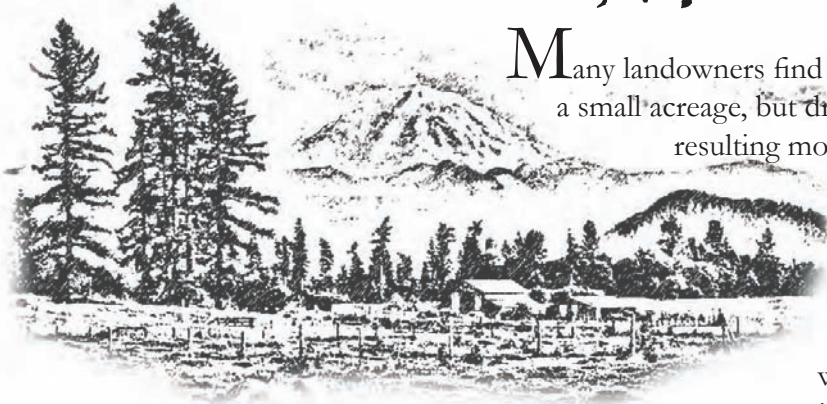


# Strategies for Collection, Storage & Disposal

## Managing Manure



Many landowners find raising animals an enjoyable part of owning a small acreage, but dread the unpleasant prospect of managing the resulting mountain of manure. Improperly managed manure provides a breeding ground for flies and other pests. Bacteria, fungi and mold from manure can cause disease and foot and respiratory illness in your animals. Nutrients and bacteria from manure harm fish and wildlife if they wash into streams. Manure also presents a potential source of pollution to local drinking water sources, such as a well.

Proper management includes regular collection, storage and disposal of livestock manure. Managing manure appropriately will reduce mud, reduce the volume of material by up to half, reduce parasites, pests and weeds and save time and money. Overall, proper manure management benefits your animals' health, water quality and the general aesthetics of your property and potentially your family's well being.

### Collection

It is important to regularly collect manure every one to three days from turnouts, stalls and confinement areas. This prevents reinfestation from parasites since many worm species can hatch as



frequently as every three days. It will also reduce mud since manure retains moisture and can become a source of mucky organic material over time, creating an ideal breeding ground for flies, mosquitoes and other pests. Rainwater flowing through turnouts and confinement areas where manure is not collected picks up raw manure (with nutrients such as nitrogen and phosphorus) and sediment. This polluted runoff may then enter the nearest water body or drinking water source.

Pet waste from cats and dogs should not be included in your manure compost pile. For more information see the factsheet, [Pet Waste Disposal](#), by the Clark County Master Composter/Recycler Program.

### Storage

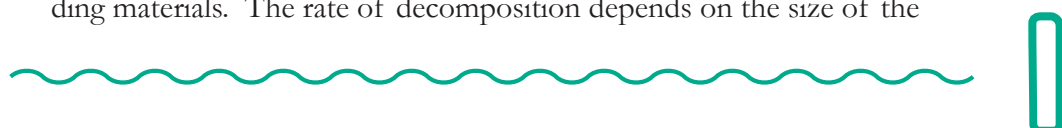
Once collected, you will need someplace to store manure until you are ready to dispose of it. When deciding where to locate manure storage there are three primary considerations: 1) whether you will compost the manure or use it fresh, 2) amount of space needed, and 3) where to locate the storage space.

### Composting

Composting manure speeds up the natural decomposition process by creating an ideal environment for the microorganisms that break down the manure and bedding materials. The rate of decomposition depends on the size of the



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pile, amount and type of bedding material used and, how well the pile is maintained. Although composting manure requires more effort than just storing fresh manure, the benefits listed in Table 1 often outweigh the extra effort.

