



**Kansas Department of
Health & Environment**

DESIGN STANDARDS FOR CONFINED FEEDING FACILITIES



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October 20, 2006

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I. Introduction

This document has been prepared consistent with Kansas Statutes Annotated (K.S.A.) 65-171h, which authorizes and empowers the Secretary of Health and Environment to “develop, assemble, compile, approve, and publish minimum standards of design, construction, and maintenance of sanitary water and sewage systems.” The level of environmental protection contained herein is consistent with the requirements of State and Federal laws and regulations. These standards supersede previous versions known as the “Design Standards for Confined Livestock Feeding Operations”.

These Design Standards provide the minimum requirements for waste control systems for new or modified confined feeding facilities, which are subject to Kansas Department of Health and Environment (KDHE) approval. These standards also apply to all expansions of existing facilities subject to approval by KDHE. These standards do not apply to those portions of the facility that existed prior to the adoption of these standards unless the existing portions are being modified or changed. KDHE should be notified early in the planning process whenever modifications to existing components of a confined feeding facility are being considered. Early coordination with KDHE will minimize the potential for redesign of the modifications.

These Design Standards are based upon the climate, topography, geology, management practices and waste utilization common to Kansas in order to achieve a desirable level of protection for public health and the environment. The waste control systems have four components: 1) waste production, 2) waste collection, 3) temporary storage and/or treatment, and 4) waste utilization. Each component has its own set of criteria which must be considered for each and every site. While providing minimum standards for existing technology, flexibility has been provided through the variance process to utilize new or innovative technologies (refer to Section VIII, Variance Procedure). Consultants may use book values from accepted reference publications, however, they must use the most recent version available. Each book value used shall be referenced.

For the purposes of these Design Standards, a confined feeding facility is any lot, pen, pool, or pond which is used for the confined feeding of animals or fowl for food, fur or pleasure purposes, which is not normally used for raising crops, and in which no vegetation intended for animal food is growing. “waste control system” shall include “animal waste management system” as per K.A.R. 28-18-1(c) and “swine pollution control system” as per K.A.R. 28-18a-1 (aaa).

The Kansas Agricultural and Related Waste Control/NPDES permit does not relieve the applicant from complying with other federal, state, or local requirements which may apply. Other Federal, State and local permits may be required; i.e. water rights, water structures, animal health, 404-discharge of dredge material, wetlands, threatened & endangered species, and local building and zoning permits, etc.

Terms such as “should” or “recommend” indicate the criterion or guideline is important and is to be given due consideration, but also indicates KDHE acknowledges that site-specific deviations may be necessary. Terms such as “must” and “shall” are used where a design practice has been sufficiently developed to delineate it as a requirement or where safeguarding of the public health and environment justifies a definitive action. Even the terms “must” and “shall” are not absolutes in that the Design Standards have also provided flexibility for new,

innovative or equivalent technology through the variance process. These Design Standards are not intended to restrict the development or use of innovative ideas, new products, or methods meeting the same intent of the requirement.

II. Plans and Specifications

A. General

This section outlines the documentation required for plans and specifications submitted to the Department for review. Plans and specifications include all drawings, calculations, construction details, specifications, and narratives which describe the construction, operation and management of the confined feeding facility's waste control system. The name, firm address, phone number and signature of the designer shall be included. Four copies of all documents shall be submitted.

There shall be no significant deviation from the plans approved by the Department unless amended plans showing the proposed changes are submitted and approved. The designer should consider incorporating an advisory statement in the plans to minimize the potential that the designers plans would be inadvertently modified during construction in the event the designer is not retained through the construction period.

B. Narrative

Several portions of the plans are best presented in narrative form. These include the description of the confined feeding facility operation, existing and planned buildings and pens or lots, the waste control system design and components (basins, ponds, etc.), the operation and maintenance requirements necessary to conform with the design, and the manure or waste utilization plans if the facility is not required to implement a nutrient management plan. Any short and/or long term plans for expansion or phased construction should be included.

1. Confined Feeding Facility

This section is a general description of the confined feeding facility and how it operates. It includes a description of the type of livestock, maximum number of head, average weight or weight range of the animals, production cycles, confinement time and the types of wastes produced. A brief description of the waste control system shall be included. A description of the entire (existing and proposed) animal waste management system should be included.

2. Waste Control System Design

This section consists of the waste control system design calculations and related documentation. Items to be included are:

a. Required Storage Volume Calculations

Calculations documenting the required storage volume shall be included. The calculations should address and account for any applicable process wastes as defined in K.A.R. 28-18-1(hh)(1) and/or K.A.R. 28-18a-1(nn)(1) and sediments accumulated during the life of the waste control system.

b. Proposed Storage Volume Calculations

Calculations documenting the proposed or the design storage volume shall be provided. An elevation/surface area/volume storage table shall be included using one (1) foot increments.

c. Design Storm Documentation

The amount of precipitation associated with the design storm; surface areas, drainage areas, evaporation values, runoff values, etc. used to calculate the amount of direct rainfall on any retention structures, retention evaporation volumes and storm water runoff.

d. Driller's/Geologist's Logs

Driller's/Geologist's logs of test borings or excavations from the site(s), results of any permeability testing of the soil and any laboratory recommendations for soil amendments, and depth to groundwater information shall be included.

This documentation shall be presented for each waste storage structure in the system. Design documentation for other system components (e.g. sediment basins, channels, terraces, diversions, etc.) must also be submitted to the Department. Documentation shall show that the design conforms to these Design Standards.

3. Operation and Utilization Plan

This section only applies to those facilities that are not required to develop and implement a Nutrient Management Plan (generally those facilities with less than 1,000 animal units).

a. Operation and Maintenance

This plan provides operation and maintenance information on each system component. Indicate how the waste structures are to be operated, including normal operating levels and if applicable, December 1 operating levels as well as pump-out schedules. Maintenance such as sediment removal, equipment operation, mowing and maintenance of vegetation, vermin control and dead animal handling/disposal are items typically included.

b. Manure/Waste Utilization

This section provides details on how wastes will be managed and utilized after production and storage. Items generally included are:

- i. Types of wastes applied (solid, slurry, liquid).
- ii. Application method used (e.g. mechanical spreading, tank wagon, sprinkler, incorporation method).
- iii. Estimated frequency and rate of waste application and requirements for incorporation of waste into the soil.
- iv. Practices or methods used to prevent pollutants from entering the waters of the state.
- v. Application area required as well as the total area available.
- vi. How the permittee anticipates using the compost from any manure and/or dead animal composting operations.

