

# DESIGN CRITERIA FOR LIVESTOCK WASTE CONTROL SYSTEMS AT OPEN FEEDLOT MEDIUM CAFOs

FEBRUARY 2011



IOWA DEPARTMENT OF NATURAL RESOURCES

The Iowa Department of Natural Resources (DNR), in conjunction with the Natural Resources Conservation Service (NRCS) and Iowa State University (ISU) Extension, has developed minimum design criteria for runoff controls that apply only to open feedlot operations that meet the definition of a medium Concentrated Animal Feeding Operation (CAFO) [see: 567 Iowa Administrative Code (IAC) 65.100 or Appendix C] and are either required, or choose, to obtain a National Pollutant Discharge Elimination System (NPDES) permit (see Appendix C).

These minimum design criteria meet the requirements for medium CAFO NPDES permits issued by the DNR and are intended to provide guidance to a professional engineer (P.E.) designing runoff controls for these facilities. The P.E. is responsible for the detailed design using sound engineering principles. These criteria do not apply to large CAFOs required to obtain an NPDES permit. Individuals seeking design standards for a large CAFO should refer to 567 IAC 65.101(3).

A medium CAFO, for purposes of these design criteria, means an animal feeding operation (AFO) which is an open feedlot housing the type and number of specific species [ defined in 567 IAC 65.100; see Appendix C to determine medium CAFO status] and meets either one of the following criteria:

- Manure or process wastewater is discharged into waters of the U.S. (a stream or flowing water – see complete definition in Appendix C) through a man-made ditch, flushing system or other similar man-made device.
- Manure or process wastewater is discharged directly into waters of the U.S. (a stream or flowing water– see complete definition in Appendix C) which originates outside of and pass over, across or through the facility, or otherwise come into direct contact with animals in the operation.

If an open feedlot meets the definition of a medium CAFO, the facility has four (4) choices:

1. Reduce animal capacity to less than the medium category threshold (i.e., 300 beef cattle) and thus no longer be defined as a medium CAFO.  
**Reducing capacity does not guarantee compliance with either state or federal enforcement of the Clean Water Act.**
2. Eliminate the direct discharge or the discharge through a man-made conveyance (no longer a medium CAFO).
3. Construct runoff controls approved by the DNR and obtain a medium CAFO NPDES permit.

4. Expand the AFO above the “large CAFO” threshold as defined in 567 65.100 and apply for a large CAFO NPDES permit if required pursuant to 567 IAC 65.102.

For the sites that choose either 1 or 2 above, additional runoff controls may still be required to protect water quality. The minimum required runoff controls for all open feedlots in Iowa are proper solids settling and no water quality violation at the point of discharge into a water source.

## **MINIMUM MANURE STORAGE REQUIREMENTS FOR MEDIUM CAFOs**

All runoff of manure, litter or process wastewater resulting from a precipitation event less than or equal to a 5- inch, 24-hour, rainfall event shall be collected, stored and land applied.

The storage of effluent may be provided in the solids settling basins (SSB), vegetative treatment areas (VTA) with surrounding berms, grassed filter strips with surrounding berms, earthen basins and any other waste control structure or practice approved by the DNR. Other on-site storage structures may be used provided permanent pumps and piping exist to transfer runoff as needed. Open feedlot medium CAFOs subject to these design criteria are allowed to include and use all runoff control structures and practices when calculating the overall storage capacity of the system. Storage calculations shall not include any areas which do not have the ability to hold water in a static condition (e.g. sloped treatment areas above the elevation of retaining berms).

## **SOLIDS SETTLING**

At a minimum, solids settling shall be provided for all open feedlot areas in accordance with 567 IAC 65.101(1). If a solids settling facility is intended to work continuously (no storage in the solids settling areas), then the operator shall install properly designed porous outlets such as perforated risers, picket dams, notched weirs or other suitable devices to reduce outlet flow under all rainfall intensities to provide temporary pooling and solids settling.

If a solids settling facility is actively managed to store runoff and then release effluent gradually, then the solids settling facility outlet(s) shall be equipped for manual control through the use of valves, gates, standpipes or other control methods which allow liquid to be held in the settling structure until a planned release is desired. Provide for

full basin overflow (emergency overflow) which shall overflow within the runoff control area. The outlets from a solids settling facility shall be managed such that erosion is prevented and vegetation is not harmed in the receiving land area.

