinking Water Protection Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

- SECTION 23(1): Subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

Environmental Management Act

The *Code of Practice for Agricultural Environmental Management* has specific requirements regarding manure storage and use.

The AEM Code introduces the term "protective base," which means:

a) A layer or soil that is at least 30 cm thick with a saturated hydraulic conductivity less than or equal to 10^{-7} cm/s, or

b) Any material that does not allow for leaks or liquids to soak through

- SECTION 17: Field storage under 2 weeks and permanent storage structures must be set back 30 m from drinking water sources, 15 m from watercourses, and 4.5 m from property boundaries, whereas field storage 2 weeks and over must be set back 30 m from drinking water sources, watercourses, and 4.5 m from property boundaries
- SECTION 32: A person may store and use solid agricultural by-products, or carry out agricultural composting on their land base only as follows:
  - The solid by-products produced, on or off the farm, may be stored or composted on the farm.
  - If solid by-products are produced off-farm and stored or composted on the farm, the stored or composted material must be used on the farm.
  - Solid by-products must be stored as temporary field storage or in a permanent structure.
  - Manure and bedding from fur bearing animals may be stored in on-ground under pen storage for a maximum of 7 months.
- SECTION 33: A person may store liquid manure only as follows:
  - Liquid manure may only be stored on-farm if it was produced or stored on-farm and will be used on the farm.
  - Liquid manure must be stored in a permanent storage structure.
  - In an emergency, liquid manure may be stored in a non-permanent storage structure if:
    - The director is notified immediately;
    - The director is notified within 5 days of the plan to apply or store the manure in a manner that applies with the AEM code;
    - The plan is implemented, taking any director-required directions or modifications into account;
    - The structure is monitored for leaks and immediately fixed if leaks are found.
- SECTION 34: A person who stores agricultural by-products must ensure the following:
  - Leachate is contained and collected until it can be land applied.
  - Runoff is diverted away from storages.
  - Storage structure and area is maintained so as to prevent contaminated runoff, leachate, wastewater and solids from escaping.
  - If any of the above do escape, that they do not cross a property boundary, enter a watercourse or go below the water table.
  - Air contaminants from stored by-products do not cross property boundaries.
  - By-products are stored in a manner to deter the attraction and access of pets, wildlife, and

- SECTION 35: A person who uses a permanent storage structure must ensure there is sufficient capacity to store agricultural by-products until they are either applied as a fertilizer or soil conditioner, or transported away.
- SECTION 36 (1): A person who stores liquid manure must ensure the structure is an existing permanent storage structure, a modified storage structure designed by a qualified professional and built according to the design, or a new permanent storage structure designed by a qualified professional and built according to the design.
- SECTION 36(2): Design plans for a modified or new permanent storage structure must be kept along with confirmation from a qualified professional which indicates the structure was constructed as designed.
- SECTION 36(3): A person who stores liquid manure must ensure that there is a 30 cm of freeboard at all times, the structure must have a protective base to prevent the manure from leaking from the structure, the protective base must be maintained to prevent leakage, and that the stored manure does not leak or overflow from the structure.
- SECTION 37: A person who uses temporary field storage to store solid manure, must ensure:
  - Field storage is not located in an area with standing water or saturated soil and that is prone to seasonal flooding;
  - Field storage is monitored once per week;
  - All field stored manure is used within 7 months, or either moved to a permanent storage facility or transported away;
  - If stored for more than 2 weeks, the same location must not be used for 3 years;
  - Vegetation is grown on the storage location after the by-products are used, moved or transported
  - Records must be kept of the field storage pile, including: type and source of material, location or storage, and weekly monitoring results.
- SECTION 38: In addition to SECTION 34, a person who uses on-ground, under-pen manure storage must ensure:
  - Runoff is diverted away from stored materials and that if contaminated leachate, runoff, solids, or agricultural by-products escape from storage, steps are immediately taken to collect and contain them;
  - A record must be kept of the steps taken, if any, to collect and contain any escaped material.

The following applies in vulnerable aquifer recharge and/or high precipitation areas:

- SECTION 22: If a person is required to have a protective base, the person must ensure:
  - The base is maintained to prevent leakage and keep a record of maintenance;
  - Assess the base for leakage at least once every 6 months;
  - Corrective action is taken to stop any leakage found on assessment and prevent further leaks;
  - For every assessment conducted, a record of the date and results of the assessment, as well as any corrective actions taken, must be kept.
- SECTION 23: A person who uses a modified or new permanent storage structure, they must ensure:
  - There is a protective base under the storage;
  - If the structure is to store liquid manure:
    - The structure is designed by a qualified professional and built according to that design;
    - Either, the structure has a vertical distance of at least 1 m from the bottom of the protective base to the seasonal high-water table, or leak detection measures demonstrate that the structure is not leaking;
    - The person must keep the design plans and a statement signed by the qualified professional indicating that the structure was constructed as designed;
    - Modified or new on-ground under-pen storage in a vulnerable aquifer recharge area must ensure that there is a protective base under the storage vectors.

- SECTION 24: A person who began, before February 28, 2019, to store liquid manure in an earthen basin must do the following:
  - Have a qualified professional assess the storage basin for leaks of stored materials before February 28, 2021;
  - Until a protective base is installed, a qualified professional assesses the basin least every 5 years or more often if required;
  - If any leaks are found on assessment, take immediate corrective action to stops the leaks and prevent further leaks, and take steps as soon as possible to install a protective base on the bottom and sides of the earthen basin;
  - Keep a record of the date and results of each assessment conducted and all corrective actions;
  - Install a protective base on the bottom and sides of the storage basin before February 28, 2029.
- SECTION 25(1): temporary field storages in high precipitation areas must be covered from October 1 to April 1 of the following year.
- SECTION 25(2): A person who uses temporary field storage for 2 weeks or more in a vulnerable aquifer recharge area must not locate the storage directly on or over coarse-textured soil.
- The *Spill Reporting Regulation* requires spills of a polluting substance (including manure) be reported immediately to Provincial Emergency Program (EMBC) at 1-800-663-3456 (24 hour service). Report spills of manure greater than 200 kg or 200 litres.

Report a spill website

Farm Practices Protection Act

The FPPA provides that a farmer is not liable in nuisance to any person for any odour, noise, dust or other disturbance resulting from that farm operation. However, for this protection to apply, the farmer must comply with the *Environmental Management Act* (EMA), among other things.

Public Health Act

Administered by the Ministry of Health, this Act has a specific prohibition that "a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard". This prohibition would apply to farm practices that may result in a health hazard, such as when nutrients, contaminants or pathogens are discharged to land, water or air so as to pose a public health problem. Any situation that entails a health hazard will enable health officers to investigate using their powers under the Act. Under the *Public Health Act*, the local Health Authority must investigate any health hazard and has authority to order that a person prevent or stop a health hazard, or mitigate the harm or prevent further harm from a health hazard amongst other powers. Similar regulatory provisions exist for addressing health hazards to drinking water supplies under the *Drinking Water Protection Act*.

- SECTION 15: a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard.

The Act also has conditions under the *Health Hazards Regulation* to regulate the distance of wells from possible source of contamination.

SECTION 8 (1) A person who installs a well, or who controls a well installed on or after July 20, 1917, must ensure that the well is located at least

(a) 30 m from any probable source of contamination,

(b) 6 m from any private dwelling, and

(c) Unless contamination of the well would be impossible because of the physical conformation, 120 m from any cemetery or dumping ground.

(2) A person who controls a well installed before July 20, 1917, must

(a) Remove any source of contamination within the distances set out in subsection (1), or

(b) Subject to subsection (3), close the well in accordance with SECTION 6 of the Code of Practice under the *Ground Water Protection Regulation, B.C. Reg. 299/2004*.

(3) Subsection (2) (b) does not apply to a well located within 6 m of a private dwelling unless it can be shown that the well should be abandoned for a reason other than proximity to a private dwelling.

(4) A well that does not meet the requirements of this section is prescribed as a health hazard.

Fisheries Act

Administered by both Fisheries and Oceans Canada and Environment and Climate Change Canada, this Act is established to manage Canada's fisheries resources, including fish habitat. The Act can also be administered provincially by FLNRORD and ENV. The Act applies to all Canadian waters that contain fish, including ditches, channelized streams, creeks, rivers, marshes, lakes, estuaries, coastal waters and marine offshore areas. It also applies to seasonally wetted areas that provide fish habitat such as shorelines, stream banks, floodplains, intermittent tributaries and privately owned land. The Act includes provisions for stiff fines and imprisonment to ensure compliance.