Note: If desired, applicants may use Manure/Waste Management Plan forms available from the Department to complete and/or supplement plans specific to their facility.

4. Nutrient Management Plan

This section applies only to facilities required by regulation or permit condition to develop and implement a Nutrient Management Plan (NMP) (generally facilities with 1,000 or more animal units).

The NMP shall be prepared in accordance with the latest edition of the Kansas Technical Standard – Nutrient Management.

Applicants for swine facilities with 1,000 or more animal units must submit a Manure Management Plan, Dead Swine Handling Plan and Nutrient Utilization Plan as required in Kansas Statutes and Administrative Regulations. These plans are considered a portion of the materials needed to meet the requirement of a NMP.

5. Subsurface Monitoring Plan

Each facility required by the Department and each swine facility with an animal unit capacity of 3,725 or more are required by K.S.A. 65-1,181 to develop and implement a subsurface or groundwater monitoring plan. The plan shall be submitted to the Department for approval before implementing the plan.

6. Other Information

Additional information that may be required to be submitted with the permit application could include the following.

- a. If needed to meet separation distance requirements, copies of all habitable structure separation distance waivers showing the register of deeds seal and/or book and page where the waiver is recorded.
- b. If needed to meet separation distance requirements, copies of all property line separation distance waivers.
- c. For swine facilities Public Notice Documentation is required including a publisher's affidavit or proof of publication, and copies of return receipts from mailings to habitable structure owners and local officials.

C. Location Map

Map(s) shall be submitted which show the location of the confined feeding facility and waste control system. U.S.G.S. topographic maps and/or aerial photos with scale of 1 inch = 2,000 feet (1:24,000) or larger are acceptable for this purpose.

In addition to the confined feeding facility and the waste control system, features such as those subject to separation distance requirements shall be shown on the map(s).

These include, but are not limited to:

1. Facility boundaries in relation to surrounding communities within one (1) mile of the facility.
2. Facility boundaries (proposed and existing) and adjacent property lines.
3. Location of habitable structures.
4. Names and mailing addresses of owners of land and habitable structures within 1 mile. Appendix 2 and Appendix 2a of the application may be used.
5. Water resources (active, abandoned and/or plugged water wells, public water supply pipelines, reservoirs, streams, ponds, wetlands, etc.) within 600 feet of the facility boundary.
6. 100-year floodplain boundaries (if delineated).
7. Active, abandoned, or plugged natural gas and oil wells within 600 feet and features such as pipelines, cables, railroads, highways, etc.
8. The location of the area(s) and acres available for waste utilization.

The property lines, water resources and other features may be shown on the plan view of the facility.

D. Drawings and Details

1. Plan Views

This consists of detailed drawing(s) with contour lines showing the location(s) of all existing and proposed waste control components (lagoons, storage ponds, pits, tanks, sediment basins, channels, terraces, diversions, staff gauges/level measuring devices, etc.) plotted to scale. The dimensions of all waste control structures shall be shown. Include the inside dimensions (width, length, etc.) at the bottom or top of each structure. The location of soil boring test holes or excavations shall also be plotted and labeled on plan view drawing(s).

Drawing scales shall be at least 1 inch = 300 feet. Scales of 1 inch = 50 or 100 feet, are recommended. A bar scale and a north arrow shall be shown on each drawing. The legal description(s) of the facility shall be shown on a drawing and at least one component of the waste control system shall be referenced to a section corner, bench mark or legal reference point. The location of any permanent or temporary bench marks shall be shown.

2. Cross Sections

Cross sections of all waste control system structures (lagoons, pits, ponds, tanks, sediment basins, diversions, etc.) shall be included as a part of the drawings. Depths, widths and side slopes, shall be dimensioned. The original ground line shall also be shown. Any pipe spillway, chute or drop spillway or similar structure shall be shown along with pertinent elevations and grades. Permanent or temporary bench marks may be used as elevation reference points. All elevations shall be relative to the referenced bench mark.

3. Profile Views

Profile views of diversions, collection channels, transfer pipes, etc., shall be included. The original ground line and its elevation shall be included. All elevations shall be relative to the referenced bench mark.

4. Detailed Views

Include detailed views of components such as pipe inlets, outlets, staff gauges, cleanouts, etc.

E. Specifications

Written specifications shall be provided for each of the materials and construction methods and testing procedures pertaining to the waste control system. The use of applicable standardized specifications developed by technical entities (e.g. American Society for Testing and Materials, American Society of Agricultural Engineers, USDA Natural Resources Conservation Service (NRCS), etc.) is acceptable.

III. Site Location Considerations

A. General

Sites selected for confined feeding facilities must be located such that animal manure and runoff can be collected, transported, stored, and utilized in a manner that does not result in degradation of land or water resources. This section details the minimum separation distance requirements from habitable structures, property lines, and water resources.

B. Separation Distances from Habitable Structures

1. Habitable Structures

For all species except swine, the minimum required separation distance is measured from the perimeter of the confined feeding facility to the closest habitable structure. For swine, the minimum required separation distance is measured to the closest non-owned habitable structure. Applicable habitable structures are defined by K.S.A. 65-171d(c)(5).

2. Separation Distance Determination

The minimum required separation distance is determined based on the maximum permitted animal unit capacity of the confined feeding facility. Animal units are based on the species and other relevant factors as defined in K.S.A. 65-171d(c)(3), except that:

- a. Animal units for chicken facilities with systems other than liquid manure systems, shall be calculated at 0.0122 animal units per head for laying hens and 0.008 animal units per head for chickens other than laying hens.
- b. Animal units for facilities with exotics (such as Ostriches, Emus, Llamas, Dogs, etc.) shall be calculated based on dividing the mature animal body weight by 1000 to obtain the animal unit per head.

