

SOLID AGRICULTURAL WASTE STORAGE ◆ HOOP FRAME ◆



INTRODUCTION

The management of manure includes activities such as cleaning out stalls, pens and holding areas in barns. For many, this will also mean ‘picking’ the manure from riding rings and tracks as well as cleaning off hard surfaced areas where livestock are held.

Managing manure also includes the provision of proper storage facilities for manure and soiled bedding as well as the environmentally responsible use of the manure as a fertilizer for crop growth. Manure management is an issue that must be addressed by all livestock producers/owners in BC.

For the small agricultural holdings, manure management requires careful consideration of the beneficial practices and storage methods.

The manure, urine and bedding produced needs to be managed in such a way that it can be used as a fertilizer on cropland without polluting the environment. To do this successfully in areas of high rainfall, some storage will be required unless the manure is removed from the operation regularly before it causes pollution.

This factsheet provides concepts and ideas for storing animal manure. It complements Plan 383-16, *Small Agricultural Waste Storage – Wood Walls*. Hoop frame structures are suitable for storing, handling and composting manure and bedding and can be adapted to many anchoring options.

Because the options for anchoring the structure are varied it is recommended that the supplier be contacted to discuss ideas before purchasing a suitable unit. There may be new improvements or ideas.

LEGISLATION

Several federal and provincial laws are in place to protect land, water and air from pollution, including pollution from agricultural sources.

- The ***Fisheries Act*** prohibits the deposition of harmful substances into fish-bearing waters and watercourses that may eventually enter fish-bearing waters.
- The ***Environmental Management Act*** empowers the Ministry of Environment to control pollution within B.C.
- Agricultural activities are subject to several Regulations under the ***Environmental Management Act***. The primary one dealing with agricultural wastes is the ***Code of Practice for Agricultural Environmental Management***. This Code of Practice applies specifically to activities devoted to the production or keeping of livestock or poultry, the operation of equipment for agricultural waste management and the application of fertilizers and soil conditioners.
- The ***Farm Practices Protection (Right to Farm) Act*** protects farmers on agricultural land from exposure to legal actions resulting from nuisance complaints regarding farming activities.
- Most local government legislation relating to agriculture is addressed in the form of zoning bylaws. A complete list of statutes and regulations of British Columbia is available online at www.bclaws.ca

DESIGN CONSIDERATIONS

Regardless of the size of manure storage being considered, forethought should be given to building placement and construction to ensure that all siting and safety criteria are met.

SITING

Storage facilities are permanent structures designed and operated to contain all manure until it can be applied as a fertilizer or removed for use elsewhere. All storage structures, including reinforced concrete tanks and simple earthen basins, require similar siting and sizing considerations. These structures should be:

- Located at least 15 metres (50 feet) from any watercourse and at least 30 metres (100 feet) from wells or domestic water sources
- Located so that clean surface runoff from adjacent areas is diverted
- Located at least 4.5 metres (15 feet) from property boundaries
- Sized to provide enough storage to avoid having to spread manure during the fall and winter or at any time runoff is likely to occur
- Built using watertight construction
- Structurally sound (consider professionally engineered designs for all types of structures).