## **MEDIUM CAFO SETTLED OPEN FEEDLOT EFFLUENT STORAGE**

If earthen runoff storage structures are planned, a P.E. shall determine and approve the best available on-site materials and the appropriate compaction and density verification methods to be used during construction. No compaction testing or permeability testing on an earthen liner will be required. Caveat: If an earthen storage structure is constructed utilizing this design criteria and additional confinement capacity for animals of the same species is added later putting a producer into a large CAFO status, then the earthen storage structure will be required to meet large CAFO construction requirements despite no actual increase in open lot animals. The facility may also need an NPDES permit (See Appendix C). Use local soil surveys to determine suitability of on-site materials for earthen basins and avoid granular soils. Side slopes shall not be steeper than a 3:1 ratio. All slopes shall be seeded upon completion and vegetation established within one year of construction to reduce erosion.

Earthen storage structures shall not be constructed in karst terrain unless the provision of 567 IAC 65.109(4) "c" can be met [see Appendix C]. Earthen storage structures located in alluvial soils as indicated by the [DNR Siting Atlas Map](#) may require a DNR floodplain determination. Earthen storage structures located in a 100-year floodplain as determined by the DNR may be required to obtain a DNR floodplain permit. Known or discovered drainage tile lines shall be removed or rerouted at least 25 feet horizontally separated from the outside toe of storage structures unless they outlet to further treatment or application areas that do not discharge to a water source. Construct all storage structures above the seasonal high water table. Artificially lowering the local ground water table is allowed.

## **VEGETATED TREATMENT AREAS**

If additional treatment and/or storage of effluent from solids settling facilities or storage structures is needed, then the system may benefit from a vegetated treatment area. A VTA is an area of specific vegetation located at the outlet of a feedlot designed, constructed, operated and maintained to provide treatment of the runoff by nutrient uptake in the vegetation, infiltration and further solids settling.

## **MANURE SOLIDS**

Manure solids (settled solids from the solids settling facilities and scraped manure from the feedlot) shall be land applied in accordance with a nutrient management plan (NMP). Stockpiling of solids onsite must be at a location within the runoff control system.

## **PROCESS WASTEWATER**

Process wastewater includes runoff or leachate from silage piles, bulk feed storage areas or stockpiled manure and must be controlled. Intact bales of hay (alfalfa, grass, clover, etc.) or any crop residue, whether used for feed or bedding, and covered feed not prone to leaching or runoff are not required to have controls. Overflow from waterers designed to overflow that does not come into contact with manure or litter is not required to be captured or contained in the runoff control system. The risk of process wastewater runoff reaching a water source should be carefully analyzed at each site.

## **PERMITTING PROCESS**

The owner of a medium CAFO for which an NPDES permit is required (see Appendix C) shall proceed with the following steps:

1. Obtain the services of a P.E. or qualified NRCS staff to assist with the design of required controls.
2. Submit a completed DNR Open Feedlot Construction Permit Application Form (Form 542-1427) and a completed DNR NPDES Permit Application Form (Form 542-4001).
3. The Applicant and Engineer shall follow the Submittal Checklist No.1 for All Open Feedlot Construction Permit Application Forms. The design criteria for medium CAFOs allow less stringent design standards and this can be reflected in the application documents.
4. The application shall contain a site specific operation and maintenance plan including the necessary information on best management practices, and monitoring and recordkeeping to allow the DNR to issue a permit.
5. The NPDES permit may be issued for any period not to exceed 5 (five) years. Applicants shall be notified at least 6 (six) months prior to renewal.

## **OPERATION AND MAINTENANCE MANUAL (O & M MANUAL)**

An application for an NPDES Permit shall include an O & M manual. The manual shall contain the necessary and applicable items to properly operate and maintain the system and shall address all of the items listed in Appendix A and include the applicable items from Appendix B.

## **NUTRIENT MANAGEMENT PLAN (NMP)**

An application for an NPDES permit shall include a nutrient management plan (NMP). Please refer to [http://www.iowadnr.gov/afo/nmp\\_producer.html](http://www.iowadnr.gov/afo/nmp_producer.html) for DNR guidance on the development of an NMP. All feedlot effluent shall be land applied in a manner to prevent discharge to a water source. Manure solids shall be land applied to treatment areas or cropland in accordance with an NMP.

# APPENDIX A

## OPERATION AND MAINTENANCE MANUAL (O & M MANUAL)

All permitted sites shall include an O & M manual with the permit application. The manual should contain the necessary and applicable items to properly operate and maintain the system. A sample O & M manual is included below.