The minimum separation distance for newly proposed and/or new expansions of confined feeding facilities shall be as per K.S.A. 65-171d(h)(1) through (3).

Separation distances shall not apply or may be reduced for all species as per K.S.A. 65-171d(i) and (j).

C. Separation Distances from Property Lines

A minimum separation distance of 100 feet shall be provided between property not owned by the facility and the perimeter of the new or expanding confined feeding facility.

When the confined feeding facility or expansion is located adjacent to a roadway, access road, alleyway, or railroad with a permanent right-of-way or easement held or authorized by a unit of government, then the right of way opposite the facility shall be the point of measurement. The distance measurement for all other roads shall be from the centerline of the road or the property line should the road be abandoned which ever is closer to the facility.

D. Separation Distances from Water Resources

1. Surface Water

New confined feeding facilities and/or waste control systems shall not be built in any stream, river, lake, reservoir, or jurisdictional wetland. New confined feeding facilities must be located down-gradient from surface water drinking water supplies unless adequate provisions are provided to prevent contamination from surface or subsurface drainage from the confined feeding facility. There shall be a minimum of 200 feet separation from public water supply reservoirs.

Surface water separation distance requirements do not apply to freshwater ponds which are wholly within the applicants property as stated in K.S.A. 65-171d(d).

a. All Species Except Swine

For water resources which are not used as a public water supply sources, a minimum of 100 feet separation shall be provided from ponds, reservoirs, streams and wetlands.

b. Swine

Separation distances for facilities with swine shall adhere to K.S.A. 65-1, 180 and any amendments thereto.

2. Flood Protection

Confined feeding facilities and waste management systems shall not be located in the 100-year, 24-hour floodplain (inundated by a storm having a 1% chance of being equaled or exceeded in any one year) unless adequate protection measures are provided (e.g. levees, diversions, etc.).

3. Groundwater

Each new waste control system and each expanded portion of an existing waste control system shall meet the groundwater separation distance requirements established in K.A.R. 28-18-17 and 28-18a-33.

There shall be a minimum of 100 feet separation from active water supply wells (and 25 feet from public water supply pipelines). Water supply well(s)

located less than 100 feet from a confined feeding facility may be exempted if used only for livestock water supply and if protected from surface water contamination.

Monitoring wells if required, shall be installed per K.A.R. 28-30-1 *et seq.*, using a licensed water well contractor.

E. Geologic Investigation

When necessary, the Department may require a site investigation, such as when the confined feeding facility is to be located in a sensitive groundwater area, or the depth to groundwater or the composition of the soil at the location is unknown, or similar situation. Site investigations for earthen retention structures will consist of borings or equivalent excavations to a depth of at least 10 feet below the lowest elevation of a waste storage structure, or where impenetrable bedrock is encountered, whichever is less. For swine facilities with more than 3,724 animal units, borings or equivalent excavations to a depth of at least 25 feet below the lowest elevation of a waste storage structure is recommended.

At least two borings or equivalent excavations shall be performed for each three (3) acres occupied by a waste storage structure; a minimum of two borings are required regardless of size. The area occupied by the structure is the surface area measured at the top elevation.

The minimum requirements for geologic site investigations are:

1. Logging all borings or investigations using the Unified Soil Classification System.
2. Recording the ground surface elevation and location of each boring. Elevation may be based upon project datum (bench mark).
3. Measuring and recording static groundwater levels after the levels have stabilized. (In the event that no water is readily evident, the boring or excavation shall be left open a minimum of 24 hours, or more as required by the Department. The required time frame will depend upon the soil profile, and soil survey or lithology and shall be selected in order to adequately determine the presence or lack of groundwater. The less permeable the soils, the greater the time requirement. If no water is observed after the required time period, a determination of "no groundwater" shall be entered. Groundwater wells in the vicinity may be accepted by the Department as proof of local groundwater levels on a case-by-case basis.)
4. Filling of all investigation borings or excavations in accordance with K.A.R. 28-30-1 *et seq.*
5. A brief summary indicating the likely impacts the observed geologic conditions will have on the performance of the waste storage structure.

IV. Minimum Design of Wastewater Control Structures

A. General

The design storm for a facility is based upon the size of the facility and if applicable the federal effluent limitation guideline for the type of livestock at the confined feeding facility. All facilities with a federal animal unit capacity of less than 1,000 shall use a 25-year, 24-hour storm for the basis of design. All facilities required to have an NPDES permit shall use the criteria specified in 40 CFR 412.

Collection and storage systems shall be designed to contain and/or convey: (1) surface drainage from open lots, (2) manure and wastewater from confinement areas, and/or (3) other flows such as dry weather wastewater accumulations. The channels, ditches, berms, culverts, pipelines, dikes, terraces, pits, tanks, ponds, lagoons, and other devices used to contain and/or convey runoff and/or pollutants have site specific conditions. Drains and pipes are to be designed to facilitate cleanout, convey daily and maximum flows, and minimize solids deposition.

Unpolluted extraneous drainage from areas adjacent to the confined feeding facility may be diverted away from the confined feeding facility. If extraneous drainage is not diverted away, the collection and storage system(s) must be sized to include these flows.

B. Open Channel Structures

All channels, ditches, berms, dikes, terraces, and diversions shall be designed to collect, and convey the peak discharge from the design storm event plus the sediment yield and the maximum daily process wastes without overtopping or failure.

Velocities should be non-erosive (generally less than 2.5 feet per second for extraneous runoff and 1.5 feet per second for polluted runoff) with the structure providing 0.5 foot of freeboard. Earthen side slopes shall be 3 horizontal to 1 vertical (3:1) or flatter.

C. Closed Conduits

Culverts, pipes, and covered channels used to transfer runoff, sediment, and/or process wastes shall be sized to handle the design storm event without causing infringement on the freeboard of other structures in the system. Conduits shall be a minimum of 6 inches in diameter and have a minimum slope of 0.5%. Drain pipes for water tank overflows can be of a less diameter, but must be sized to handle the design flow. Cleanouts should be located at least every 300 feet and at changes in direction and/or grade.