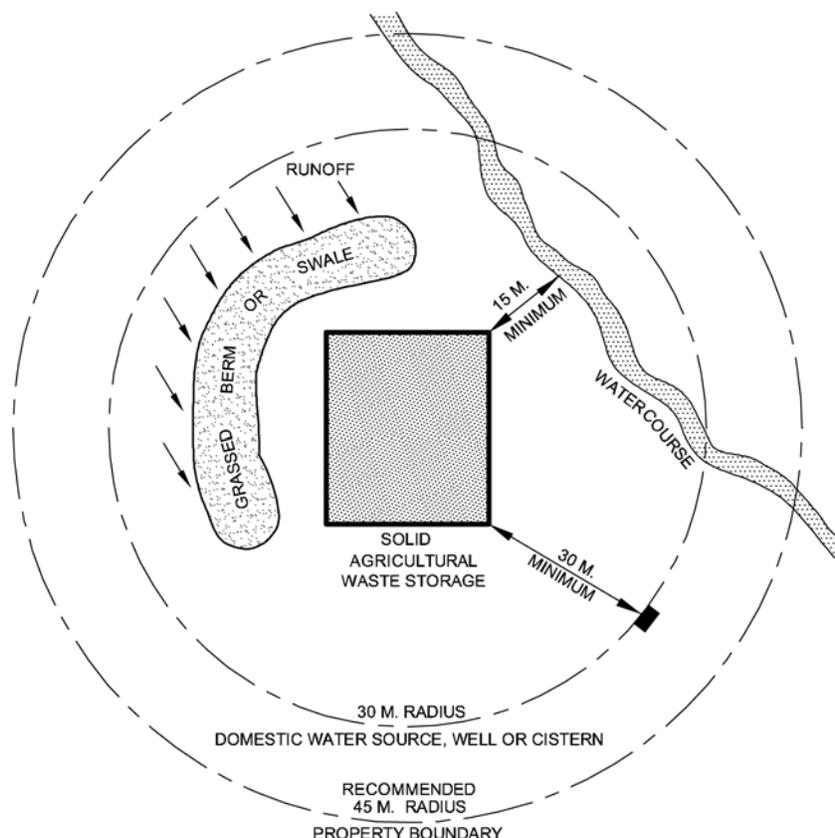
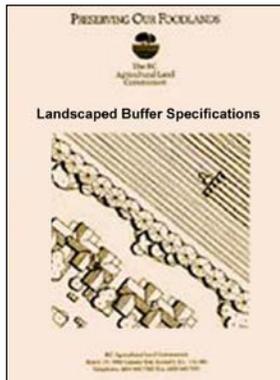


Figure 1
Recommended
Setbacks for
Siting of Small
Agricultural
Waste Storages

LANDSCAPE

Today's increasingly complex land use pressures demand that special attention be paid to the relationship between agricultural and non-farm uses. In the past, a very simple fence and a good neighbour policy may have sufficed; however, present-day realities suggest that the impact of agricultural operations on non-farm areas (most often residential) requires that special efforts be made to avoid the conflicts that many agricultural producers are concerned about. Trespass and vandalism to farm crops and equipment, complaints about early morning farm vehicle noise, the drifting of dust and sprays from field operations, and odours from the application of manures and composts are some of the more commonly-expressed concerns.

With the increasing demands being placed on a very limited land base, unique challenges will exist along defined edges between agricultural and non-agricultural edges.



In an effort to make urban/rural edges work to the advantage of the farmer and non-farming public, the **Agricultural Land Commission** has developed **Landscaped Buffer Specifications** which set out a variety of buffering guidelines for use in different circumstances.

SIZING

All storage structures should be sized so that the waste they contain can be disposed of in accordance with the Code of Practice for Agricultural Environmental Management (the Code).



Adequate capacity ensures the application of agricultural by-products as a fertilizer or soil conditioner only at times of the year when crops are able to utilize it for growth. Appropriate construction and maintenance of a structure will prevent any escape of by-product that could cause pollution.

The Code states, generally speaking, that agricultural by-products must not be applied on frozen ground, in diverting winds, on areas having standing water, on saturated soils or at rates of application beyond the agronomic rate. In most areas of the province, the recommended requirement for storage is six months. The required length of storage depends on a number of factors such as crop use, soil fertility, local climatic conditions, and availability of land at times that do not interfere with crop management practices. In some years, eight months may be considered a more appropriate storage period.

The following table outlines manure generation volumes and bedding requirements for livestock operations that commonly handle solid by-product.

Animal Type	Animal Size	Manure As Excreted Litres/Day/Animal	Suggested Storage Litres/day/animal (with bedding)
Horses	455 kilograms (1000 lb)	26 Litres (0.92 ft. ³)	56.6 litres (1.9 ft. ³)
Beef Cattle	500 kg (1100 lbs)	21 Litres (0.75 ft. ³)	23 Litres (0.81 ft. ³)
Dairy Cattle	640 kg (1400 lbs)	60 Litres (2.12 ft. ³)	75 Litres (2.65 ft. ³)
Calves	135 kg (300 lbs)	8 Litres (0.28 ft. ³)	10 Litres (0.35 ft. ³)
Sheep	60 kg (135 lbs)	2.8 Litres (0.10 ft. ³)	4.2 Litres (0.15ft. ³)
Goats	65 kg (145 lbs)	2.6 Litres (0.09 ft. ³)	3.3 Litres (0.11 ft. ³)