**Table 1: Advantages and Disadvantages of Composting Livestock Manure**

Type	Advantages	Disadvantages	Other Considerations
<b>Unprocessed or Raw Manure</b>	<ul style="list-style-type: none"> <li>Low cost - requires only a cover and means to spread</li> <li>Higher nutrient content</li> <li>Low time input</li> </ul>	<ul style="list-style-type: none"> <li>May be difficult to spread</li> <li>Risk of leaching nutrients and other contaminants</li> <li>Likely to contain weed seeds, parasites and other pathogens</li> <li>No reduction of material volume</li> <li>Odors</li> </ul>	<ul style="list-style-type: none"> <li>Must have adequate land to spread - requires more space than composted manure</li> <li>Requires aggressive deworming</li> </ul>
<b>Composted Manure</b>	<ul style="list-style-type: none"> <li>Reduce material volume up to 50%</li> <li>Nutrients more stable - slow release to plants</li> <li>Lower water quality risk</li> <li>Reduced odor</li> <li>Easier to spread</li> <li>Weeds seeds, parasites and other pathogens greatly reduced</li> <li>Easier to give away or sell</li> </ul>	<ul style="list-style-type: none"> <li>Requires turning or other form of aeration</li> <li>Requires more time and money investment</li> </ul>	<ul style="list-style-type: none"> <li>Must have adequate land to spread composted manure</li> </ul>

*Adapted from Strategies for Livestock Manure Management, WSU King County Extension and King County Dept of Natural Resources and Parks*

The ideal environment in your compost pile requires adequate moisture, oxygen, and a 25:1 ratio of carbon to nitrogen in the composting materials. Bedding materials such as straw, shavings, and sawdust are high in carbon. If your livestock waste has a lot of bedding and very little manure or urine, the carbon to nitrogen ratio will be too high and the compost pile will take more time to break down. In this case, you may need to add some other materials that contain nitrogen, such as grass clippings, coffee grounds or vegetable wastes. These are commonly referred to as green materials and provide a good source of nitrogen to balance out the carbon rich bedding (Table 2). Vegetable scraps may attract pests like rats and mice. These types of nitrogen rich materials may be better suited to [vermicomposting](#), or composting with worms. Meat, dairy products and other fatty food wastes should never be added to your compost

**Table 2: Carbon to Nitrogen Ratios for Common Compost Materials.**

Material		C:N
Green (high in nitrogen)	Grass clippings	15:1
	Food wastes	15:1
	Manure	20:1 - 25:1
Brown (high in carbon)	Leaves	60:1
	Straw	80:1
	Bark	115:1
	Shredded Paper/ Cardboard	170:1
	Wood or sawdust	500:1

pile. On the other hand, if you have mostly manure your mix will be high in nitrogen. Wood chips, fall leaves or other brown materials are good carbon sources which will balance out the carbon to nitrogen ratio (Table 2). Be sure to mix all the materials in well so they are evenly distributed.



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Covering the compost pile keeps it from getting too damp in the winter and dried out in the summer. With all of the rain Clark County receives, it becomes double important to cover a compost pile since saturation can kill the microorganisms in the pile and halt the composting process. Keep the pile as damp as a wet, wrung out sponge.

Microorganisms also require oxygen to decompose materials efficiently. Air can be added to the pile through turning, either by hand or using equipment, such as a tractor. To limit turning, place three or four PVC pipes with holes every 6 inches along the length in the middle of the pile. This helps get air into the middle of the pile as the pipes act like a chimney. Maintaining moisture and oxygen will help the pile heat up enough to kill parasites, pathogens and many weed seeds. The proper carbon to nitrogen ratio will ensure the microorganisms decompose the manure and other materials to produce a valuable resource. Most problems such as bad odor, dry piles and slow decomposition result from issues with moisture, oxygen and the carbon to nitrogen ratio (Table 3).

