Manure Management Plan Checklist

- ☐ Map of area or farm plan (Hamilton Co. General Viewer, Hand drawn map to scale, plat drawing, etc.) which includes:
  - Proposed site(s) of manure storage or spreading

    Recommendations for the storage locations:

    — on high ground
    — on a pad that can be scraped
    — away from buildings
    — not in paddock/pasture
    — accessible to stable
    — visually remote location
    — downwind of residences
  - Surface Water on or adjacent to property (stream, pond, wetland, lake, drainage ditches, etc.). Include lines showing where water flows during and/or shortly after rain events from the property.
  - Water Well locations (public and/or private)
  - Subsurface tile or surface drain inlets
  - Building location and type
  - Property lines
  - Any land applications areas
    - With Setback distances honored (Table 1 in appendix) –
      - Any on-site manure storage or application should not contribute to groundwater or surface water pollution.
      - Setback distance from adjacent residence or business may be reduced with permission of owner
  - Loading areas or temporary stockpile locations
- ☐ Manure Storage Plan, including:
  - ☐ Maximum number of animals and type of animal(s)
  - ☐ Expected volume of manure/beding produced per month (See appendix)
  - ☐ Storage size
    - Storage for onsite disposal should be large enough to contain 180 days (winter storage & during crop growth) for total animal units current or planned
    - Storage for hauled manure should be based on removal plan plus excess volume for secondary plan
  - ☐ Storage pad, building or container specifications (flooring material, drainage, berms, etc.)
  - ☐ Drainage/Runoff handling (covers, capture & reuse, soil testing, nutrient uptake plantings, etc.)
- ☐ Manure Use/Transfer Plan- A successful use plan will indicate the timing (include season considerations), nutrient breakdown, odor considerations, back up or secondary plan, and emergency spill response.
  - ☐ Transfer plan
    - Location (to field for spreading, offsite hauler, composting system, or other end location)
    - Details (frequency, hauler, end location of manure if not professional hauler)
  - ☐ Application plans (only for onsite application)
    - Spreading location and frequency (ID fields for spreading
    - Composting plans (location(s), specifications, drainage considerations, etc.)
    - Nutrient expectations, Soil testing results, and use (See appendix)
    - Equipment considerations (spreader, loader,
    - Timing of application
  - ☐ Back-up Plan (plan for storage or other use, if primary plan is out of service or unavailable)
  - ☐ Emergency Spill Plan

Additional assistance and resources can be provided by the Hamilton County Soil and Water Conservation District. Email soil.water@hamiltoncounty.in.gov , visit hamiltonswcd.org , or call (317) 773-2181 for assistance or information

APPENDIX

Manure in the Environment

Ensuring that manure application does not degrade water quality should be a primary goal in developing any manure storage and land application system. Pollutants in manure include pathogens, nutrients (particularly phosphorus and nitrogen), and organic material that can deplete oxygen in surface waters.

The nutrients in manure that boost plant growth can be a pollution hazard if the manure is improperly handled. For example, if manure is overapplied to fields, nitrogen in the form of nitrates can move into the soil and eventually into groundwater, a major source of drinking water for many rural homes and communities. Consumption of water with high nitrate levels can reduce the oxygen-carrying capacity of blood (methemoglobinemia). Nitrate consumption has also been linked to cancer. Risks are higher near shallow wells used for drinking water.

Manure also contains phosphorus. When phosphorus enters lakes, rivers, and other surface waters, it stimulates the growth of algae, aquatic plants, and other vegetation. One pound of phosphorus can produce up to 500 pounds of aquatic plants. When these plants decay, they reduce oxygen to levels where many fish species cannot survive. Generally, phosphorus moves into surface waters when manure applied or stored on the soil surface is moved laterally, usually by rainstorms, into a drainage flow system toward the water. Even manure that has been worked into the soil can be a concern if the soil erodes into the water body throughout the year.

Surface waters like rivers, lakes, and streams can be polluted if manure runs off the land surface or reaches tile drains (from open tile intakes or through cracks in dry, fractured soil). The risk is particularly high when manure is applied to land sloping toward a nearby water body or tile intake. Setbacks from surface waters are needed, especially if the slope is steep, if there is little or no plant residue on the surface, or if the ground is frozen or saturated. Buffer strips are strips of land adjacent to water bodies that help to remove and capture excess nutrients. These are highly encouraged in planning you manure application and storage.