EXAMPLE CALCULATION

TO DETERMINE 6-MONTH STORAGE REQUIREMENT FROM A 10-HORSE OPERATION

Daily Manure Volume	= Table 1 value x 10 animals = 26 litres x 10 = 260 litres/day (9.2 ft ³)
with average amount of bedding	= Table 1 value x 10 animals = 56.6 litres x 10 = 566 litres/day (20 ft ³)
Suggested Storage Period	= 6 months (180 days)
Minimum Storage Capacity	= 260 litres/day x 180 days = 46,800 litres (1,660 ft ³)
with average amount of bedding	= 566 litres/day x 180 days = 101,880 litres (102m ³ or approx. 7.5 m x 7 m x 2 m)
Conversion to Cubic Feet	= 102 m ³ x 35 ft ³ /m ³ = 3,570 ft ³ (approx. 24 ft. x 24 ft. x 6 ft.)

The calculated quantity of waste (manure and bedding) can be contained in a structure of dimensions 7 metres by 7 metres by 2 metres (approximately 24 feet x 24 feet by 6 feet).

1. BUILDING CONSTRUCTION

Various building designs can provide a suitable manure storage structure provided the following requirements are met:

- It is built on a well-compacted granular subgrade that is at least 6 inches thick.
- The foundation and floor must contain seepage. A floor sloping to a shallow, watertight sump allows for easy capture of leakage.
- Concrete aprons are recommended for cleanup and for equipment traffic convenience.
- Concrete surfaces should be durable and watertight. A 25 MPa, low-slump concrete with 5% air entrainment provides an ideal base. Building foundations and floor should be constructed in a continuous pour to ensure watertightness. Where this is not possible or practical, waterstops are recommended to be placed between the floor and walls.
- The building is structurally sound for given site conditions and climatic areas.
- Building size should allow for the organized storage and handling of manure.

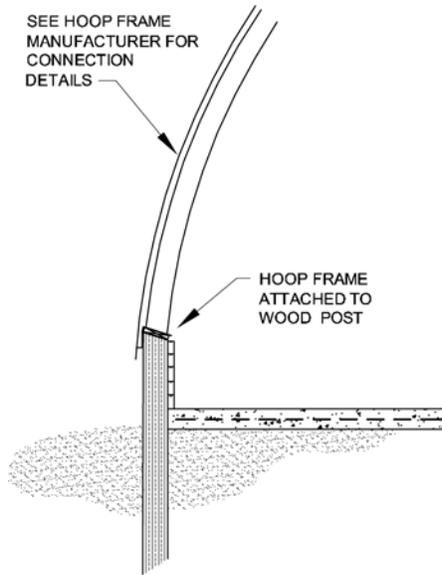


Figure 2 - Round and Square Wood Post

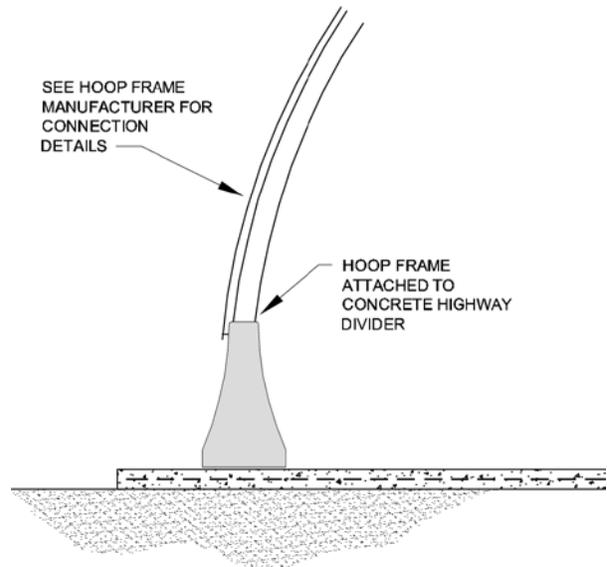


Figure 3 - Highway "No-Post" Divider

NOTE

Hoop frame structures generally offer numerous anchoring options. Only four options are shown here. Discuss anchoring options with the manufacturer prior to purchase.