### SAMPLE OPERATION AND MAINTENANCE MANUAL

#### MEDIUM FEEDLOT ANY COUNTY, IOWA

#### INTRODUCTION

Describe the feedlot, owner, location, DNR facility number, type of operation and detailed description of the feedlot. *(Example: This facility is an existing 990-head beef cattle open feedlot using one solid settling basin, a settled open feedlot effluent basin (SOFEB) and vegetated treatment area (VTA) for runoff controls and treatment. This operation and maintenance manual will be directed to the operation of the solid settling basin, the SOFEB and the VTA and the proper maintenance of the system).*

#### OVERALL DESIGN AND OPERATION PRINCIPLES

Describe in detail how the runoff controls are designed. *(Example: The solids settling structure is an earthen-bermed area with a manually operated slide gate that can be closed to provide storage in the solids area. The effective storage volume in the solids area is for 2.5 inches of rainfall. An earthen settled open feedlot effluent basin receives gravity outflow from the solids settling area and stores the effluent. The effective capacity of the storage basin is for 2.5 inches of rainfall. Therefore the minimum storage requirement has been met in this system (Storing runoff from a 5-inch, 24-hour rainfall). A small permanent manure pump is located in the basin and will pump out effluent to the VTA when conditions are suitable. Pumping is a completely manual operation. A VTA exists adjacent to the basin and receives effluent during suitable application times.*

*The VTA has a 1 foot tall berm around the perimeter including the outlet end. The outlet end also contains a slide gate valve on the outlet pipe through the berm to allow some storage of effluent in the VTA. This valve will be normally open when the outlet valve on the solids settling structure is closed. This will allow rainfall on the VTA to leave the VTA and be available for effluent application sooner).*

*Describe in detail how the system is intended to be operated. (Example: The slide gate on the outlet of the solids settling structure is normally open. The screen at the outlet always remains in place to remove solids. Effluent flows through the solids settling structure into the SOFEB. After a couple of days the VTA is checked to see if the ground is dry enough to allow effluent to be applied. If dry enough, the pump is turned on for 1 to 4 hours depending on dryness in VTA and amount of effluent in SOFEB. After pump is turned on, the distribution header pipe at the upper end of the VTA is visually checked for even flow out of each opening. After one [1] hour of pumping the VTA outlet is checked to see if any effluent is reaching the VTA outlet. After one [1] year of operation the pumping time to generate a discharge out of the VTA depending on soil moisture conditions should be able to be estimated to prevent a discharge. The intent of the system is to have continuous solids settling, temporary storage and further treatment in the VTA. The storage basin should be maintained at minimum level to provide maximum storage capacity. When larger rains are forecasted, the slide gate on the solids settling outlet structure will be closed to provide additional storage capacity so effluent application to the VTA is not required until conditions allow.)*

## **GENERAL MAINTENANCE OF THE SYSTEM**

*Describe in detail the maintenance of the entire system. (Example: In periods of dry weather the lots will be scraped and dry manure will be hauled and spread. If solid manure is stockpiled on site it will be located within the drainage area served by the runoff control system.*

*When the settling basin is empty of liquid and has been dry for a couple of weeks the settling basin can be entered and cleaned out. It can be accessed by a gently sloping concrete ramp into the basin and cleaned out with either a pay loader or tractor with a bucket. The operator should be careful so the bucket only scoops the soft solids and does not try to clean below the original bottom. The solids screen should also be cleaned.*

*The storage basin (SOFEB) berms will be maintained with healthy vegetation and kept mowed to prevent animal burrows. Weeds will be sprayed as needed and eroded areas filled in and reseeded. Any areas where pipes or hoses are laid will have erosion*



protection. A staff gauge will be installed in the basin so levels can be recorded. Pumping out of the basin is a completely manual operation. After pump is turned on a visual inspection of hose or pipe fittings can be performed. The ground water was artificially lowered around the basin with a perimeter tile. The outlet of the tile was tied into an existing field tile. A monitoring port and tile valve was installed before the connection to the existing tile. This monitoring port will be inspected periodically.

The vegetation in the VTA is reed canarygrass and will be maintained in a healthy stand at all times. The grass will be harvested a minimum of two [2] times per growing season. Any channeling or rutting developing in the VTA will be corrected by filling with soil and reseeding. If channeling continues, slight ripping across the VTA will be done or additional spreaders will be installed).

### **SCHEDULED MAINTENANCE AND RECORDKEEPING (Example)**

This portion of the manual will provide guidance to the owner or employees as to what areas of the feedlot runoff control structures need regularly scheduled inspection and maintenance, and monitoring and recordkeeping.