The purpose of this Act is to provide a framework for (a) the proper management and control of fisheries; and (b) the conservation and protection of fish and fish habitat, including by preventing pollution.

This Act was updated in 2019 and now empowers the Minister to make regulations for the purposes of the conservation and protection of biodiversity.

The definition of fish habitat is: "water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas". The quantity, timing and quality of the water flow that are necessary to sustain fish habitat are also deemed to be a fish habitat. Furthermore, serious harm to fish includes the death of fish or any permanent alteration to, or destruction of, fish habitat.

Provisions of the *2019 Fisheries Act* relevant to agricultural operations include:

- Protection for all fish and fish habitats;
- Prohibition against the death of fish or the 'harmful alteration, disruption or destruction of fish habitat';
- A permitting framework and codes of practice to improve management of large and small projects impacting fish and fish habitat;
- Protection of fish and/or fish habitats that are sensitive, highly productive, rare or unique; and
- Consideration for the cumulative effects of development activities on fish and fish habitat.

Specific sections of the Act include:

SECTION 34.2(1) The Minister may establish standards and codes of practice for:

(a) The avoidance of death to fish and harmful alteration, disruption or destruction of fish habitat;

(b) The conservation and protection of fish or fish habitat; and

(c) The prevention of pollution.

SECTION 34.4(1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.

SECTION 35 (1) No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.

Every person who contravenes subsection 34.4(1) or 35(1) is guilty of an offence and liable.

Notifying authorities about serious harm to fish or deposit of a deleterious substance:

SECTION 38 (4.1) Every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations of a harmful alteration, disruption or destruction of fish habitat that is not authorized under this Act, or of a serious and imminent danger of such an occurrence, if the person at any material time

(a) Owns or has the charge, management or control of the work, undertaking or activity that resulted in the occurrence or the danger of the occurrence; or

(b) Causes or contributes to the occurrence or the danger of the occurrence.

SECTION 38 (5) If there occurs a deposit of a deleterious substance in water frequented by fish that is not authorized under this Act, or if there is a serious and imminent danger of such an occurrence, and detriment to fish habitat or fish or to the use by humans of fish results or may reasonably be expected to result from the occurrence, then every person shall without delay notify an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations.

SECTION 38 (7) As soon as feasible after the occurrence or after learning of the danger of the occurrence, the person shall provide an inspector, a fishery officer, a fishery guardian or an authority prescribed by the regulations with a written report on the occurrence or danger of the occurrence.

Migratory Birds Convention Act

This Act has a section of importance to manure management:

This Act protects migratory birds and their eggs and nests.

- SECTION 5.1: prohibits the deposit of substance(s) harmful to migratory birds in any area frequented by migratory birds, or in a place where the substance(s) can enter these areas
- SECTION 33: no person shall introduce into Canada for the purpose of sport, acclimatization or release from captivity a species of migratory bird not indigenous to Canada except with the consent in writing of the Director
- SECTION 35(1): prohibits the deposit of any substance harmful to migratory birds to any area frequented by migratory birds

MANURE HANDLING AND STORAGE BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable manure related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

➔ see **Chapter 6**, Soil Amendments, regarding manure use (i.e., application to land)

Manure Handling

Minimize the risk of causing pollution when manure handling during cleanup of pens or barns and moving to or from storage facilities by implementing the following practices:

- Contain manure during transport within equipment to avoid spills
- Ensure manure is not carried onto public roads by equipment tires
- Limit the amount of manure handling near watercourses
- In case of a pipe break when piping manure near watercourses, have a containment method, such as a double-walled pipe within 10 m of the watercourse (suggested) and a low pressure switch to turn off the pump
- Where manure is moved from barns or pens to storage facilities by scraping over outside hard surfaces, ensure runoff from these surfaces is collected
- Have a manure spreading plan

➔ see Nutrient Application, **page 6-9**

- Where possible, use air emission and odour-reduction practices

➔ see Air Emissions, **page 10-6**,

➔ see Odours, **page 10-17**

Manure Storage

Storage of manure is necessary during times of the year when manure cannot be applied to cropland, either because the crop will not be able to utilize the nutrients, or the risk of causing pollution is too high.

Storage Facilities. A storage facility is a permanent structure designed and operated to contain manure and other agricultural by-products in an environmentally sound manner and sized to hold wastes until they can be used as a fertilizer or soil conditioner. New or modified permanent storage structures in vulnerable aquifer recharge areas must have a protective base.

Implement the following practices for all manure storage structures:

- Only store manure produced, or that will be used, on the farm (do not store manure produced off the farm that will be used off the farm, *Code of Practice for Agricultural Environmental Management*).
- Have facilities designed by a professional engineer whether of earthen, concrete or metal construction.
- size facilities to provide storage for the manure, any contaminated water that may enter, and if not roofed, precipitation.
- Size to allow the by-products to be stored until they can be spread as a fertilizer or soil conditioner.

➔ see Manure Storage Sizing , **page 3-35**

- Cover solid or semi-solid manure storages and locate storage areas to keep manure cool, to minimize the release of methane).

➔ see **Appendix B.1** for a map showing high and low precipitation areas, **page B-1**

- Incorporate leak detection with semi-solid and liquid storages as shown in **Figure 3.5**, next page.
- Incorporate secondary containment with liquid storages.
- Locate on a well-drained graded site, to divert clean runoff away (collecting clean water is an expense to be avoided).
- Protect from 100-year flood events.
- Establish and maintain an adequate buffer between manure storage and watercourses to prevent wastes or leachate from polluting.

➔ see Buffers, **page 11-4**

Leak Detection. Good management of semi-solid and liquid manure storages requires a means of monitoring for leaks. If a storage facility is built on fine-textured or "clayey" soil, install a tile line draining to a dry observation well underneath the structure. Check the observation well for the presence of leachate at least four times a year. Implement the following practices (see **Figure 3.5,** next page):

- Install a tile line under the middle of the facility, and
- Under the facility at the toe of the sloping wall for lagoon type, or
- About 1 m (suggested) inside the perimeter for concrete or steel walled type facilities;
- Install a tile line for every 3,000 m^2 of floor area (suggested).

In coarse-textured soils, lines underneath storages may not detect leakage because percolation paths tend to be more vertical than in less permeable soils. Complete monitoring would include regular testing for ammonia and nitrate levels in groundwater around the facility.

Secondary (Failure) Containment. If a structural failure of a liquid manure storage facility would result in manure entering a watercourse, install some form of secondary containment. Secondary containment can be as simple as a berm away from the manure storage located and sized such that any manure that might escape from the failed structure could be contained behind the berm. Sizing will normally be equal to the volume of manure stored.

Manure Storage Structures Factsheet BC

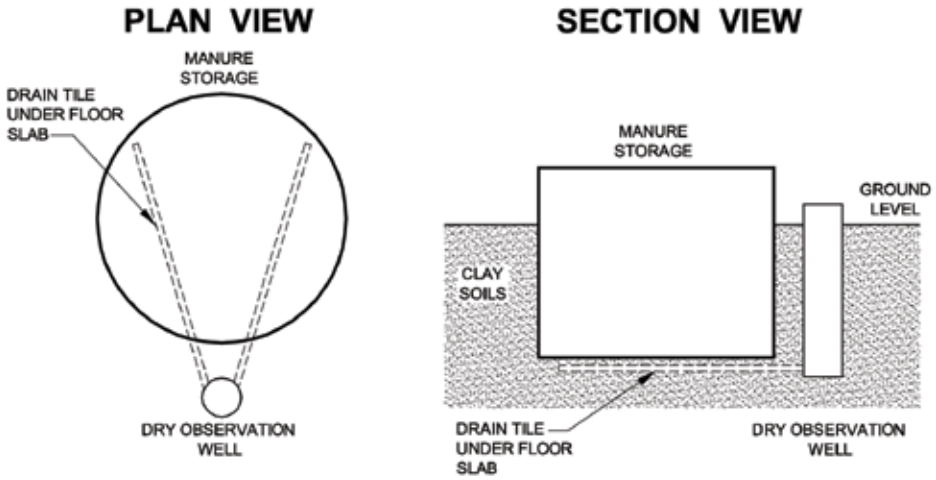


FIGURE 3.5 Leak Detection Under a Manure Storage Facility

Solid Manure Storage

Solid manure has a solid matter content of more than 18% (by mass) and will not flow when piled. Uncovered solid manure structures are suitable only if contaminated runoff from such storages is prevented from entering a watercourse, crossing a property boundary or going below the water table. Typical features of solid manure storage are shown in **Figure 3.6**. In addition to the practices described in Manure Storage, implement the following practices:

- Construct a concrete base and a curbed sidewall along at least one side to allow easy unloading of the facility.
- In high rainfall climates, construct a sump to collect and store the contaminated leachate for future land spreading.