Conduit slopes should not exceed 10%. Designs should consider measures which will prevent plugging of the inlet and which allow cleanout of the pipe or conduit (i.e. removal of sediment and waste accumulations).

D. Basins and Structures

1. Sedimentation Structures

a. General

The purpose of sedimentation structures is to reduce solids/sludge accumulations in storage structures and facilitate the routine removal of solids/sludge. These standards address two of the most common types of sediment basins, those for removing solids from feedlot runoff (runoff sediment basins) and those for removing solids from process wastes (process waste sediment basins) such as milking centers. All earthen structures shall have side slopes of 3 horizontal to 1 vertical (3:1) or flatter. Sedimentation basins shall have at least one-half (0.5) foot of freeboard at the design condition.

b. Runoff Sediment Basins

Runoff sediment basins shall have capacities to detain the design storm rainfall and runoff in addition to sediment for the design detention period for the design storm, with 0.5 foot of freeboard. The minimum detention period for the structure should be 4 hours. Flood routing procedures should be used to determine the required discharge based upon the detention storage provided. Discharges may be controlled by weirs, orifices, or other devices. Runoff sediment basins should be dewatered as quickly as possible, within a maximum of 10 days after a storm event. The volume allocated to sediment storage shall be the expected annual sediment yield as a minimum. If the sediment basin is not designed to completely dewater, then the basin must have a liner designed in accordance with Retention Structure liner requirements.

c. Process Waste Sediment Basins

Process waste sediment basins should have consideration given to drying of the waste to allow for removal. Each process waste sediment basin should be sized with a minimum capacity of thirty days of process waste flows. Process waste sediment basins shall be lined in the same manner and to the same criteria as retention structures. Consideration should be given to sediment removal equipment and practices to minimize damage to the liner.

2. Retention Structures

Individual or combinations of retention structures must provide the total required storage volumes as outlined in "a. Hydraulic Volume Calculations" and if necessary "b. Biological Volume Calculations", which follow.

a. Hydraulic Volume Calculations

i. Sediment Accumulation

All retention structures serving open lots shall provide for at least the volume of sediment generated in a 10-year period. As an alternative to site-specific information, if a sediment basin precedes the retention structure, the sediment load may be calculated at 0.5 acre-inch per acre of lot area drained. If there is no sediment basin, a minimum of 1.5 acre-inch per acre of lot drained may be used.

ii. Process Waste (Dry Weather Flows) Volume

All retention structures receiving dry weather process wastes (for example overflow waterer discharges, milking parlor discharges, free stall alley flushes silo liquors, and swine building flushes) shall provide for the volume (including bedding, litter, etc.) equal to or greater than the amount of dry weather process waste delivered in a minimum period of 120 days.

The solids volume amount may be reduced up to 20% if the retention structure is preceded by a sedimentation structure or solids separator. In the case of recycle systems, net volumes may be considered.

iii. Net Inflow (Rainfall/Runoff/Evaporation) Volume

Designers of retention structures should give consideration to providing for an additional volume of the December 1 through March 31 of the sum of the volumes produced from:

- Runoff generated from precipitation on any contributing drainage area,
- The precipitation on the structure,
- The evaporation loss on the structure.

For estimating the volume due to precipitation, the area at the top of the structure shall be used. For estimating evaporation loss, the December 1 operating level may be used. The evaporation loss should be calculated using evaporation rates no greater than 70% of the lake evaporation for the county where the facility is located. Lake evaporation values may be obtained through the County Natural Resources Conservation Service Field Office.

A water budget may be used to determine the net inflow volume. At no point in the water budget, shall the sum of the net inflow and process waste volumes be less than zero.

iv. Storm Water Volume

All retention structures shall provide for a volume which will contain the design storm runoff from any contributing drainage area (including extraneous areas) plus the design storm rainfall on the structure.

v. Freeboard

All newly proposed earthen retention structures shall have a minimum of 2 feet of freeboard. All retention structures of non-earthen material, such as concrete or fiberglass, shall provide 0.5 foot of freeboard. Wastewater should not be allowed to encroach upon the freeboard level.

b. Biological Volume Calculations

Some confined feeding facilities generate waste which contains negligible amounts of dilution water from runoff induced rainfall, washdown or flushing, etc. These are primarily facilities with confinement buildings such as swine facilities (with pull-plug systems and/or recycling of wastewater), and dairies without overland flow contributions. Retention structures for these facilities should contain a minimum biological activity volume in order to operate properly. Facilities which dry scrape waste accumulations and/or those with fresh water flush gutters usually will not need a minimum biological volume.

A minimum biological volume should be considered in retention structures at all facilities with 1,000 or more animal units which 1) have swine in confinement buildings, 2) accept dairy parlor wastes, or 3) are required by the Department to provide a minimum biological volume. The biological volume calculation shall be made in addition to the previously stated hydraulic volume calculations. Retention structures shall be sized to always maintain the biological volume while reserving space for any required hydraulic volume(s).

Retention structures shall have a supplemental water source to maintain an adequate volume and to dilute waste inflows. The supplemental water source may be either a surface or groundwater supply and should be capable of delivering sufficient water to maintain the minimum biological activity volume considering peak evaporation. Plans shall include an operational section which identifies supplemental water sources, requirements, and discusses the methods to be employed to initially establish and maintain the minimum water level, and the system for waste utilization.

Single stage retention structures and primary cells in two stage designs for these types of facilities shall be designed for a daily loading rate not to exceed the pounds of volatile solids (V.S.)/1000 ft.³ of retention

structure volume listed in the following table shown for each county in Kansas. The values shown were obtained from Figure 10-22 Anaerobic Lagoon Loading rates by the United States Department of Agriculture, Natural Resources Conservation Service, revised June 1995, Part 651, Agricultural Waste Management Field Handbook.