<b>Time Schedule</b>	<b>Inspection and Maintenance</b>	<b>Monitoring and Recordkeeping</b>
<b>Daily</b>	Check above ground waterlines, waterline routes and waterers for any signs of leakage.	Record rainfall amount
<b>Weekly</b>	<ol style="list-style-type: none"> <li>1. Visually inspect solid settling outlet controls for blockage.</li> <li>2. Visually inspect all storm water diversion structures to insure all clean water is being diverted.</li> <li>3. Visually inspect feedlot runoff diversion structures for ponding or manure build-up.</li> <li>4. Visually inspect solid settling facility for ponding and manure build-up.</li> <li>5. Read and record the depth of the staff gauge in the settled effluent basin.</li> <li>6. Visually look at VTA vegetation for bare spots, weeds and unhealthy vegetation.</li> </ol>	Record weekly estimate of stored settled open feedlot effluent volume either as a percent of total storage or as a volumetric number.

<b>Monthly</b>	<ol style="list-style-type: none"> <li>1. Inspect the inside and outside of the basin dikes for erosion, rodent holes and visible leakage. Fill eroded areas in with dirt, reseed and mulch. Fill rodent holes with granular bentonite. Trap rodents. Report visible leakage to the design engineer to determine course of action.</li> <li>2. Inspect and examine the monitoring port and outlet of the perimeter tile for signs of discoloration and/or odor.</li> </ol>	
<b>After Rainfall</b>	<ol style="list-style-type: none"> <li>1. Clean solid settling outlets.</li> <li>2. Check clean water diversion structures including berms, tile inlets or terraces.</li> <li>3. Inspect VTA for suitability of effluent application.</li> <li>4. Inspect VTA for suitability of effluent application.</li> </ol>	
<b>Each Time Effluent is Applied</b>	Inspect vegetated treatment and land application areas to ensure no discharges occurred.	<ul style="list-style-type: none"> <li>• Inspection of storage area berms and outlets,</li> <li>• Distribution system pumps and piping,</li> <li>• Moisture condition of the receiving land,</li> <li>• Any discharges at outlet</li> <li>• Other requirements as identified in NPDES permit</li> </ul>

## APPENDIX B

### BEST MANAGEMENT PRACTICES (BMP)

Even the best designs can fail if not properly operated and maintained. Follow best management practices to improve runoff control system performance and protect water quality.

These practices include:

- Scrape lots ahead of forecasted rainfall;
- Maintain and calibrate manure application equipment;
- Manage mortalities to ensure proper disposal of dead animals;
- Strictly adhere to stockpiling rules, 567 IAC 65.101(2) and Code of Federal Register (CFR) 40 Part 412.31;
- Land apply manure on days when weather and soil conditions are suitable;
- Prevent direct contact of animals with waters;
- Fix and remove the “conduits” to water source;
- Maintain solid settling basin and basin berms at design height;
- Manage outlets used with the settling basins to promote timely dewatering;
- Check outlet pipes to ensure they are free of solids or trash;
- Protect treatment application areas from up-slope water additions (run-on);
- Move and manage effluent discharge areas to prevent channeling and runoff;
- Dewater settling basins in a timely fashion so they are ready for the next rainfall;
- Remove accumulated solids from settling basins frequently;
- Measure travel distance of effluent (as an example: greater than 6 inches per head in grass, or 2 feet per head in crop fields, where planned treatment/infiltration areas are not used).

The intent of storing runoff and releasing it from a solids settling facility is to hold the runoff to allow proper solids settling and then manually release the effluent to other storage structures, cropland, pasture or vegetated treatment areas when the moisture conditions have improved. This practice will allow better infiltration, evaporation and treatment.

## APPENDIX C

### FACILITIES REQUIRED TO OBTAIN AN NPDES PERMIT

#### **NPDES Permits Required for CAFOs. 567 IAC 65.102 ([455B,459A](#))**

Concentrated animal feeding operations (CAFOs) are point sources that require NPDES permits.

**65.102(1) Duty to apply.** Each CAFO owner or operator must apply for an NPDES permit, except as provided in subrule [65.102\(2\)](#). The owner or operator of a CAFO that includes an open feedlot must apply for an individual NPDES permit. The application procedures are prescribed in [567—65.104\(455B,459A\)](#).

**65.102(2) Exception.** An open feedlot operation shall not be required to obtain an NPDES permit if the operation does not discharge manure, process wastewater, settled open feedlot effluent, settleable solids, or open feedlot effluent into any waters of the United States.