Field Storage of Solid Agricultural By-Products. Temporary field storage is one of two ways to store solid manure, composts or other solid agricultural by-products. Compared with the alternative of storage in a permanent storage structure, temporary field storage offers flexibility, convenience and time savings to farmers. Temporary field storage is short-term, usually in or near the fields where the manure will be applied, and may change location from year to year with a crop rotation.

However, precautions need to be taken to reduce environmental risks. Field storage is not meant to replace a storage facility. In some cases, particularly when there are few suitable field locations for storage or if the manure is nutrient-rich (e.g., poultry manure), it makes more sense to have a permanent storage structure to more easily manage risks to the environment and to comply with the *Code of Practice for Agricultural Environmental Management*.

According to the *Code of Practice for Agricultural Environmental Management*, field stored materials must be utilized within 7 months of when storage begins. If the by-products cannot be used within the timeframe, move the by-products to a suitable permanent storage facility.

For field storage of solid manure, follow the requirements of the *Code of Practice for Agricultural Environmental Management* and read the following factsheet for a description of risk factors, rationale, and beneficial management practices:

- Health of our Air: Toward sustainable agriculture in Canada
- Health of our Soil: Toward sustainable agriculture in Canada
- Health of our Water: Toward sustainable agriculture in Canada

The beneficial management practices include the following:

- Cover the pile with a rain-shedding tarp, anchored against wind removal. The tarp also provides a barrier between the material and wind or wildlife.
- Consider adding materials such as wood shavings or bedding to increase the amount of water that the pile will absorb, if the pile is not covered.
- Consider importing materials for field storage that are lower in nitrogen and phosphorus content if they are available.
- Plan to use the material as quickly as possible after the pile is established.
- Move the pile from year to year between suitable locations, especially if the material is nutrient-rich (e.g., poultry litter).
- Increase the distance that runoff must travel to reach receiving waters.
- Avoid field storage on soils with rapid infiltration rates and high permeability.
- Try to stay at least 3 m (10 ft, horizontally) from sites with bedrock within 0.9 m (3 ft) of the surface. The risk is high if the bedrock is within 0.3 m (1 ft) of the site.
- On sites with poorly drained soil, place piles on relatively flat land (i.e. less than 3% slope) if overland flow of water from the storage site will enter a watercourse. Alternatively, locate on a graded site to intentionally divert contaminated runoff for collection (in a liquid storage facility).
- Floodplain maps can be found online, such as:
  - Floodplain Maps by Region
- The *Code of Practice for Agricultural Environmental Management* refers to requirements to cover a field-stored manure pile from October 1 to April 1 in a high-precipitation area. See **Appendix B** for a description of these areas.
- The *Code of Practice for Agricultural Environmental Management* also requires that field-stored manure piles must not be located over a specific subset of "coarse-textured soils" in vulnerable aquifer recharge areas. **Chapter 8**, provides guidance to help determine if a location is over such soils, and the guidance can be used with soil maps that can be accessed using the Soil Information Finder Tool.
  - SIFT: Soil Information Finder Tool
  - Nutrient Losses to Soil from Field Storage of Solid Poultry Manure

Semi-Solid Manure Storage

Semi-solid manure has less than 18% solids by mass, but does not flow freely as liquid manure. In addition, the practices described in Manure Storage, implement all of the following practices:

- Construct reinforced concrete walls or adequately strong wooden walls along at least three sides, to contain manure.
- Construct concrete floor sealed at the walls to provide manure tight storage and prevent the entrance of groundwater or runoff.
- In areas with high water table, construct entirely above ground to minimize inward seepage of groundwater.
- Construct an adequate roof to keep out rain and snow particularly in areas with high annual or seasonal precipitation (unless extra size is less expensive than the roof or extra dilution is of value).
- In drier interior regions, an uncovered storage structure may be suitable.
- In high rainfall climates, construct a sump to collect and store the contaminated leachate for future land spreading.
- If roofed or enclosed, have ventilation to prevent any accumulation of hazardous gases and to aid in the drying of wastes.
- Construct access doors or bulkheads of tight fitted tongue-and-groove pressure treated timbers and collect any seepage.
- Have a system to detect leaks.
- Construct a suitable concrete slab area for tractor and manure spreader activity, sloped away from the building so that water on the slab does not enter the storage area.
- If runoff becomes contaminated.
➔ see Runoff, **page 9-51**

For High Rainfall Areas

For Low Rainfall Areas

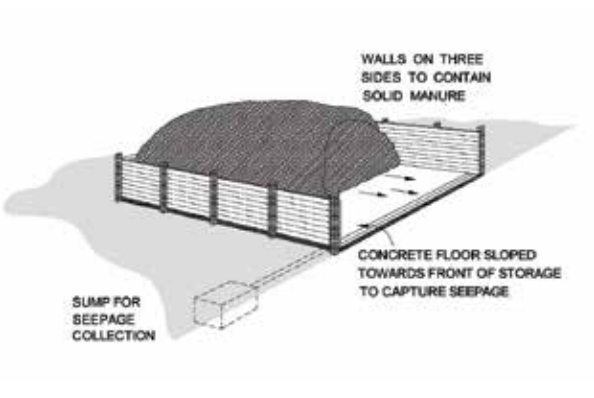


FIGURE 3.6 Typical Solid Manure Storage Facilities

Liquid Manure Storage

Liquid manure storage structures are used for containing liquid wastes such as manure or contaminated water. Liquid manure storages must have a minimum freeboard of 30 cm at all times, for all individual structures.

Modified or new liquid manure storages that are located in vulnerable aquifer recharge areas are required to be designed by qualified professionals who are able to take aquifer protection into consideration of the design, and subsequently built it to the design. Each new or modified liquid manure storage must either have a vertical distance of at least 1 m from the bottom of the protective base to the water table, or a leak detection system in place to demonstrate that the structure is not leaking.

In addition to the practices described in Manure Storage, implement the following practices:

- Construct of sulphate-resistant concrete with a compressive strength of 20 MPa or greater (suggested), plastic, glass-lined metal, etc.
- If very large, construct cross walls and/or baffles to facilitate agitation.
- If constructed entirely or partially above grade:
  - Ensure valves close tightly and install backup valves;
  - Install a manure level indicator that is readable from the ground.
- If constructed entirely below grade and covered:
  - Install childproof access ports weighting 20 kg or more (suggested);
  - Divert clean runoff away from the tank.
- Have a system to detect leaks.
- Install an auto shut off for manure transfer tanks.
- Have secondary containment.
- Limit uncovered surface area to reduce odour and fly problems.
- A system that collects and stores winter precipitation that could be added into the manure storage in the drier months would decrease overall environmental risks and increase opportunities to use manure beneficially.

  Report on an Efficient Liquid Manure Application Study

Earthen Storage Basins. As of February 28, 2019, additional requirements came into effect for earthen storage basins in vulnerable aquifer recharge areas that began to store liquid manure prior to February 28, 2019.

All existing storage basins in a vulnerable aquifer recharge area are required to have a qualified professional assess the basin for leaks prior to February 28, 2021, and assessed at least every 5 years thereafter. If it is determined that the basin is leaking, a protective base must be installed as soon as possible. Regardless if a basin is leaking or not, a protective base must be installed by February 28, 2029.

Manure Storage Sizing

Size a storage facility to allow all manure generated on the farm to be used as a fertilizer with little chance of causing pollution. Note that manure storage sizing assumes the facility will be empty, or near empty, at the start of the no-spread season.

Estimating Daily Manure Volume. The average daily livestock waste volumes produced by livestock type or class may be obtained using the standard values listed in **Table 3.3.** More accurate estimates can be obtained by measuring actual manure volume produced.

Determining Storage Duration. Manure storage requirements vary depending on location of the farm. The *Code of Practice for Agricultural Environmental Management* stipulates that manure cannot be spread from November to January. While this dictates all farmers must have at least 3 months of storage, it is highly encouraged in high-precipitation areas that farmers have 6 months of storage due to the likelihood of unsuitable conditions for land application in the shoulder months. Other parts of BC may need 7 months (210 days) or more of storage. Variations within regions depend on crops grown and field accessibility factors such as soil type, soil temperature, and local rainfall. Storage requirements are reduced on farms where manure is spread on grasslands on well drained soils.