Selecting an appropriate site to store and apply manure can directly affect the success of your animal operation. A producer should select a site that can optimize use of manure nutrients and reduce the risk of expensive environmental problems and adverse public relations.

Table 1: Setback Distances

Feature	Manure Storage or Composting Location	Solid Surface Spreading	Injection or Single Pass Incorporation	Liquid Incorporation (w/in 24 hrs)	Liquid Surface Application <6% Slope or with Crop Residue	Liquid Surface Application > 6% Slope
Public Water well & intake structures	500’	500’	500’	500’	500’	500’
Private Well	100’	100’	100’	50’	100’	100’
Surface Water	100’	100’	50’	50’	50’	50’
Drainage inlets	50’	50’	15’	50’	100’	200’
Property Lines	50’	10’	5’	10’	50’	50’
Public Roads	50’	10’	25’	10’	50’	50’
Residence or place of business*	200’	100’	50’	50’	50’	50’

***** Distance may be reduced with written permission of owner

Table 2: Daily manure production and characteristics, as-excreted (per head per day)[a].

Values are as-produced estimations and do not reflect any treatment. Use these values only for planning purposes. The actual characteristics of manure for individual situations can vary ± 30% or more from table values due to genetics, dietary options and variations in feed nutrient concentration, animal performance, and individual farm managment.

	Size[a]	Total manure[b]			Water[c]	Density[c]	TS[d]	VS[c]	BOD_5	Nutrient content		
Animal	**(lbs)**	**(lbs)**	**(cu ft)**	**(gal)**	**(%)**	**(lb/ft³)**	**(lb/day)**	**(lb/day)**	**(lb/day)**	**(lbs N)[d]**	**(lbs P_2O_5)[d]**	**(K_2O)**
Dairy												
Calf	150	12	0.18	1.38	88	65	1.4	1.2	0.19	0.06	0.01[c]	0.05
	250	20	0.31	2.30	88	65	2.4	2.0	0.31	0.11	0.02[c]	0.09
Heifer	750	45	0.70	5.21	88	65	6.7	5.7	0.69	0.23	0.08[c]	0.23
	1,000	60	0.93	6.95	88	65	8.9	7.6	0.92	0.30	0.10[c]	0.31
Lactating cow	1,000	111	1.79	13.36	88	62	14.3	12.1	1.67	0.72	0.37[c]	0.40
	1,400	155	2.50	18.70	88	62	20.0	17.0	2.34	1.01	0.52[c]	0.57
Dry cow	1,000	51	0.82	6.14	88	62	6.5	5.5	0.75	0.30	0.11[c]	0.24
	1,400	71	1.15	8.60	88	62	9.1	7.7	1.04	0.42	0.15[c]	0.33
	1,700	87	1.40	10.45	88	62	11.0	9.3	1.27	0.51	0.18[c]	0.40
Veal	250	6.6	0.11	0.79	96	62	0.26	0.11	0.04	0.03	0.02	0.05[d]
Beef												
Calf (confinment)	450	48	0.76	5.66	92	63	3.81	3.20	1.06	0.20	0.09	0.16
	650	69	1.09	8.18	92	63	5.51	4.63	1.54	0.29	0.13	0.23
Finishing	750	37	0.59	4.40	92	63	2.97	2.42[d]	0.60	0.27	0.08	0.17
	1,100	54	0.86	6.46	92	63	4.35	3.55[d]	0.89	0.40	0.12	0.25
Cow (confinment)	1,000	92	1.46	10.91	88	63	11.0	9.38	2.04	0.35	0.18	0.29
Swine												
Nursery	25	1.9	0.03	0.23	89	62	0.21	0.17	0.06	0.02	0.01	0.01
	40	3.0	0.05	0.37	89	62	0.33	0.27	0.10	0.03	0.01	0.02
Finishing	150	7.4	0.12	0.89	89	62	0.82	0.65	0.23	0.09	0.03	0.04
	180	8.9	0.14	1.07	89	62	0.98	0.78	0.28	0.10	0.04	0.05
	220	10.9	0.18	1.31	89	62	1.20	0.96	0.34	0.13	0.05	0.06
	260	12.8	0.21	1.55	89	62	1.41	1.13	0.41	0.15	0.05	0.08
	300	14.8	0.24	1.79	89	62	1.63	1.30	0.47	0.17	0.06	0.09
Gestating	300	6.8	0.11	0.82	91	62	0.61	0.52	0.21	0.05	0.03	0.04
	400	9.1	0.15	1.10	91	62	0.82	0.70	0.28	0.06	0.04	0.05
	500	11.4	0.18	1.37	91	62	1.02	0.87	0.35	0.08	0.05	0.06
Lactating	375	17.5	0.28	2.08	90	63	1.75	1.58	0.58	0.17	0.11	0.13
	500	23.4	0.37	2.78	90	63	2.34	2.11	0.78	0.22	0.15	0.18
	600	28.1	0.45	3.33	90	63	2.81	2.53	0.93	0.27	0.18	0.21
Boar[c]	300	6.2	0.10	0.74	91	62	0.57	0.51	0.20	0.04	0.03	0.03
	400	8.2	0.13	0.99	91	62	0.75	0.67	0.26	0.06	0.05	0.05
	500	10.3	0.17	1.24	91	62	0.94	0.84	0.33	0.07	0.06	0.06
Poultry												
Broiler	2	0.19	0.003	0.023	74	63	0.050	0.038	0.011	0.0021	0.0014	0.0010
Layer	3	0.15	0.002	0.017	75	65	0.037	0.027	0.008	0.0026	0.0008	0.0012
Turkey (female)	10	0.47	0.007	0.056	75	63	0.117	0.088	0.034	0.0078	0.0051	0.0034
Turkey (male)	20	0.74	0.012	0.088	75	63	0.186	0.139	0.054	0.0111	0.0074	0.0048
Duck	4	0.44	0.007	0.053	73	62	0.118	0.089	0.016	0.0043	0.0034	0.0026
Sheep												
Feeder lamb[c]	100	4.1	0.06	0.5	75	63	1.05	0.91	0.10	0.04	0.02	0.04
Horse												
Sedentary	1,000	54.4	0.88	6.56	86[d]	62	7.61	6.5	1.52	0.18	0.06	0.06[d]
Intense exercise	1,000	55.5	0.90	6.70	86[d]	62	7.78	6.6	1.56	0.30	0.15	0.23[d]