Biological Loading for Retention Structures: Pounds of Volatile Solids/Day/1000 Cubic Feet

Allen	5.2
Anderson	5.1
Atchison	4.7
Barber	5.3
Barton	4.9
Bourbon	5.2
Brown	4.7
Butler	5.2
Chase	5.0
Chautauqua	5.4
Cherokee	5.4
Cheyenne	4.6
Clark	5.2
Clay	4.8
Cloud	4.7
Coffey	5.1
Comanche	5.3
Cowley	5.3
Crawford	5.3
Decatur	4.6
Dickinson	4.9
Doniphan	4.7
Douglas	4.9
Edwards	5.1
Elk	5.3
Ellis	4.8
Ellsworth	4.9
Finney	5.0
Ford	5.1
Franklin	5.0
Geary	4.9
Gove	4.8
Graham	4.7
Grant	5.1
Gray	5.1

Greeley	4.9
Greenwood	5.2
Hamilton	5.0
Harper	5.3
Harvey	5.1
Haskell	5.1
Hodgeman	5.0
Jackson	4.8
Jefferson	4.8
Jewell	4.6
Johnson	4.9
Kearny	5.0
Kingman	5.2
Kiowa	5.2
Labette	5.4
Lane	4.9
Leavenworth	4.8
Lincoln	4.8
Linn	5.1
Logan	4.8
Lyon	5.0
Marion	5.0
Marshall	4.7
McPherson	5.0
Meade	5.2
Miami	5.0
Mitchell	4.7
Montgomery	5.4
Morris	4.9
Morton	5.2
Nemaha	4.7
Neosho	5.3
Ness	4.9
Norton	4.6
Osage	5.0

Osborne	4.7
Ottawa	4.8
Pawnee	5.0
Phillips	4.6
Pottawatomie	4.8
Pratt	5.2
Rawlins	4.6
Reno	5.1
Republic	4.6
Rice	5.0
Riley	4.8
Rooks	4.7
Rush	4.9
Russell	4.8
Saline	4.9
Scott	4.9
Sedgwick	5.2
Seward	5.2
Shawnee	4.9
Sheridan	4.7
Sherman	4.7
Smith	4.6
Stafford	5.1
Stanton	5.1
Stevens	5.2
Sumner	5.3
Thomas	4.7
Trego	4.8
Wabaunsee	4.9
Wallace	4.8
Washington	4.7
Wichita	4.9
Wilson	5.3
Woodson	5.2
Wyandotte	4.8

3. Design Criteria for Earthen Structures

a. Liners

Liners shall extend over the bottom and side slopes of the interior of the structure to an elevation at least 1 foot above the freeboard level. Liners shall have a finished or compacted final thickness of at least 1 foot. Where consolidated material such as a rock layer is encountered, the liner shall have a final thickness of at least 2 feet. Any areas overexcavated to remove undesirable material such as rock, must be backfilled with compacted material.

i. In-Situ Soil Liners

In-situ soil liners may be acceptable for sites where no groundwater, bedrock or other consolidated material is encountered within the required geologic site investigation. Where this is the case, soils found during the site investigation must be classified as CH, MH, or CL according to the Unified Soil Classification System in order to be used as in-situ soil liners.

ii. Constructed Soil Liners

Constructed soil liners are those which do not conform to the criteria for in-situ soil liners.

During the geologic investigation, soil samples shall be collected, logged and prepared for testing. The samples must be representative of the foundation and perimeter material encountered and any materials which may be used for soil liners.

The soil samples shall be subjected to accepted laboratory tests to determine the materials and construction techniques required to provide adequate permeability. These tests may include, but may not be limited to, moisture-density tests to determine moisture and compaction requirements, soil amendment tests including those to determine the amount of bentonite, chemical dispersants or other materials needed to provide acceptable permeability.

A design must then be developed and documented which determines the amount and type of amendment materials required, if any, the construction techniques required and the projected permeability.

Post-construction permeability tests must be completed and the results submitted to the Department for review.

iii. Synthetic Liners

Synthetic liners shall be installed when the required permeability cannot be achieved and/or when required by the Department. They shall be installed in addition to a compacted soil liner. Synthetic liners shall have a minimum thickness of 40 mils, and a permeability of 1/64 inch per day or less. They shall be designed and installed in conformance with the manufacturers specifications.

b. Embankment Foundation and Fill

Embankment berms shall have a minimum top width of ten (10) feet and shall be constructed of compacted soils essentially void of rock, gravel, sand, organic material, or other porous media. All vegetation shall be removed from the foundation and fill areas prior to the placement of earth fill.

c. Emergency Spillways

Retention structures which have an embankment height of 25 feet or more, or which impound 50 acre-feet (2,178,000 ft³) or more and have a height of 6 feet or more shall have emergency spillways. The height shall be determined by measuring from the lowest elevation of the outside limit of the dam to the top of the dam. Emergency spillways shall be designed in conformance to the Kansas Department of Agriculture, Division of Water Resources requirements.

The crest of each emergency spillway shall be a minimum of one foot above the level associated with the total required design volume.

d. Inlets

All inlets shall be designed to provide erosion protection of impoundment embankments. Splash pads, riprap, or other devices shall be provided as needed.

e. Depths

The maximum design depth of newly proposed waste storage structures, not including freeboard, is 20 feet.

For single cells and primary cells in multiple-cell systems which must contain a minimum biological volume, the minimum depth shall be 8 feet. They shall be maintained with at least a minimum water depth of 5 feet. Secondary cells shall be a minimum of 6 feet deep.

A staff gauge or level measurement device shall be installed in each retention structure (lagoons, ponds, etc.). The device shall be:

- constructed of durable material
- marked in 1-foot (vertical) increments
- marked with zero to coincide with the lowest point of the top of the structure berm

4. Non-earthen Structures

The allowance for sediment accumulation may be reduced to the bottom 6 inches of the water-tight structure so long as agitation and pumping equipment is capable of draining the structure.

a. Concrete Tanks

All concrete manure tanks shall be constructed with reinforced concrete in a water tight manner. Side walls shall be a minimum of 6 inches thick and tank bottoms a minimum of six (6) inches thick. Professional design assistance is required in the design of these watertight structures.

b. Metal, Fiberglass, and Other Storage Vessels

Several manufacturers provide prefabricated storage structures consisting of stave concrete silos, epoxy lined metal tanks, etc. These storage structures shall be of water tight construction and of quality design. These and other designs will be individually evaluated.