➔ see Appendix B.1, **page B-2**, for BC map showing recommended storage periods

Determining Manure Storage Size. Size storages using **Worksheet #2**, for liquid manure or **Worksheet #3**, for solid manure. Using the appropriate worksheet, follow the steps below:

- **STEP 1:** estimate daily manure volume.
- **STEP 2:** determine manure storage required.
- **STEP 3:** determine total storage required.
- To determine contaminated runoff to be collected for the duration of time that manure spreading is not possible, use **Worksheet #11.**
- Estimate the amount of other contaminants, such as silage leachate.
- **STEPS 4 and 5:** determine the effective depth and size of the storage facility.

Note that if a chosen width and depth does not give the preferred length, choose different width(s) and/or depth(s) until the calculated length is acceptable. For the same depth, a wider width will reduce the length; a narrower width will increase the length.

Sizing Dairy Manure Storage Facilities

TABLE 3.3	Average Daily Livestock Waste Production and Suggested Storage			Worksheets #2, #3	
Class of Animal		Waste Production Litres/day	Liquid[1] Manure Storage Litres/day	Solid Manure Storage [2]	
				Solid [3] Litres/day	Liquid Leachate Litres/day
Beef Cattle	Cows, including Calves (avg. 590 kg)			34.0	
	Backgrounding to Grass (180-270 kg)			12.7	
	Backgrounding to Feedlot (180-385 kg)			15.0	
	Finishing – Yearling (385-630 kg)			28.3	
	Finishing – Feeders (250-565 kg)			21.5	
	Finishing – Short Keep (405-590 kg)			28.3	
Dairy Cattle	Dairy Calves (0 to 3 months old)	6	6		
	Dairy Calves (3 to 6 months old)	8	11		
	Heifers (6 to 15 months old)	16	22	19	4
	Heifers (15 to 26 months old)	24	35	25	7
	Dairy Cow – free stall (avg. 640 kg)	60	75	63	12
	Dairy Cow – tie stall (avg. 640 kg)	60	67	65	10
	Dairy Cow – loose housing (avg. 640 kg)	60		75	
	Milk centre wastes per milking cow	22 to 45 [4]			
Ducks	(avg. 1.4 kg)	0.15			
Goats	(avg. 64 kg)	2.6			
Horse	(avg. 450 kg)	26.1		56.6	
Poultry Eggs	Pullets – cage housing	0.039		0.039	
	Pullets – floor housing	0.039		0.059	
	Layer	0.13		0.13	
	Broiler Breeder Layer – cage housing	0.14		0.14	
	Broiler Breeder Layer – floor housing	0.14		0.18	
Poultry Meat	Broiler Breeder Pullets	0.049		0.077	
	Broiler Chicken	0.054		0.096	
	Roaster Chicken	0.057		0.090	
	Turkey Broiler	0.20		0.29	
	Turkey Heavy Hen	0.29		0.41	
	Turkey Heavy Tom	0.33		0.47	

Rabbits	Doe and Litter	0.71			
Sheep	Ewe or Ram	2.8	6.8	4.2	
Hogs	Dry Sow, Boar or Gilts	11.3	15.8	13.6	
	Nursing Sow and Litter	16.8	23.5		
	Nursery Pigs (5 to 20 kg)	1.8	2.5		
	Grower Pigs (20 to 60 kg)	4.5	6.3		
	Finisher Pigs (60 to 100 kg)	8.6	12.0		
	Grower Finisher Pigs (20 to 100 kg)	7.2	10.1	10.1	
Veal	(avg. 91 kg)	5.6			
Alpaca/ Llamas	Average 130lbs	2.5			

1 Liquid manure production includes typical spilled drinking water and wash water.
2 Some solid manure storages will have a liquid leachate which must be stored separately.
3 Including bedding.
4 This is a typical range – less milking centre waste is produced per cow for large milking herds compared to small herds.

WORKSHEET #2
Sizing Liquid Manure Storage

Workbook Question 138

Question: **What size of liquid manure storage is required for this livestock operation?**

Information:

Desired storage duration (identify site) (Table B.1*)	Enderby	180	1	days
Precipitation on the site from Oct 1 to April 30 (refer to Table B.1*)		0.456	2	m
Storage depth		3	3	m
Storage width		20	4	m
Check if storage is roofed: ☐		No		
Runoff to be stored from roofs and confinement yards - from Worksheet 11		512	5	m^3
Other liquid wastes to be stored		35	6	m^3

Calculation:

Step 1 **Establish daily manure volume**

EQUATION: Daily Manure Production for type and Class of Class of Livestock

Number of Animals x Animals Daily Manure Production Rate = Daily Manure Production for type and Class of Class of Livestock

Class of Animal	7 Average Number on Farm		8 Liquid Manure Storage litres/day/animal		9 Total Storage Required litres/day
DAIRY – CALVES (0–3 months old)	10	x	6	=	60
DAIRY – CALVES (3–6 months old)	10	x	11	=	110
DAIRY – HEIFERS (6–15 months old)	28	x	22	=	616
DAIRY – HEIFERS 15–26 months old)	33	x	35	=	1155
DAIRY – COWS, free stall(avg. 640kg)	20	x	75	=	1500
DAIRY – COWS, free stall(avg. 640kg)	100	x	75	=	7500
DAIRY – milk center wastes/milking cow	100	x	30	=	3000
		x		=	

Farm Daily Manure Volume

EQUATION: Farm Daily Manure Production

Sum of the Daily Manure Production For Each Livestock Type or Class = Farm Daily Manure Production

	13941	10	litres/day
Converted to m^3	13.9	11	m^3/day

Step 2 **Determine manure storage required**

EQUATION: Manure Storage Required

Farm Daily Manure Production x Days of Storage Required = Manure Storage Required

13.94 (11) m^3/day x 180 (1) days = 2509.38 (12) m^3

Step 3 **Determine total storage required**

EQUATION: Total Storage Required

Manure Storage Required + Contaminated runoff (liquid storage only) + Other liquid wastets = Total Storage Required

2509 (12) m^3 + 512 (5) m^3 + 35 (6) m^3 = 3056.38 (13) m^3

Step 4 **Determine effective storage facility for rectangular tanks**
NOTE: If calculated length is unsuitable, choose different width or depth until size is suitable

EQUATION: Effective Storage Depth

Storage depth	-	Precipitation at the site (0 if roofed)	-	Safety freeboard (normally 0.2 m)	=	Effective Storage Depth
3 (3) m	-	0.456 (2) m	-	0.2 m	=	2.3 (14) m

EQUATION: Storage Length

Total storage required	÷	Effective Depth of Storage	÷	Storage Width	=	Storage length
3056 (13) m^3	÷	2.3 (14) m	÷	20 (4) m	=	65.2 (16) ft^2

Answer: An uncovered manure storage facility for this farm should be 3.0 m deep by 20.0 m wide and 65.0 long to hold precipitation that falls directly into the storage and 3,056 m^3 of waste.