TS = total solids; VS = volatile solids; BOD_5 = the oxygen used in the biochemical oxidations of organic matter in five days at 68 F, which is an industry standard that shows wastewater strength.

[a] Use linear interpolation to obtain values for weights not listed in the table.

[b] Calculated using TS divided by the solids content percentage.

[c] Based on MWPS historical data.

[d] Values calculated or interpreted using diet based formulas being considered for the ASAE Standards D384: *Manure Production and Characteristics*.

Table 3. Density of bedding materials.

a. Loose bedding.	
Material	**Density (lbs per cu ft)**
Straw	2.5
Wood Shavings	9
Sawdust	12
Sand	105
Non-legume hay	4
Alfalfa	4
b. Baled bedding.	
Material	**Density (lbs per cu ft)**
Straw	5
Wood Shavings	20
Non-legume hay	7
Alfalfa	8
c. Chopped bedding.	
Material	**Density (lbs per cu ft)**
Straw	7
Newspapers	14
Non-legume hay	6
Alfalfa	6

Values are approximate.

Table 4. Absorption properties of bedding materials.
Approximate water absorption and density of dry bedding (typically 10% moisture).

Material	Water absorption (lbs water absorbed per lb bedding)
Wood	
Tanning bark	4.0
Fine bark	2.5
Pine	
Chips	3.0
Sawdust	2.5
Shavings	2.0
Needles	1.0
Hardwood chips, shavings or sawdust	1.5
Shredded newspaper	
	1.6
Corn	
Shredded stover	2.5
Ground cobs	2.1
Straw	
Flax	2.6
Oats	2.5
Wheat	2.2
Hay, chopped mature	
	3.0
Shells, hulls	
Cocoa	2.7
Peanut, cottonseed	2.5

Values are approximate.