5. Solid Waste Storage Structures

a. General

Solid waste storage structures receive scraped or mechanically deposited manure, bedding, litter, etc., for temporary storage before land application, before use in composting facilities, or before final use.

b. Design Criteria

These structure(s) shall be sized to store the expected accumulation of manure, bedding, litter, etc., and the volume of direct precipitation from the design storm plus a 0.5-foot reserve.

The combined volumes of solid waste storage structures, other associated storage structures and temporary storage and/or stacking areas must have the capacity to contain the 120 day solid waste accumulation volume.

Any contaminated leachate and/or runoff from solid waste storage structures must be controlled. If necessary, control structures shall be built to detain runoff.

6. Hoop Structures

Hoop or Deep-bedded structures are partially or totally enclosed units for housing livestock. The units utilize absorbent material (hay, stover, fodder, or straw) spread throughout the floor of the unit. The deep layer of absorbent material soaks up the liquid portion of the manure and dries the semi-solid portion of the manure so the animal excrement can be managed in dry or solid form.

- a. Hoop structures shall have a finished grade of 0.5% slope or less. Extraneous drainage shall be diverted away from the structure. Site grading shall be such that roof and other runoff is directed away from the structure.
- b. Hoop structures must meet the same vertical separation distance to groundwater as feedlots. Structures located in a sensitive groundwater area where groundwater is within 25 feet of the lowest elevation of the structure shall have a compacted soil liner. The compacted soil liner shall be a minimum of 12 inches thick and shall have a hydraulic conductivity no greater than 10^{-7} cm/sec or utilize other materials or methods which provide the same level of protection to the groundwater.
- c. Hoop structures shall be capable of providing a minimum of 120 days of solids storage. Solid waste stockpiles shall be temporary, not to exceed six (6) months. Stockpiles shall be located such that runoff from the stockpiles does not enter or collect adjacent to the structure.

7. Other Structures Not Typically Used in Kansas

From time to time, situations arise which may call for innovative use of methods or structures not covered in these standards such as aerobic lagoons, mechanically aerated lagoons or digesters (methane gas production systems), etc. These will be considered on a case-by case basis. Complete design documentation showing technical references shall accompany the plans and shall describe how the proposed method will provide a level of protection consistent with the intent of these standards and applicable federal and state laws and regulations.

E. Grass Filter Systems

The purpose of grass filter systems is to protect and improve water quality by removing significant amounts of pollutants generated by confined feeding facilities. These systems use the processes of deposition, infiltration, absorption, volatilization, vegetative consumption and decomposition.

Grass filter systems are not suitable for most confined feeding facilities. Suitability generally depends upon the facility's size, setting and process waste characteristics. Grass filter systems are generally limited to facilities with less than 300 animal units. Grass filter systems proposed for facilities with 300 or more animal units will be considered on a case-by-case basis.

Grass filter systems usually consist of at least three components: sediment basin, flow distribution devices and grass filter area. The grass filter is an area of perennial grass used to reduce sediment, organic waste, nutrients and other pollutants from stormwater runoff from confined feeding facilities. The design of each grass filter system should be based upon the most current Kansas NRCS practice standard for Wastewater Treatment Strip (Practice Code 635). The performance objectives of each component are:

1. Sediment Basin
 - a. Have the capacity to store the average annual sediment yield from the lot.
 - b. Detain lot runoff to induce the settling or deposition of solids and nutrients.
 - c. Provide controlled outflow to the grass filter area.
 - d. Detain the design storm event without overtopping or having an uncontrolled discharge.
 - e. Facilitate maintenance, especially sediment removal.
2. Flow Distribution System
 - a. Uniformly distribute sediment basin discharge onto the grass filter area.
 - b. Provide the inflow, velocity and flow depth to the grass filter area required to meet hydraulic performance criteria.
3. Grass Filter Area
 - a. Infiltrate the sediment basin discharge resulting from a 2-year, 24-hour storm event and the direct rainfall on the filter area. The soil in the

filter area shall be a minimum of 2 feet deep. The available water capacity of the soil shall be assumed to be 50% before the storm occurs.

- b. Control the sediment basin discharge resulting from a 25-year, 24-hour rainfall event such that: all flow is controlled within the filter area, flow depth does not exceed 6 inches, average velocity does not exceed 1.5 ft./sec., and contact time (i.e. travel time) through the filter area is at least one hour.
- c. Ensure uniform sheet flow by utilizing methods such as dividing the filter into borders having a maximum width of 50 feet.
- d. Distribute and apply nutrients at agronomic rates.

F. Livestock Truck/Trailer Washes

1. General

The design of each Livestock Truck/Trailer Wash (LTTW) should be based upon site-specific information whenever possible rather than the general criteria provided below. These criteria are intended for use in the design of truck washes used for the washing of trucks and trailers used for livestock transportation only. Any other type of truck/trailer wash or a combined washing facility serving livestock truck/trailers and other types of truck/trailers or vehicles are required to meet other requirements not addressed by these standards.

Usually, a LTTW producing livestock related waste should consist of the following components: washwater collection area, solid separation and/or storage (sediment basin, mud trap, etc), wastewater storage, and waste utilization.

2. Design Criteria

- a. Settling basin shall be sized for at least 30 minutes retention time.
- b. Settling basin shall allow for 10 ft³ per truck washed for solid storage with no less than one month cleanout interval.
- c. If any on-site solids storage is provided it must be sized to hold 120 days of solids. Any runoff from the solids storage site must be directed to the wastewater storage structure.
- d. Minimum wastewater storage shall be designed as provided in other sections of these Design Standards. If actual quantities or book values are not available, a minimum storage volume of 270 ft³ of wastewater per truck shall be provided.