WORKSHEET #3
Sizing Solid Manure Storage

Workbook Question 138

Question: **What size of solid manure storage is required for livestock operation?**

Information:

Desired storage duration (indicate site, see Table B.1*)	Abbotsford	180	1	days
Storage Depth		3	2	m
Storage Width		20	3	m
Other solid wastes to be stored		0	4	m^3

Calculation:

Step 1 **Establish Daily Manure Volume**

EQUATION: Daily Manure Production for type and Class of Class of Livestock

Number of Animals x Animals Daily Manure Production Rate = Daily Manure Production for type and Class of Class of Livestock

Class of Animal	5 Average Number on Farm		6 Solid Manure Storage litres/day/animal		7 Total Storage Required litres/day
Eggs – Layer	50000	x	0.13	=	6500
Eggs – pullets – floor housing	25000	x	0.059	=	1475
		x		=	
		x		=	

Farm Daily Manure Volume

EQUATION: Farm Daily Manure Production

Sum of the Daily Manure Production For Each Livestock Type or Class = Farm Daily Manure Production

Farm daily manure volume	7975	8	litre/day
Converted to m^3	8.0	9	m^3/day

Step 2 **Determine Daily Manure Storage**

EQUATION: Manure Storage Required

Farm Daily Manure Volume x Days of Storage Required = Manure Storage Required

8.0 [9] m^3/day x 180 [1] days = 1435.5 [10] m^3

Step 3 **Determine Total Storage Required**

EQUATION: Total Storage Required

Manure Storage Required + Other Solid Wastes = Total Storage Required

1435.5 [10] m^3 + 0.0 [4] m^3 = 1435.5 [11] m^3

Step 4 **Determine effective storage facility for rectangular tanks**
NOTE: If calculated length is unsuitable, choose different width or depth until size is suitable

EQUATION: Effective Storage Depth

Storage depth - Safety freeboard (normally 0.2m) = Effective Storage Depth

3.0 [2] m - 0.2 m = 2.8 [12] m

EQUATION: Storage Length

Total Storage Required ÷ Effective Depth of Storage ÷ Storage Width = Storage Length

1435.5 [11] m^3 ÷ 2.8 [12] m ÷ 20.0 [3] m = 25.6 [13] m

Answer: An uncovered manure storage facility for this farm should be 3.0 m deep by 20.0 m wide and 25.6 m long to hold 1,436 m^3 of waste. Note: an uncovered solid manure storage is not recommended do to risk of spontaneous combustion. Also precipatation falling in this manure storage facility would generate contaminated runoff that would need to be collected and handled as a liquid waste. A roof on the storage facility to exclude precipitation is recommended.

Manure Gas Emissions Reduction

Carefully plan and manage the handling, composting, spreading or storage of all wastes to avoid the creation of gas emissions and nuisance conditions.

Implement the following practices to minimize the release of emissions from manure:

- Choose manure storage options that will reduce the release of emissions, such as:
  - Using dry rather than wet storage methods when there is the option;
  - Use enclosed storages that reduce air movement across the surface of manure storage.
- Minimize the handling and agitation of manure during storage.
- Minimize amount of bedding in manure, such as straw or woodchips.
- Keep storage tanks cool by either insulating or placing below ground.
- For liquid manures, separate urine and feces immediately upon excretion to reduce ammonia emissions.
- Dewater manure before storage to reduce N_2O emissions.
- Do not wet or re-wet solid manure to avoid N_2O emissions.
- Incorporate vegetative buffers around manure storage facilities.

➔ see Buffers, **page 11-4**

- Use methane collection and utilization techniques such as anaerobic digestion.

➔ see Climate Change Mitigation Beneficial Management Practices, **page 12-9**

Farm Practices - Manure Storage and Use

Covered Storage. Cover storages, particularly for liquid manure, to reduce gaseous emissions that are air contaminants and can lead to odours. Liquid systems can also be covered with permeable covers, such as mineral oil, straw or peat on tanks or lagoons. A secondary but major benefit in covering storages for all types of waste is that snow and rain are excluded, thereby reducing the amount of material needed to be both handled and stored. In addition, covers keep solid manure dry, which is necessary to prevent anaerobic conditions from occurring and to reduce the risk of leachate generation.

To reduce emissions from covered storage, use the following as guidelines:

- For solid manure storages install an impermeable cover, impermeable base, and run-off control.
- For tanks and lagoons for liquid manure storage, install either an impermeable or permeable cover.
- Install an air-inflated fabric roof system or floating cover on an open tank.
- Use bottom loading tanks for liquid manure storage to minimize aeration.

Caution should be taken and safety considerations must be given when covering manure. Hydrogen sulfide (H_2S) and methyl groups (CH_3) can form when manure is covered.

Confined Space Safety in BC Agriculture: A resource guide

Ammonia Emissions and Safety

Safe Work Practices for Dairy Farmers in BC

Table 3.4 shows effectiveness of manure cover options in reducing emissions for various air contaminants.

TABLE 3.4 Efficacy of Covered Manure Storage Options for Emission Reduction

Cover	Type	Effectiveness (%)				
		Odour	H_2S	NH_3	Life Expectancy	Relative Capital Cost (1 = most expensive)
	Inflatable plastic	95	95	95	10 years	1
	Floating plastic	95	95	95	10 years	2
	Natural crust	10 – 90**	10 – 90**	10 – 90**	2 to 4 months	5
	Straw	40 - 90	80 - 95	25 - 85	Up to 6 months	4
	Geotextile (non-woven, 6.35 mm thick)	15 - 75	0 - 100	25 - 50	3 - 5 years	3

Adapted from University of Kentucky, College of Agriculture, Using Covers to Minimize Odor and Gas Emissions from Manure Storages, José R. Bicudo, David R. Schmidt, and Larry D. Jacobson

**depends on thickness and other physical characteristics of the natural crust.

Nutrition and Ration Management. Nitrogen in manure and greenhouse gas emissions can be controlled through nutrition and ration management by formulating diets as close as possible to the requirements of the animal. For optimal growth, animals are often overfed crude proteins to meet the intake levels needed of valuable amino acids. In this case, other amino acids are supplied in excess and excreted in urine as ammonia or in manure as undigested protein. Controlling the amount of nitrogen uptake, particularly in non-ruminants, including poultry and swine, can significantly reduce nitrogen losses as ammonia, during land application or as N_2O emissions from wet soil. This can be done by:

- Reducing protein in diets and formulating diets closer to the animals needs.
- Feed less frequently and use phase feeding to match nutritional needs to sex, age and stage of production.
- Chop, grind, pellet or use concentrates to improve the digestibility of feed.
- Supplementing diets with synthetic amino acids to allow the dietary protein (nitrogen component) to be minimized.
- Have a nutrition analysis done on your feeding practices.


Feeding strategies to lower nitrogen and phosphorus levels in manure

Anaerobic Digestion. The decomposition of manure in the absence of oxygen, known as anaerobic decomposition, results in the release of many odorous and often dangerous gases, including ammonia, hydrogen sulphide, and methane, a greenhouse gas contributing to climate change. Gas release is increased when manure is disturbed or spread. Anaerobic conditions occur within one hour when wet manure is stored in piles or as little as 15 minutes when liquid manure is stored in tanks. Manure odours from solid manure can be minimized by:

- Keeping manure sufficiently dry to allow air movement and aerobic conditions through the pile to occur.
- Using appropriate manure timing and application techniques:
  - Anaerobic digestion is a natural process in which bacteria break down carbon rich material in the absence of oxygen. This process, popularly called the "biogas process", generates a mixture of methane and carbon dioxide - the biogas. On-farm biogas production facilities typically utilize manure as the main substrate, but other materials such as food processing waste and crop residues can be added to increase biogas production. Anaerobic digestion technology is commonly employed as an integrated part of farming in Europe, the USA, and Asia.
  - Due to the relative low cost of electricity and natural gas, scrubbing and injecting biogas into the pipeline is typically the best option on an economic basis.
  - A manure management plan must be in place in order for a farm operator to use anaerobic digestion practices.


On-Farm Biogas Development Handbook: For Farmers in British Columbia

Manure Treatment

Manure management refers to capture, storage, treatment, and utilization of animal manures in an environmentally sustainable manner. Manure treatment practices can be used to separate the solid and liquid components or to reduce the amount of moisture in a solid manure. The treatment allows the manure to be more readily used as a farm resource.


Manure Management website

Solid Liquid Separation. Solid/liquid manure separation, or de-watering, involves the partial removal of solids from liquid manure (slurry). The process converts the initial slurry manure product into two streams: solids and liquids. Solid/liquid manure separation is generally conducted using a gravity system or mechanical separation system. The gravity separation system involves the use of settling basins where solids settle to the bottom and the liquid portion remains at the top and is pumped out to a separate tank for storage or application. The mechanical separation system uses some form of mechanical process to separate liquids from solids. A variety of systems are available on the market such as vibrating screens, roller systems, rotary centrifuges, and screw presses. The appropriate type of mechanical separation system will depend on the specifics of the manure and farm in question. With all types of mechanical separation systems, the solid component is separated from the liquid component and the streams are stored separately.

The possible advantages of Solid/Liquid Separation Equipment include:

- Liquid stream of solid/liquid manure separation is less likely to plug transfer pipes and requires less power to pump;
- Solid component of solid/liquid manure separation is more cost effective to transport due to lower moisture content;
- Liquid component is easier to apply/irrigate due to reduced viscosity;
- Liquid component requires less agitation time relative to untreated slurry;
- The odours associated with separated liquids and solids is reduced compared to unprocessed slurry; and
- N:P ratios of the solid and liquid components are different (solid component has higher P while liquid component has higher N). Thus, the separation allows for more accurate application of nutrients based on the needs of each field. (Only applicable to centrifuges from the list above).