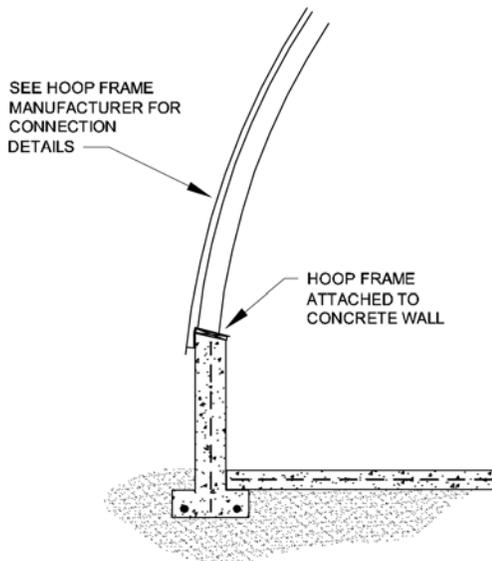


Figure 4 - Solid Concrete Wall

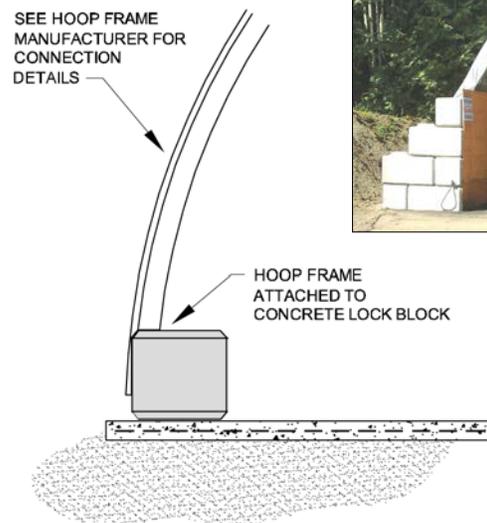


Figure 5 - Lock Blocks



VENTILATION

Covered manure storage structures should be kept as open as possible to prevent the buildup of gases that could impact the health and well-being of people working within the structure during cleanout. In addition, prolonged exposure to airborne contaminants generated from manure decomposition can compromise the integrity of such buildings over time. Ammonia is a particularly corrosive gas that, when combined with moisture in the air or on building surfaces, will deteriorate structural steel in hoop frame buildings and fasteners and truss plates in wood-frame structures. Such effects can be mitigated by keeping side walls as open as possible and by ensuring roof vents are in place. For hoop frame structures without built-in venting features, it is recommended that end walls not be included in the design. For situations where end walls may be desired to prevent the ingress of windblown rain, for example, appropriate venting openings or louvers should be incorporated near the roof peak. Building features that include rollup curtains for side and end walls may be desired in some cases.

Wherever possible, manure storage structures should be oriented perpendicular to prevailing winter winds to discourage the entrance of precipitation through end wall openings. If significant volumes of rain fall on building aprons that are contaminated with waste product, provision should be made to collect such runoff into a reception pit. For rain entering the back end of such structures, the solid manure itself can act as an absorbent if a push wall acts as the barrier to seepage leaving the structure.

SAFETY

All farm building structures, including small agricultural waste storages, should be constructed in accordance with accepted building practices and in conformance with local and national building codes. The National Farm Building Code of Canada is the primary legal document that ensures good quality construction is adopted in areas where local governments enforce adherence to such legislation. Most building departments throughout the province will require an engineered seal on drawings for buildings exceeding 12 metres in width and having load-bearing frame members spaced at intervals greater than 600 millimetres. For areas not subject to building inspection at the municipal or regional district level, it is strongly advised to retain the services of an engineer familiar with local soil, wind and snow conditions. For premanufactured and pre-engineered structures such as hoop frames, it is essential that the owner request supporting documentation that the structure has indeed been designed to local loading criteria.



Figure 6 Small Agricultural Waste Storage Anchored with Lock Blocks

SUMMARY

This plan offers most livestock operations with a variety of size options for storing manure and soiled bedding. This concept should provide affordability to manure storage for a wide range of livestock managers.

Due to the high rainfall in many parts of BC, the storage of manure must be an integral part of maintaining livestock. Research regarding leachate and runoff from uncovered manure piles suggests that pollution from such sources is common.

Those livestock managers that do not remove accumulated manure on a regular (daily, monthly) basis will find this plan to be a suitable option to open storage.

The installation of a concrete floor with an apron at the front ensures that muddy conditions during cleanout are avoided and that groundwater and surface water are protected.



Figure 7

Interior View of Agricultural Waste Storage

FOR FURTHER INFORMATION CONTACT

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