- e. Land application area may be estimated using 0.008 acre for each truck washed annually for liquids disposal area and 0.027 acre for each truck washed annually for solid disposal area.

G. Public Livestock Markets

From a hydraulic or drainage standpoint, waste systems for public livestock markets shall adhere to the design requirements for confined feeding facilities contained herein. For nutrient utilization, however, the design shall be based on the expected average annual number and type of animals to be sold by the market. Nutrient loads shall be determined for each animal type represented, taking into account the average number of days and/or hours the animal would be present at the facility. The various waste loads shall then be aggregated. Book values may be used in determining the waste loading.

Nutrient loadings for existing public livestock markets shall be computed utilizing the average annual number and type of animals sold by the market during the past five calendar years, taking into account the average number of days and/or hours the animals are present at the facility.

H. Composting Operations

Any contaminated leachate and/or runoff must be controlled. If necessary, structures shall be built to control the runoff. The facility's "Kansas Water Pollution Control Permit For Agricultural and Related Wastes" will include retention structures within the facility's drainage control area, including any receiving runoff from composting. The proper operation of composting operations and any control structures outside the facility's drainage control area shall be subject to the Department's Bureau of Waste Management regulations, permitting, inspection and oversight (See K.A.R. 28-19-25c and 25d).

V. **Construction**

A. Required Construction Time Frames

1. Newly Proposed Construction

Construction initiation and completion of approved new facilities or expansions of existing facilities shall adhere to the time frames in K.A.R. 28-18-12 (e) and/or K.A.R. 28-18a-12 (e). Failure to initiate and complete the approved construction in the appropriate time frame(s) shall void the Department's approval of the construction plans, specifications, and other associated plans.

2. Voided Approval/Resubmitting Plans

In cases where the Department's approval becomes void due to a construction

time frame failure, the permit or permit modification shall remain in effect for the term of the permit. If the applicant desires to construct the proposed new facility or expanded facility after the approval has become void, the previously approved construction plans, specifications, and other associated plans may be resubmitted for review and approval, but must include any modifications to meet current requirements. The applicant shall not initiate construction or expansion prior to the Department's approval of the resubmitted plans.

B. Discoveries During Construction

If an active, abandoned, or plugged water, oil or gas well, pipeline or similar feature is found to be in a location other than that shown on the approved plans, the Department shall be notified within 48 hours of discovery. Construction activities relative to the well, pipeline or feature in the vicinity shall immediately halt and shall not resume until authorization is given.

If a discovery necessitates changes to the approved plan, proposed changes shall be submitted for review and approval prior to implementation. Any approved modifications shall be incorporated into the permit upon renewal.

Archaeological discoveries such as human remains shall be dealt with according to K.S.A. 75-2741 through 2754.

C. Soil Liners

Care should be taken not to allow soil liners to dry out during and after construction. Cracked soil liners must be repaired prior to permeability testing or acceptance by the Department.

D. Post-Construction Permeability Tests

1. General

Construction observation and testing is required for each waste control structure required to be watertight or to control seepage to established requirements. Unless specific test methods are required by regulation or statute, any of the following methods may be utilized:

- a. Individual sample methods such as the core sample method
- b. Whole lagoon or whole pond method
- c. Construction oversight method
- d. Other methods approved by the Department

For individual sample methods, one sample site per acre occupied by the waste

control structure shall be selected for testing. The area occupied by the structure is the surface area measured at the top of berm elevation. Fractional acres shall be rounded up to the next whole number. Retention structures shall be treated separately from one another in the surface area calculations and the testing. No less than one sample site per waste control structure shall be selected for testing.

If the core sample method is used, samples must be analyzed by a laboratory familiar with soil testing. Core samples shall be representative of the constructed soil liner and shall not be mixed with one another. Samples shall be complete unified soil masses and shall not be re-molded. The soil cores shall be collected in accordance with ASTM D-1587 preserved in accordance with ASTM D-4220 and tested in accordance with ASTM D-5084 methods. Any holes resulting from core samples shall be filled with bentonite or other approved material(s).

Materials and equipment to be used in field or site tests shall be subject to approval by the Department prior to testing. The Department shall be notified at least 48 hours in advance of a field test and given an opportunity to view and record the test procedures and readings or the test results will not be accepted.

The whole pond seepage test as described in ASAE Paper Number 034130 is suitable for testing impermeable synthetic membrane liners or soil liners.

If the construction oversight method is used, a geologic survey must be completed with the pre-construction soil samples tested and a liner design developed as herein described. The construction shall be observed to ensure correct construction methods are being used, and proper compaction is being achieved. After construction, consideration should be given to construction quality assurance testing such as core sample or whole pond test methods when the construction oversight method is used.

Permeability test results shall be submitted to the Department within thirty (30) days of test completion. Tests results must be approved by the Department prior to populating the facility. Should any structure not meet the permeability requirements, additional sealing will be required.

If a synthetic liner is to be installed, permeability tests shall be completed, submitted and approved prior to the placement of the synthetic liner.

The permittee may also propose and use any other methods approved by the Department.

2. Compaction Testing

Compaction testing may be done utilizing nuclear gage moisture density determination or other methods approved by the Department. Nuclear density

testing may only be done on horizontal surfaces as indicated in ASTM D-2922.

Pre-construction laboratory test results showing the corresponding density and moisture parameters shall be submitted to the Department with the permit application. A minimum of one site for every 10,000 square feet of the area occupied by the structure shall be tested. The waste retention structures shall be treated separately from one another in the surface area calculations and the testing.

E. Synthetic Liners

The manufacturer specifications including installation and testing protocols shall be provided to the Department with the permit application. Prior to commencing operations at the site, a certification that the liner was installed consistent with the manufacturers' specifications shall be provided to the Department by a professional engineer licensed to practice in Kansas or an approved consultant.

F. Completion Certification

Following the completion of construction of a new or expanded portion of a confined feeding facility with a waste control system, a completion certification, and when requested, any supporting documentation shall be submitted to the Department. It shall certify that the waste control system was constructed in accordance with the plans and specifications approved by the Department. For facilities designed by an approved consultant, the consultant shall sign and submit the certification. Where there is no consultant, the applicant shall sign and submit the certification.