The possible disadvantages of Solid/Liquid Separation equipment include:

- High initial cost associated with implementation;
- Ongoing maintenance costs;
- The system results in two waste streams and farms may not be set up to manage two streams of manure;
- Solid/liquid manure separation adds an additional step to the manure management system, which requires attention; and
- The system may require modification to existing facilities such as the construction of new buildings to house the equipment or new electrical systems.

The solid component can have a variety of uses:

- Land application;
- Green bedding (i.e., not-composted bedding);
- Soil amendments; or
- Solids can be composted for use or sale.

Alternative uses for the liquid component include:

- Use in in-barn flushing systems; or
- A source of irrigation water.

Risks of Using Recycled Drywall for Animal Bedding. Recycled drywall is made mostly of gypsum that reacts with organic matter and water (including liquid manure) to produce hydrogen sulfide (H_2S) and other gases that can be harmful. Older drywall materials might also contain foreign substances such as fire retardants, metals, and asbestos. Regardless of whether the use of drywall or gypsum is permitted, there are serious risks of using it in manure handling systems that are wet or anaerobic.

Manure Treatment for Odours. In situations where well-managed manure storages or field spreading practices are not enough to control odours, manure treatment options can be considered. These could include:

- Aerobic treatment and carbon reduction for liquid manure systems.
- Composting for solid manure.
- Using additives to manure or bedding for odour reduction.
- Using emission and odour control technology on housing or storage facilities, such as scrubbers or electrostatic precipitators.

Manure Additives. Ammonia emissions can be controlled by using additives when moving manure farm yards, feedlots manure piles or when applying manure to land. Additives to control ammonia emissions function by binding ammonia, by inhibiting the enzyme that breaks urea down to ammonia, or a pH balancing. Additives can be incorporated in manure slurries, manure piles or in livestock holding areas.

- Use manure additives to reduce ammonia from liquid or dry manure.
- Additives to inhibit nitrous oxide emissions are available, but are cost-prohibitive for most operations.
  - Manure additives are effective for the following systems:
    - Storage slurry, storage dry pile or onsite in livestock holding areas.

Manure Uses

Manure produced on the farm can be used on-farm, by other farmers, or by the public.

Land Application. The best current option for manure disposal is in its application to crops as a fertilizer to provide nutrients or to improve soil conditions.

➔ see **Chapter 6**, Nutrient Application

Manure Injection. Injection of manure directly into the soil can be used to minimze emissions and maximize nutrient potential.

Currently there are five Efficient Liquid Manure Application (EMA) technologies available to BC producers and custom applicators. They consist of:

- Aeration system (Aerway),
- Trailing hose,
- Trailing shoe,
- Shallow injection,
- Deep injection,
- Or immediate incorporation by the producer

➔ see **Chapter 6**, Nutrient Application

Efficient Liquid Manure Application Systems

Nutrient Recovery. Nutrient recovery is a process that enables the removal and concentration of nutrient by-products from agricultural manures or anaerobic digestate (the output from anaerobic digesters) (**Figure 3.7**). Nutrient recovery technologies (NRTs) can facilitate improved nutrient management on agricultural operations with excess nutrients. NRTs produce a concentrated nutrient by-product that may more easily be transported off-farm and/or potentially transformed into a commercially saleable nutrient product.

Nutrient recovery efforts can help to meet nutrient management plan goals.

Evaluation of Nutrient Recovery Technologies

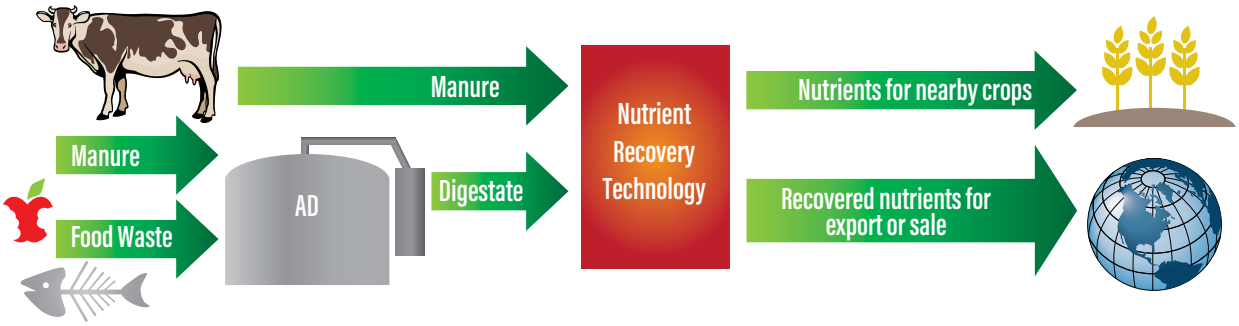


FIGURE 3.7 Nutrient recovery process on the farm (Source: Hallbar Consulting, 2016).

Compost. On-farm manure can be composted and then used on the farm or sold off the farm. Sections 39 – 43 of the *Code of Practice for Agricultural Environmental Management* specifies composting conditions. If a producer wants to take in manure from other farms to compost and then market the compost off the farm, approvals from ENV and the Provincial Agricultural Land Commission are required.

➔ see Compost, **page 2-44**

On-farm Composting in British Columbia: a Step -by-Step Guide for small to Medium-sized Farm Operations

Soilless Media Production. Untreated manure can be used along with other materials such as sand or sawdust to create a suitable media for landscaping or nurseries. However, in most cases composted manure is the preferred choice. Separated solids, or solids with finely chopped bedding, can also be used.

Refeeding. Recycling of some types of manure to livestock as a feed ingredient is permitted under the federal *Feeds Act*. Agriculture and Agri-Food Canada requires the registration of all feed ingredients and their sources. Because consumer opinion towards refeeding is generally adverse, it is recommended that this practice not be implemented for livestock feeds in BC.

Bedding Recovery. Bedding Recovery Systems take the manure from a dairy operation and convert a portion of it into bedding material for cows through a composting process. A bedding recovery system is a two-step process:

STEP 1. Liquid/slurry manure is separated into solid and liquid streams using a solid/liquid manure separator, such as a screw press (Figure 1). The purpose is to reduce the separated solid component to approximately 65% to 68% moisture content. Solids can be separated from manure as well as anaerobic digestate.

STEP 2. The separated solids are fed into a drum that rotates and draws in fresh air to feed the aerobic bacteria creating ideal conditions for composting. The composting solids can reach temperatures of 65 to 70 degrees Celsius, which kills most pathogens in the manure. The solid material will remain in the drum for between one and three days. When the composting process is complete, the solids are ready to be used as livestock bedding. It is recommended that the bedding is to be used fresh. If the bedding is stored for two or three days, it may begin to compost again.

The possible advantages of Bedding Recovery Systems include:

- Producers may realize savings related to reduced bedding expenses;
- Bedding recovery systems ensure producers have a reliable source of bedding;
- Producers can realize additional revenue;
  - Producers may process other dairy farms' manure for bedding either for a fee or for use on their farm;
  - Producers may sell excess bedding to other farms; or
  - Producers may sell composted materials as soil amendments or fertilizer;
- Some aspects of animal health, such as hock sores, abrasions and mastitis, may improve with the use of manure bedding.

The possible disadvantages of Bedding Recovery Systems include but are not limited to:

- Bedding can reheat if stored for too long prior to use, leading to new bacterial growth which in turn could increase environmental mastitis, therefore bedding should be used when fresh;
- Potential for higher disease incidence when used for calves, in sick pens or maternity pens; and
- Initial investment costs and ongoing operating costs.

Manure Spills

Develop a contingency plan when storing any amount of manure. The plan should outline a timely and effective response to any emergencies involving the release of manure products into the environment from:

- Accidental spills, such as when transporting, storing, applying or dispensing;
- Equipment failures;
- Release due to building fires or vandalism;
- Release due to natural events, such as forest fires, floods, or earthquakes.

Contingency Plan

Emergency Plan Template for Farms

Emergency Management Plan for Small BC Farms

REPORTING REQUIREMENT

Under the ***Spill Reporting Regulation***, manure spills greater than 200 kg or 200 litres must be reported immediately to the Provincial Emergency Program (PEP) at 1-800-663-3456 (24hr service).