### DEFINITIONS

**65.109(4) Karst Terrain:** *c.* Construction of settled open feedlot effluent basins is allowed in areas identified as karst terrain if site-specific geologic information is submitted documenting that 25 feet of suitable materials exist between the structure bottom and carbonated bedrock or limestone or dolomite.

**Man-made conveyance:** constructed device to direct where water is going, including but not limited to a pipe, channel or road ditch.

**(continued next page)**

**Medium Concentrated Animal Feeding Operation:** The type and number of animals that it stables or confines fall within any of the following ranges:

Animal	Number	Animal	Number
Mature Dairy Cows (milked or dry)	200 – 699	Turkeys	16,500 to 54,999
Cattle	300 – 999	Laying Hens or Broilers <sup>1</sup>	9,000 to 29,999
Swine (55 pounds or more)	750 to 2,499	Chickens <sup>1</sup>	37,500 to 124,999
Swine (less than 55 pounds)	3,000 to 9,999	Laying Hens <sup>1</sup>	25,000 to 81,999
Horses	150 to 499	More than one category <sup>2</sup>	300 to 999
Sheep or Lamb	3,000 to 9,999		

<sup>1</sup> if the AFO uses a liquid manure handling system

<sup>2</sup> more than one category of animals is maintained using the same type of operation

**AND either of the following conditions are met:**

Manure or process wastewater is discharged into waters of the U.S. through a man-made ditch, flushing system, or other similar man-made device.	<b>OR</b>	Manure or process wastewater is discharged directly into waters of the U.S. which originate outside of and pass over, across or through the facility or otherwise come into direct contact with animals confined in the operation.
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**Settled Effluent Basin:** a covered or uncovered impoundment which is part of an open feedlot operation, if the primary function of the impoundment is to collect and store settled open feedlot effluent.

**Settled Open Feedlot Effluent:** a combination of manure, precipitation-induced runoff, or other runoff originating from an open feedlot after its settleable solids have been removed.

**Waters of the United States or waters of the U.S.:** as defined in 40 CFR 122.2:

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(b) All interstate waters, including interstate "wetlands;"

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows,

playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

- (1) Which are or could be used by interstate or foreign travelers for recreational or other purposes;
- (2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
- (3) Which are used or could be used for industrial purposes by industries in interstate commerce;
- (d) All impoundments of waters otherwise defined as waters of the United States under this definition;
- (e) Tributaries of waters identified in paragraphs (a) through (d) of this definition;
- (f) The territorial sea; and
- (g) "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition) are not waters of the United States. This exclusion applies only to manmade bodies of water which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States. [See Note 1 of this section.] Waters of the United States do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

Code of Federal Regulations (CFR) link: [www.gpoaccess.gov/cfr/](http://www.gpoaccess.gov/cfr/)

Waters of the U.S. are further defined in the Rapanos Supreme Court case and EPA's guidance Q and A:

[http://water.epa.gov/lawsregs/guidance/wetlands/upload/2006\\_6\\_19\\_wetlands\\_Rapanos\\_SupremeCourt.pdf](http://water.epa.gov/lawsregs/guidance/wetlands/upload/2006_6_19_wetlands_Rapanos_SupremeCourt.pdf)

[http://water.epa.gov/lawsregs/guidance/wetlands/upload/2008\\_12\\_5\\_wetlands\\_Rapanos\\_-20Guidance\\_QA-20120208.pdf](http://water.epa.gov/lawsregs/guidance/wetlands/upload/2008_12_5_wetlands_Rapanos_-20Guidance_QA-20120208.pdf)

**Water source:** a lake, river, reservoir, creek, stream, ditch, or other body of water or channel having definite banks and a bed with water flow, except lakes or ponds without outlet to which only one landowner is riparian.

## **DNR CONTACTS**

**Permit Engineer:** Paul Petitti, P.E., at (712) 262-4177 or [paul.petitti@dnr.iowa.gov](mailto:paul.petitti@dnr.iowa.gov)

**DNR Field Offices:** <http://www.iowadnr.gov/fo/index.html>

Northeast Iowa, Manchester, (563) 927-2640.

North central Iowa, Mason City, (641) 424-4073.

Northwest Iowa, Spencer, (712) 262-4177.

Southwest Iowa, Atlantic, (712) 243-1934.

South central Iowa, Des Moines, (515) 725-0268.

Southeast Iowa, Washington, (319) 653-2135.

**24-hour Spill Line:** (515) 725-8694.

**Additional DNR AFO Staff:** <http://www.iowadnr.gov/afo/staff.html>