**Table 3: Troubleshooting the Composting Problems**

Symptom	Problem	Solution
Bad odor	Not enough air	Turn the pile, add more PVC pipes
Bad odor & soggy	Not enough air & too wet	Mix in dry ingredients such as straw, leaves or wood shavings
Pile dry inside	Not enough water	Add water while turning the pile
Pile damp & warm in middle, but nowhere else	Pile is too small	Collect more raw material and mix in well. Small piles do not hold heat.
Pile is damp, smells ok, but is not heating up	Too much carbon material - ratio of carbon to nitrogen incorrect	Mix in some greens, such as grass clippings or fresh manure

### Estimating Storage Needs

The number and types of livestock you have and the type of bedding material used will determine the amount of space required. A few brief calculations will help determine how much manure your animals produce and how much soiled bedding you will need to store. Table 4 provides the volume of manure produced by a 1,000 lb animal for various livestock types. Table 5 provides the volume of bedding per pound of bedding for four main bedding or footing material types. These tables, along with the example calculation below will assist you in estimating storage needs for a six month period.

### Example

Below are sample calculations for manure and soiled bedding storage requirements in cubic feet (ft<sup>3</sup>) for four beef cows using straw bedding over a six month period.

#### Manure Storage Requirements

(Number of animals) x (volume of manure produced over 6 months in ft<sup>3</sup>) = Manure Storage Needs in ft<sup>3</sup>

$$(4 \text{ cows}) \times (184 \text{ ft}^3) = 736 \text{ ft}^3$$

#### Soiled Bedding Storage Requirements

(lbs of bedding used/month) x (Volume (ft<sup>3</sup>) of bedding/lb of bedding) = ft<sup>3</sup> bedding used per month

$$(60 \text{ lbs straw/month}) \times (0.35 \text{ ft}^3 / \text{lb of straw}) = 21 \text{ ft}^3 \text{ of bedding per month}$$

ft<sup>3</sup> bedding / month x 6 months x 0.5 compaction factor

$$(21 \text{ ft}^3 \text{ bedding/month}) \times (6 \text{ months}) \times (0.5 \text{ compaction}) = 63 \text{ ft}^3$$



### Total Storage Needs

(Manure storage needs in ft<sup>3</sup>) +  
(Soiled bedding storage needs in ft<sup>3</sup>)  
= Total Storage Capacity Needed

$$736 \text{ ft}^3 + 63 \text{ ft}^3 = 799 \text{ ft}^3$$

### Storage/ Compost Bin Size

Dimensional lumber at 8 feet long in a square bin = 8 ft x 8 ft = 64 ft<sup>2</sup> size  
of one bin

$$(\text{Total storage needs}) / (\text{Size of one bin in ft}^2) = \text{height of storage bin}$$

$$799 \text{ ft}^3 / 63 \text{ ft}^2 = 12.5 \text{ feet}$$

Three bins about four feet high each will handle manure and bedding from the four beef cows over six months.

**Table 4: Manure Volumes Produced by Animals**

Animal	Volume Per Day (ft <sup>3</sup> )	Volume in Six Months (ft <sup>3</sup> )
Beef Cow	1.02	184
Horse	0.81	146
Chickens	0.96	173
Sheep	0.63	113
Goats	0.63	113
Swine	0.73	131
Alpaca/Llama	0.68	122
Ducks	0.73	131

**Table 5: Volume of Common Bedding Materials**

Bedding Type	Volume (ft <sup>3</sup> ) Per Pound
Straw (loose)	0.35
Sand or Soil	0.01
Sawdust	0.08
Wood chips/shavings	0.11

### Location

Select a level, dry area to keep mud and runoff to a minimum and make chores easier. Observe where runoff moves across your property. Do not locate manure storage on sloped ground, in low or wet areas, or in drainage ways. Divert roof runoff away from manure storage. Swales, shallow vegetated ditches, or berms, small vegetated mounds of soil, are two methods for diverting rainwater around storage areas. Further information is available from the factsheet [Improving Drainage](#). Consider distance to property lines, surface water and drinking water sources. Maintain at least 100 feet between manure storage and streams, wetlands and well heads. Maintain vegetated grass buffer strips to at least three to four inches in height around the storage area, to collect and filter runoff leaching from the piles. While properly maintained composting produces little odor, you might consider placing the compost bins downwind of homes and outside entertaining areas.