Manure Contingency Plan

Develop a contingency plan when storing any amount of manure. The plan should outline a timely and effective response to any emergencies involving the release of manure products into the environment from:

- Accidental spills, such as when transporting, storing, applying or dispensing;
- Equipment failures;
- Release due to building fires or vandalism;
- Release due to natural events, such as forest fires, floods, or earthquakes.

Contingency Plan

MORTALITY DISPOSAL

MORTALITY DISPOSAL ENVIRONMENTAL CONCERNS

Primary environmental concerns related to dead animal disposal are:

- Death of livestock due to disease that results in disease spread;
- Holding or burial sites that result in surface or groundwater or air pollution;
- Flies or rodents that results in a nuisance and disease transfer to people, livestock or wildlife;
- Attraction of predators to the site that may be undesirable for wildlife;
- Decomposition of buried livestock releases methane, a powerful greenhouse gas contributing to climate change.

For information on these concerns:

➔ see Water Quality and Quantity Factors, **page 9-1**, and refer to Contaminants, and to Oxygen Demand

➔ see Air Quality Factors, **page 10-1**, and refer to Odours

➔ see Impacts on Biodiversity and Habitat, **page 7-9**, and refer to Farm Activities and Impacts

MORTALITY DISPOSAL LEGISLATION

The following is a brief outline of the main legislation that applies to mortality disposal.

➔ see **page A-1** for a summary of these and other Acts and Regulations

Drinking Water Protection Act

This Act and Regulations have requirements regarding the protection of drinking water quality and regulate domestic water systems (those serving **more** than one single-family residence).

- SECTION 23(1): subject to subsection (3), a person must not (a) introduce anything or cause or allow anything to be introduced into a domestic water system, a drinking water source, a well recharge zone or an area adjacent to a drinking water source, or (b) do or cause any other thing to be done or to occur if this will result or is likely to result in a drinking water health hazard in relation to a domestic water system

Forest and Range Practices Act

This Act has conditions under the *Range Planning and Practices Regulations*:

- SECTION 35: requires dead livestock within 100 m of a watercourse in a community watershed be removed as soon as the holder becomes aware of the dead livestock

Environmental Management Act

The *Code of Practice for Agricultural Environmental Management* makes provisions for on-farm mortality disposal through composting, burial and incineration provided that the disposal activities are carried out on the farm where the animal died.

- SECTION 17: The required setbacks for various mortality disposal methods are as follows:
  - Composting in a permanent structure: 30 m from drinking water, 15 m from watercourses, and 4.5 m from property boundaries.
  - Composting in an outdoor pile: 30 m from both drinking water and watercourses, and 4.5 m from property boundaries.
  - Incineration: 15 m from both drinking water and watercourses, and 4.5 m from property boundaries.
- SECTION 67(1): A person may dispose of mortalities that died on their land through burial, incineration or composting.
- SECTION 67(2): A person may only dispose of mortalities that died on the person's agricultural land base.
- SECTION 67(3): A person may dispose of processing waste only if it comes from livestock or poultry that were reared, kept or slaughtered on the person's agricultural land base.
- SECTION 67(4): A person must not dispose more than 5 tonnes of livestock processing waste or 1.5 tonnes or more of poultry, determined on a live weight basis.
- SECTION 68: People who dispose of mortalities on their land base must ensure:
  - Mortalities do not enter a watercourse, but if this occurs, the owner must immediately remove said mortality.
  - Processing waste does not enter a watercourse.
  - Odours, particulate matter and vector attraction is minimized.
- SECTION 69: Mortalities must be stored in a manner that prevents putrefaction and the escape of leachate, whereas processing waste must be stored in a completely enclosed structure on the agricultural land base from which processing waste and leachate cannot escape
- SECTION 70: Mortalities may be transported in containers in which the mortalities and leachate cannot escape
- SECTION 71: A person who disposes of mortalities through composting must ensure:
  - Composting occurs in a permanent structure or outdoor agricultural composting pile.
  - Leachate and solids do not enter a watercourse, cross a property boundary or go below the water table.
  - Air contaminants do not cross a property boundary.
  - Vectors, wildlife and domestic pets are deterred from the composting pile.
  - Mortalities and processing waste are completely decomposed before application to land.
  - Composted livestock mortalities are only applied to land on which the composting occurred.
  - A person must not dispose of more than 5 tonnes of mortalities in any 30-day period.
- SECTION 72: Outdoor composting piles must not be located in areas prone to seasonal flooding and that have standing water or saturated soils
  - The pile cannot be left for more than 15 months and another pile must not be erected in the same spot for 3 years.
- SECTION 73(2): A person who applies wastewater to land must ensure that the wastewater:
  - Contains no solid waste or visible tissue.
  - Is applied only on the agricultural land base on which the wastewater was generated.
  - Is not applied to land used to grow crops for human consumption or to graze domestic ruminants.
- SECTION 73(4): Compost containing specified risk material cannot be applied to land used to grow crops for human consumption or to graze domestic ruminants

- SECTION 74: A person who buries mortalities must ensure:
  - No more than 2.5 tonnes are buried in a single pit.
  - That burial pits are not located:
    - Within 60 m of each other.
    - In, over or in the vicinity of coarse-textured soil.
    - In standing water or on saturated soil.
    - In areas prone to seasonal flooding or within a 200-year flood plain.
  - The bottom of the pit is 1.5 m from the high water table.
  - That the burial pit is covered with at least 1 m of soil that is compacted and mounded.
  - Records must be kept of the pit location, type and amount of mortalities, and the date the pit was closed.
- SECTION 75: A person who incinerates mortalities must ensure that the incinerator is:
  - Designed and manufactured to incinerate mortalities.
  - Designed such that under standard conditions, an O_2 reference level of 11%, at 25°C and 101.3 kPa, does not exceed the following limits:
    - 180 mg/m^3 for an existing incinerator.
    - 175 mg/m^3 for new incinerators of capacities less than 181 kg.
    - 155 mg/m^3 for new incinerators of capacities 181 kg or more.
- SECTION 75(2): A person who incinerates mortalities must:
  - Visually assess the opacity of the emissions from the incinerator at least once every 12 hours and during every burn cycle.
  - Immediately take corrective action if opacity levels exceed 20% for existing and new incinerators with a chamber capacities less than 181 kg and 10% for new incinerators with a chamber capacity greater than 181 kg.
- SECTION 76: Records must be kept for the type and quantity of mortalities incinerated, the date of incineration, inspection and maintenance of the incinerator, opacity results, and if opacity limits were exceeded.

REPORTING REQUIREMENT

The ***Spill Reporting Regulation*** requires spills of a polluting substance (including mortalities) be reported immediately to Provincial Emergency Program (PEP) at 1-800-663-3456 (24 hour service). Report spills of mortalities greater than 200 kg or 200 litres or report any amount, if the mortality spill contains organisms that are reasonably believed to be infectious.

Public Health Act

Administered by the Ministry of Health, this Act has a specific prohibition that "a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard". This prohibition would apply to farm practices that may result in a health hazard, such as when nutrients, contaminants or pathogens are discharged to land, water or air so as to pose a public health problem. Any situation that entails a health hazard will enable health officers to investigate using their powers under the Act. Under the *Public Health Act*, the local Health Authority must investigate any health hazard and has authority to order that a person prevent or stop a health hazard, or mitigate the harm or prevent further harm from a health hazard amongst other powers. Similar regulatory provisions exist for addressing health hazards to drinking water supplies under the *Drinking Water Protection Act*.

- This Act prohibits activities that may cause a health hazard:
- SECTION 15: a person must not willingly cause a health hazard, or act in a manner that the person knows, or ought to know, will cause a health hazard.

The Act also has conditions under the *Health Hazards Regulation*:

SECTION 8 (1) A person who installs a well, or who controls a well installed on or after July 20, 1917, must ensure that the well is located at least 120 m from any cemetery or dumping ground, unless contamination of the well would be impossible because of the physical conformation.

(a) unless contamination of the well would be impossible because of the physical conformation, 120 m from any cemetery or dumping ground.

Wildlife Act

The provincial *Wildlife Act* protects wildlife designated under the Act from direct harm, except as allowed by regulation (e.g., hunting or trapping), or under permit. Legal designation as Endangered or Threatened under the Act increases the penalties for harming a species. The Act also enables the protection of habitat in a Critical Wildlife Management Area.

The Act makes it an offence to feed dangerous wildlife (e.g., bear, cougar, coyote, wolf). However exemptions are made for landowners to allow for the removal of nuisance pests that are not listed as endangered or threatened (e.g. raccoons, skunks).