Example Manure volume produced by 1 horse per month:

From the tables above. If your horse is stalled: for every 1 lb. of manure add 0.3 lbs. wood shavings

					Nutrient content, lbs./day		
Source	**Size, lbs.**	**Density, lbs/ft^3**	**lb./day**	**ft^3/day**	**N**	**P_2O_5**	**K_2O**
Horse (Ave. sedentary & exercised)	**1,000**		**55**	**0.90**	**0.270**	**0.117**	**0.252**
Wood Shavings	Based off 1000 lb horse	9	16.5	1.83			

1,000 lb. horse = 55 lbs. manure/day
55 lbs. manure X 30 days = **1,650 lbs. of manure/month/horse**
1,650 lbs. of manure/month/horse x 0.3 lbs./lb. of manure = 495 lbs. shavings
OR 16.5 lbs. manure/day x 30 days = 495 lbs
1,650 lbs. manure/month + 495 lbs. shavings **=**
2,145 lbs. feed stocks (manure + shavings)/horse/month
-*Pro-rate volume produced to the specific weight of your animal*.
1,000 lb. horse = 55 lbs. of manure produced/day
1,000 lb. horse / 100 lbs. of body weight = 10
55 lbs. of manure produced /10 = 5.5 lbs. per 100 lbs. of body weight
800 lb. horse (8 x 5.5 lbs. per 100 lbs. of body weight) = 44 lbs. of manure per day

Nutrient

The typical key nutrients involved with nutrient balance are Nitrogen (N), Phosphorus (P), and Potassium (K) as they tend to have the greatest impact on soil health and growth of a pasture/crop. This is where an analysis of the soil and manure become important. Testing the soil will help to give an indication of the soils nutrient levels while testing the manure shows the nutrients that can potentially be applied to a pasture/crop. Applying manure to meet the N needs of a crop is ideal, but if the nutrient saturation in the soil has too much P, this can result in loss of nutrients via runoff due to the soil being unable to retain the nutrients and crops not utilizing enough of the nutrients. This is where economic and environmental concerns come into play. Let's take a look at an example.

In figure 1 below, the removal of nutrients from the soil of orchardgrass is shown and in figure 2, the amount of nutrients found in horse manure. The balance of phosphorus needed for orchardgrass with horse manure is shown in figure 3.

These figures show that when applying horse manure to meet the soil phosphorus replacement needs after orchardgrass is grazed (harvested), the nitrogen needs of the soil may not be met. This is why it is important to have an understanding of the dynamics of how the nutrients in manure (fertilizer source) interact with the crop or grass being grown and the soil. In being consistent in manure utilization practices, this ultimately builds up the organic matter in the soil, which produces a healthier crop/grass yield.

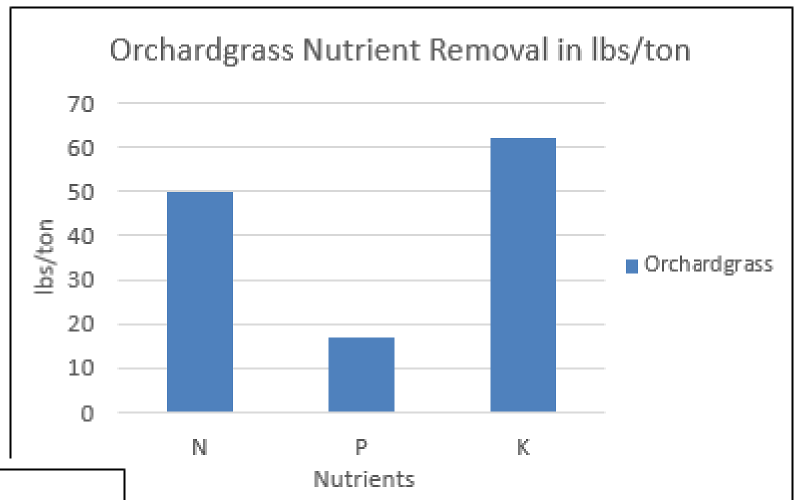

Figure 1: Orchardgrass nutrient removal of nitrogen (N), phosphorus (P), and potassium (K) in lbs/ton

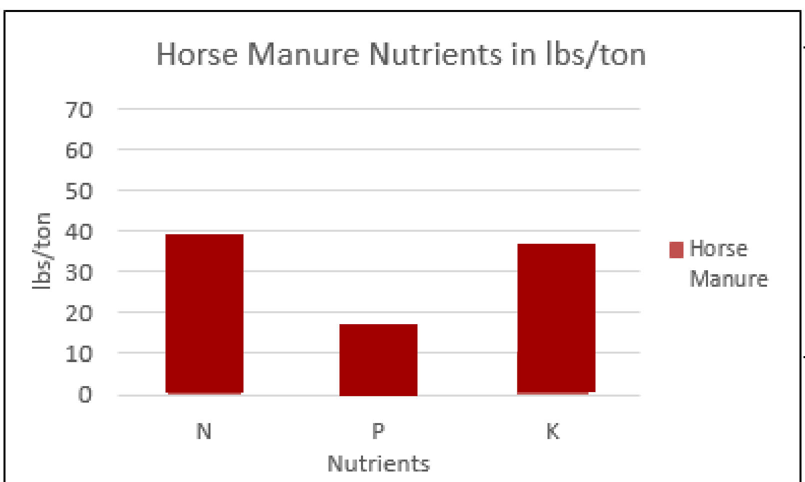

Figure 2: Horse manure nutrients (nitrogen – N, phosphorus – P, and potassium – K) in lbs/ton