Based on the calculations and your chosen location, you can determine what type of storage system will be needed for storing manure. The type varies from the most simple, a pile with a weighted tarp, to a premium bin with a concrete pad and a roof with gutters and downspouts. A three-bin system is one of the most commonly used, as it allows the compost to be turned as it is moved from one bin to another. A three bin system also provides sufficient space to allow one pile in the compost process, another for fresh waste and a third for finished compost.



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### Tips to Reduce Waste

Use less bedding by cleaning turnouts and stalls carefully. Remove only manure and soiled bedding. Also, most animals do not need a lot of bedding, so use only enough to soak up urine and moisture.

Install rubber mats to provide extra cushion (requires less bedding). The initial investment will produce savings over the long-term and make cleaning easier. Rubber mats provide a level surface for livestock to stand on, decrease dust, and prevent animals from ingesting dirt or sand from the ground, thus reducing health problems.

Try different bedding materials, such as wood pellets or shredded paper, which absorb more than shavings or sawdust. This requires less bedding and storage space, so you'll have less to dispose of and less to purchase. For a comparison of the different bedding types, see the factsheet [Alternative Bedding](#), from the Snohomish Conservation District.

Compost bins can be constructed from landscape timbers which are treated to handle the elements or even from pallets, which can be obtained free from many sources. While pallets provide a flexible, convenient and inexpensive way to build a compost bin, they are not very durable and are unsuited for mechanical turning. Pallet bins can be assembled in any configuration and moved easily if needed and pallets are just the right size (usually 4 feet by 4 feet). Bins can also be constructed from concrete blocks and many other materials. If a tractor will be used for mechanical turning, make sure the walls of the storage bin are sufficiently strong. Plans for manure compost bins can be found on the web and at the WSU Clark County Extension office.



### Disposal Options

Spreading composted manure on a pasture is one of the best ways to dispose of manure. Composted manure



fertilizes and improves the structure of your soils, thus reducing fertilizer costs and minimizing runoff. The easiest way to spread manure on your pastures is to use a manure spreader. A tractor or strong riding lawnmower can pull a ground driven manure spreader. The Clark Conservation District has a [manure spreader](#) available for rent at low cost. Composted manure will have the greatest benefit when plants are actively growing from April to July. Limited volumes may be applied outside of this window if managed carefully to minimize runoff. Spreading compost on wet fields can also cause soil compaction. As a general rule, apply about 1/4 inch at a time in three to four applications throughout the year. For more specific application recommendations, have your composted manure and soil tested. Resources are available to help you determine which soils tests to conduct and how to interpret the results. Dragging the pasture with a harrow will help incorporate the compost or fresh manure more quickly. Harrows can be made from a section of chain link fencing or even an old bed spring.

Spreading fresh manure requires you maintain a good deworming program. Let the manure age on the pasture for a couple of weeks before allowing animals to graze the area. This will not kill parasites, but instead allows the manure to decompose enough that animals will be willing to graze. Most animals naturally avoid grazing in areas with fresh manure.

If you have too much manure for the size of your fields, consider giving it away. Composted manure is often easier to give away or even sell than fresh manure. Posting an ad in the local newspapers or putting out a sign in front of the farm are two ways to advertise manure for free or sale. The Clark Conservation District also



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hosts a free [manure exchange](#) linking those with compost and/or manure with those who want compost or manure. If you are interested in selling your compost, please contact Clark County Health Department Solid Waste Division about local regulations.

### For more information on manure composting contact:

WSU Clark County Extension – [Small Acreage Program](#) (360) 397-6060 x7720

[Clark Conservation District](#) (360) 883-1987

[Clark County Health Department Solid Waste Division](#) (360) 397-8428

[Clark County Master Composter/Recycler Program](#) (360) 882-4567

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*Managing Manure*