VI. Operation and Maintenance

A. Initiating Operations

The operation of a new confined feeding facility or expanded portion of an existing facility or waste control system shall not be initiated until after issuance of the new or modified permit.

B. Required Retention Structure Operating Levels

Most retention structures are required to have maximum and sometimes a minimum operating level or range as stated in the facility's permit. The level will be measured from the lowest point on the top of the berm and/or referenced to the bottom of the retention structure and will be stated in feet.

Usually, facilities with daily flows will have a required normal operating level and/or a December 1st or winter operating level. Facilities without daily flows generally have only a normal operating level. Facilities which must have a minimum biological volume will have the minimum required biological volume level stated in their permit in addition to other required levels.

When setting the required operating levels, the Department will include all facility runoff including extraneous areas. Runoff curve number 90 will be used for all unpaved lots, pens, feeding alleys, and roads. Runoff curve number 97 will be used for roofs and all paved (concrete and asphalt) areas. All (100 percent) of the design storm precipitation will be used on the retention structure area.

In order to facilitate control of the retention structure operating level(s), a staff gauge or level measurement device shall be maintained in working order, in each retention structure.

C. Solids Handling

1. Sedimentation Basins and Retention Structures

Sedimentation basins shall be cleaned annually or more frequently as needed to ensure proper operation of the retention structures. Retention structures shall be cleaned of solids accumulation whenever the accumulation infringes on the required storage depth.

2. Open Lots

Open lots and facilities such as hoop structures which accumulate solid wastes should be scraped or cleared of manure, bedding, etc., after each cycle. Manure accumulations should be minimized during summer months or dry periods to minimize off site deposition of dust and manure. Solid wastes may be temporarily stockpiled not to exceed six (6) months. Stockpiles shall be located such that runoff is controlled.

D. Waterers

When setting permit requirements, unless it is otherwise stated in the plans submitted, the Department will assume that "continuous flow" waterers will overflow only during periods of potentially freezing weather. Malfunctioning waterers shall be repaired in a timely manner such that excess flows do not impact the waste control system.

Waterers in hoop structures shall be located such that excess flow does not enter into the pen area.

E. Erosion and Liner Protection

Perennial grass should be established on the side slopes above wastewater levels, berms, and back slopes of all newly constructed or expanded earthen structures. Short-rooted grass such as Bermuda, Fescue, Brome, Timothy, and native grasses are suitable. Trees and/or other deep rooted vegetation must not be allowed to grow within 100 feet of the outside toe of newly constructed or expanded earthen structures. Fencing or other means shall be utilized to prevent animals from accessing or disturbing earthen liners.

Earthen liners shall not be allowed to dry out thus risking the integrity of the seal. Any mechanical or structural damage to the liner shall be reported to the Department within two workdays of identification and shall be repaired in a time frame approved by the Department.

Any erosion damage shall be repaired on all waste control structures in a timely manner. All repairs shall conform to the approved plans and specifications.

VII. Waste Utilization

A. Land Application

Waste may be applied to agricultural land by any method that will result in uniform application of the material and not exceed agronomic rates. Liquid wastes shall be applied at agronomic rates and at rates less than or equal to the soil intake rates.

Wastes shall not be applied:

1. To areas within 100 feet of any down-gradient surface water, open tile line intake structure, sinkhole, agricultural wellhead, or other conduit to surface waters. The required distance may be reduced to 35 feet if a permanently vegetated buffer is established where applications of manure, litter, or process wastewater are prohibited.
2. As a liquid, when soil is frozen, snow-covered, saturated, or during a precipitation event, unless approved in advance by the Department. (Solid wastes may be applied to frozen ground if measures are taken to ensure that the wastes will be retained at the application site).
3. To areas subject to active erosion, especially gully erosion.
4. At rates which allow the wastes to leave the land application site or property.

B. Application Equipment

The waste application equipment shall be sufficient to operate and manage the waste control system as designed. Systems storing and handling liquid wastes shall maintain application equipment capable of applying the ten (10) day wastewater accumulation volume and the design storm (25-year, 24-hour) volume, in ten twelve-hour operating days. For center-pivot sprinkler systems, 24-hour operating days may be considered when determining the required minimum application rate.

Waste application equipment is to be owned, contracted, leased or under a use agreement. Equipment obtained by lease or use agreement must be available for use on-site within four working days.

C. Sampling

When directed by the Department, sampling and analysis of wastes and/or waste application sites shall be conducted to confirm application of waste at agronomic rates.

D. Evaporative Utilization

Facilities which intend to utilize evaporation as a disposal method must develop a water budget to determine the extent to which evaporation can control liquid wastes. The design shall take into consideration sediment accumulation, process waste, net inflow, storm water (from the design storm), freeboard and any required biological volume. The area required for land application of liquid waste shall be based on applying waste at agronomic rates. Application equipment capacity requirements will be the same as for conventional land application systems. Salinity and water quality testing shall be conducted on the wastewater in the storage structure as a condition of permit renewal to determine the suitability of waste material for land application.

VIII. Variance Procedure

A. General

This section allows for innovative solutions to confined feeding facility waste control systems. Situations may arise which, because of engineering considerations, industrial practices, or new technology, may require variance from the criteria published in these Design Standards. The Department of Health and Environment will consider requests for variance from these Design Standards on a case-by-case basis. Such requests for variance shall justify the need for a variance and show how the requested variance will protect the surface and groundwater quality consistent with the intent of these Design Standards.

B. Procedure

Requests for a variance shall be submitted in writing to the Department and will address the following:

1. Purpose of the requested variance and why it should be considered/granted.
2. Section(s) of these Design Standards for which the variance is requested.

3. How the variance will be consistent with the intent of these Design Standards and protect surface water and groundwater quality.
4. Any other information the Department may require to justify the request for variance.

The Department will respond to a request for variance in writing and either deny, grant, or conditionally approve the request.