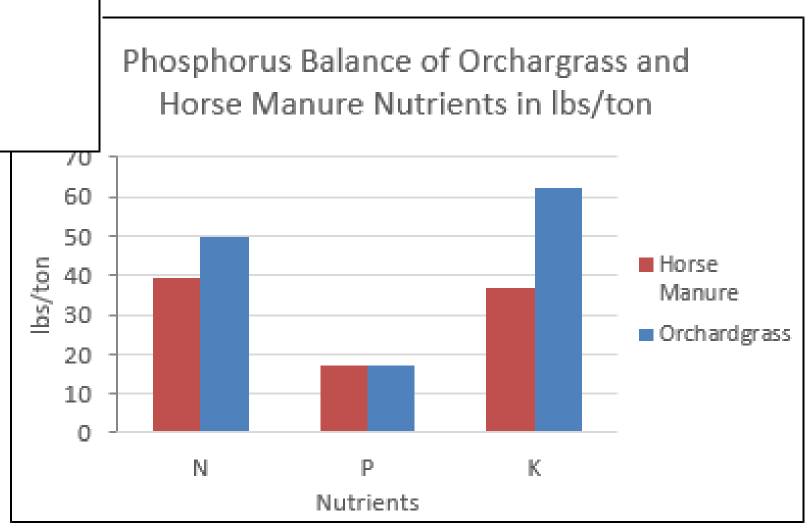

Figure 3: Phosphorus balance of orchardgrass and horse manure nutrients (nitrogen – N, phosphorus – P, and potassium – K) in lbs/ton

In order to avoid overloading the soil with P, the following should be considered any time manure is to be applied to a pasture or crop:

- Fields over 150 ppm of P – no manure application is allowed
- Fields between 75 to 150 ppm P – manure application should be based on crop removal
- Fields below 75 ppm – manure applied to meet crop N needs

Even if you are not trying to necessarily match crop needs, but are applying to a pasture, it is still important to garner a soil and manure analysis to prevent over saturation of nutrients in the soil. This is also where rotational grazing can be important and a valuable resource to keep the soil and, consequently the pasture, healthy.

Animal Manure as a plant resources (ID-101): https://www.extension.purdue.edu/extmedia/ID/ID-101.html (Purdue publication)

Calculate manure application rates for each crop nutrient needed by dividing the available nutrient level in the manure source into the crop nutrient level needed per acre.

For example, if a corn crop required 150 lb plant available N per acre and the liquid manure source contained 23 lb of available N per 1,000 gal, then 6,522 gallon application rate (150 lbs N/ 23 lbs N/ 1000 x 1,000) is needed.

Similar calculations can be made for P and K crop needs. AMANURE computer program for more detailed information on calculating application rates. Or this publication:

Calculating Manure and Manure Nutrient Application Rates (AY-227)
https://www.extension.purdue.edu/extmedia/AY/AY-277-W.html (Purdue publication)

<u>Manure Transfer</u>

There are also options to move manure off the farm, which may be necessary if nutrient concentrations in the soil are too high:

- Compost and sell manure
- Sell manure as is
- Give manure away to those who can utilize the manure
- Large dumpsters

<u>Example Emergency Spill Response</u>

Should a spill occur, here are the spill response steps that should be followed:

- Human safety first – always the number one priority. Make sure that everyone involved in the situation is safe and has received medical attention, if needed
- Control the spill – the source of the spill
- Contain the spill – It is best to keep the manure in one area if possible and prevent it from flowing into nearby surface waters. Ideas or considerations for this may include damming up an area using dirt or utilizing straw/hay bales as a buffer to absorb manure
- Contact the appropriate authorities – Indiana Department of Environmental Management (IDEM): 888-233-7745; Regulated Drains or Stormwater Drain impacts: 317-776-8495
- Clean-up the spill
- Document the spill – this serves to protect you as it is proof that you made a concerted effort to minimize any associated environmental risk.