- SECTION 33.1: makes it an offence to feed dangerous wildlife (bear, cougar, coyote or wolf) unless as approved hunting or trapping

Health of Animals Act

The Health of Animals Act enables regulatory control over Specified Risk Material (SRM), so that it does not enter the animal feed system. Regulations under this Act (enhanced feed ban) require that producers do not feed any animal products containing SRM to livestock and that abattoirs properly identify SRM to ensure that it is removed from the feed system. A permit from the Canadian Food Inspection Agency (CFIA) is required to handle, transport or dispose of cattle carcasses and certain cattle tissues if they are moved off of the farm of origin. Composting processes do not destroy SRM, therefore composted mortalities must be handled in accordance with CFIA regulations as the compost is still considered to contain SRM.

MORTALITY DISPOSAL BENEFICIAL MANAGEMENT PRACTICES

Comply with applicable mortality disposal related legislation, including the above, and where appropriate, implement the following beneficial management practices to protect the environment.

Livestock Mortality Disposal

Dispose of mortalities in a manner that protects surface and groundwater. For livestock of all classes and types implement the following practices:

- Remove dead animals from buildings and fields as soon as possible.
- Dead animals may be carriers of disease and, if not promptly removed, will attract wildlife, rodents and flies, and produce offensive odours.
- Dispose of dead animals in an approved manner within one day.
- Where this is not possible, freeze or store in a covered container for disposal at a more convenient time.
- Know the cause of death of an animal in order to select an appropriate disposal option as shown in **Table 3.5**.

Do not dispose of dead animals into manure pits or onto land during manure spreading operations. If experiencing excessive death losses, contact ENV immediately for acceptable site-specific mortality disposal options.

Off-Farm Disposal. The default for disposal of farm animals is to manage the disposal on the farm where the animal died. If off-farm disposal is needed it should be done at an authorized facility or through an authorized service provider. Options for off farm ruminant mortality disposal must meet the regulatory requirements of the Canadian Food Inspection Agency and ENV for the handling of specified risk materials (SRM).

On-Farm Mortality Disposal. By following the beneficial management practices referred to on the next page for on farm disposal of any livestock species, producers should not contravene the Canadian Food Inspection Agency and ENV regulatory requirements.

Secondary Users. In BC a few rendering plants or secondary user operations accept dead animals. For information regarding the closest operation, contact your respective livestock association. Dead animals should be stored in either airtight containers or freezers until they can be picked up by a rendering company or deadstock collection service provider. Deadstock collectors may only accept dead animals within 24 hours of their death.

Composting. Composting of smaller dead animals is commonly practised. Research has demonstrated the ability to safely compost larger livestock, if properly monitored. When composting mortalities, implement the following practices:

- Follow general composting guidelines

  ➔ see Compost, **page 2-48**
- Install moisture control options for compost piles. A roof is necessary in high precipitation areas to control moisture.
- Use absorbent materials for the compost base and cover mortalities with a minimum of 30 cm (suggested) of woodchips, litter or straw – top and sides
- Space layers of small dead animals with organic matter
- Larger animals may need to be cut into small pieces for efficient composting. Opening the hide and stomach chambers have shown to accelerate the decomposition
- Specified Risk Material regulatory requirements must be followed when composting bovine mortalities
- CFIA Specified Risk Material Transport Permit is required to move compost offsite.
- The following videos provide guidance and best practices for disposing of routine mortalities:

  Disposing of Routine Mortalities - Video.

TABLE 3.5 Mortality Disposal Options Based on Cause of Death

Cause of Death	← Most Preferred Method				Least Preferred Method →
	Rendering	Composting	Municipal or Private Refuse Site	Incineration	On-farm Burial
Disease 1 (withdrawal time of medication not met)	✓[2]	✓[2]	✓	✓	✓[3]
Disease 1 (no medication, or withdrawal time met)	✓	✓	✓	✓	✓[3]
Poisoning	X	X	✓	✓	✓[3]
Weather (hot or cold)	✓	✓	✓	✓	✓[3]
Flood, Earthquake, and Forest or Building Fire	✓	✓	✓	✓	✓[3]
Starvation	✓	✓	✓	✓	✓[3]

✓ means this disposal option is recommended, subject to any footnote
X means this disposal option is not recommended
[1] Depends on disease: check with veterinarian
[2] Depends on medication used: check with veterinarian
[3] On-farm burial only at suitable sites. ➔ see Livestock Mortality Disposal, page 3-30

Landfills. In some cases, approved landfills operated by municipalities, regional districts, or private owners are made available for the disposal of dead animals. Contact site managers prior to delivering carcasses. Take large animal mortalities to landfills within one day of death. Small animal mortalities, such as poultry, may be stored in a frozen state in airtight containers for as long as required prior to disposal.

Landfills must be permitted by the CFIA in order to be able to accept SRM.

Incineration. Farm mortalities or processing waste can be incinerated on the farm that the mortalities died or the preprocessing waste that was generated by the animals and poultry reared, kept and slaughter on the farm. Generally, a single-chamber two-burner incinerator, or equivalent, is required.

- Approximately half of all poultry farms in BC have onsite small scale incinerators as incineration is the best option for the small amount of waste produced by poultry operators (less then 5 tonnes of live weight livestock or 1.5 tonnes poultry). Currently, there are no incinerators on cattle, dairy and hog farms in BC. Similarly, no known incinerators are operating at slaughter houses and poultry processing facilities. Where dedicated incinerators are employed for small animal disposal, implement the following practices:
  - Locate the incinerator away from residential areas.
  - Always operate the incinerator according to manufacturers instructions.
  - Use best available technology to help meet the best emission standards possible.
  - When purchasing a new incinerator, choose one with a secondary burner to achieve optimal emission reductions.
  - Do not overload. Incinerators are legally require to burn at or below 50 kg per hour. Overloading creates inefficient combustion and emits high levels of particles, Volatile Organic Compounds (VOC), and CO gas.
  - Ensure that the burner and after-burner temperatures are operating at correct levels.
  - The use of after-burners is essential to minimize emissions of VOC, CO, and particulate. The burner and the after-burner should be both switched on for the full combustion cycle to ensure minimum pollutant emissions.
  - Regular de-ashing of the incinerator chamber is important and should be disposed of safely.

Burial. Consider burial pits for dead animals as the least preferred method for disposal. Contact ENV if considering on-farm burial. Decomposition of buried livestock can release methane, a powerful greenhouse gas contributing to climate change.

If burial pits are the only option, locate them at least 30 m from any source of water used for drinking water *(Code of Practice for Agricultural Environmental Management*), and 30 m from a well (*Health Hazards Regulation*). Burial sites must be at least 60 m apart from each other, unless each pit has not been used for 10 years. The pit must be covered immediately with 0.6 m of soil and covered with at least 1 m of compacted and mounded soil so as to minimize infiltration of precipitation, divert runoff away from the pit and deter vectors, wildlife and pets. Alternatives to on-farm burial will likely be necessary during the winter season in cold climates.

Animal Disposal – On-Farm Burial Option
Large Animal Disposal – On-Farm Composting Option

It is highly unlikely that on-farm sites suitable for burial are available within the Lower Mainland and other flood plains throughout BC.

Place no more than 2,500 kg of mortalities in a single burial pit. Locate only where the water table or bedrock is at least 1.5 m below pit bottom and where soil type is dense. Do not dig pits on floodplains or in low-lying areas prone to seepage.

Natural Disposal. The deliberate disposal of livestock mortalities by natural disposal is not permitted under Section 6(3) of the *Environmental Management Act*. For any mortalities that are known to have occurred on crown or private land the farmer or rancher must make every reasonable effort to recover and properly dispose of the mortality through accepted methods (see Table 3.5). It is an offence under the *Wildlife Act* to feed dangerous wildlife (bear, cougar, coyote and wolf).

Mass Mortality Contingency Plan

Develop a contingency plan for mass mortalities. The plan should provide a timely and effective response to any emergencies involving the unexpected impact to the environment, from:

- Unusually high numbers of mortalities resulting from disease, vandalism, loss of electrical power, severe weather events, etc.
- Accidental spills of livestock or livestock mortalities.
- Impacts due to building fires or natural events, such as forest fires, floods, or earthquakes.
- Impacts due to vandalism, such as poisonings.

 Contingency Plan

 Emergency Plan Template for Farms

 Emergency Management Plan for Small BC Farms