Environment

The purpose of the Environment Section for the CLPP is to recognize producers who demonstrate their commitment to excellence in environmental practices on their farm.

The Environment Section contains the following:

- Regulatory guidance document
- Myths and facts about the environment
- Planning and zoning resources
- Web resource guide
- A self assessment

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Environment

Environmental issues are one of the greatest challenges facing the livestock industry today. We can listen and learn from community concerns about the environment and work to demonstrate our commitment to environmental stewardship.

Livestock operations are required to adhere to regulations, guidelines, rules, monitoring, record-keeping, inspections and paperwork. With new technologies producers will continue to monitor, change and improve their management skills.

For Concentrated Animal Feeding Operations (CAFO):

- Read the Environment section on compliance requirements.
- The self-assessment is divided into two parts :
    1. A review of compliance requirements for a CAFO operation. Please certify by signing the assessment that your operation follows CAFO compliance.
    2. Series of questions with a minimum of 100 points to complete

For Confined Feeding Operations (CFO) or smaller confinement farms that do not have an IDEM permit:

- Read the Environment section on CFO requirements.
- The self-assessment is divided into two parts:
    1. A review of compliance requirements for a CFO operation. Please certify by signing the assessment that your operation follows CFO compliance standards, even though the operation is not permitted by IDEM.
    2. Series of questions with a minimum of 100 points to complete

If your operation does not have an environmental spill response plan, please use the sample environmental spill response form in the Emergency Plan Section to write down specific action steps for different situations. Look at ways to prevent potential problems and how to respond to those situations. Planning and prevention are key elements for protecting the environment and your ability to stay in business. We are relying on each other to manage our operations in a legal and socially responsible manner. One bad apple, truly affects us all.

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Regulatory Guidance Document

This is not a complete listing of all the rules and regulations for CFOs and CAFOs, but only a highlight of the major components which draw the most questions and concerns.

Livestock facilities in Indiana may be subject to one of two environmental regulatory programs administered by IDEM. Some operations do not fall within the parameters of either permitting process.

Confined Feeding Operations (CFOs)
327 IAC 16-7-2

- Applies to a person who owns, designs, constructs, operates or closes a CFO or who is responsible for the application of manure in Indiana from a CFO.
- Confinement
    - Animals must be confined, fed and maintained for at least 45 days in any 12 month period.
    - Crops, vegetation, forage growth or post-harvest residue not sustained in the normal growing season over at least 50 percent of the lot or facility.
- Minimum number of animals
    - 300 Cattle
    - 600 swine or sheep
    - 30,000 fowl
    - Facilities with populations below the minimum number of animals are still subject to water pollution control laws.
- The CFO permit is valid for 5 years and must be renewed.
- Performance standards
    - Designed and managed to avoid non-permitted discharges into state waters and to minimize leaks and seepage.
    - Manure must be staged or applied in such a manner as to:
        - Not enter or threaten to enter state waters.
        - Prevent run-off, ponding for more than 24 hours and spills
        - Minimize nutrient leaching beyond the root zone.
- Design and construction standards
    - Application requirements
        - Waste management system drawing.
        - Soil and water table information from test holes.
        - Manure management plan.
            - Procedure for soil testing every 3 years.
            - Procedure for manure testing every 3 years.
        - Plot maps
            - Soil survey maps.
            - Topographical map labeled with public water supplies within 1000 feet.
            - Location of waste management systems.
            - Boundaries of CFO and manure application areas.

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        - Farmstead plans
            - Waste management systems and all residences, surface waters of the state, roads, water wells, characteristics of karst terrain, drainage patterns, property boundary lines, outfalls of subsurface drainage structures and drainage inlets.
            - Diversion of uncontaminated surface water
        - Public notice requirement
            - Letter from applicant about the application's submittal to each person owning and residing on land adjoining proposed CFO site
            - Notice from IDEM about the application's submittal to local officials, such as county commissioners.
            - Public notice from IDEM about 30-day public comment period.
            - IDEM notice to applicant, local officials, adjacent property owners and residents, and other known interested parties upon agency decision.
- Waste management system
    - Must not be constructed in the following:
        - Karst terrain or above a mine except with approval of the IDEM commissioner based upon site-specific information.
        - A floodway.
        - A 100 year flood plain unless access is 2 feet above 100 year flood plain.
        - Soil with a seasonal high water table unless water table is lowered below waste management system.
    - Setback requirements
        - 1000 feet from any public water supply.
        - 300 feet from surface waters of the state, drainage inlets, sinkholes and off-site water wells.
        - 100 feet from on-site wells, property lines, and public roads.
        - A solid manure storage structure that contains manure and prevents water from entering the structure must be maintained to have a minimum setback of 100 feet from surface waters, drainage inlets, sinkholes and off-site wells.
    - Design requirements
        - Base must be 2 feet above bedrock or, if in karst terrain, at distance commissioner determines.
        - Drainage system to lower seasonal water table must have access point for sampling.
        - If determined by the commissioner, IDEM may require monitoring systems, liners, higher compaction, innovative technology or other measures.
    - Storage capacity requirements
        - 180 days storage for manure, bedding, net average rainfall, and run-off from 25-year, 24-hour rainfall from drainage areas around any manure storage structure.
    - Uncovered liquid manure storage structure requirements
        - Two feet of freeboard.

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        - Emergency spillway directed to secondary containment, manure storage structure, or vegetative management system and handle 50 year, 24 hr rain event.
    - Concrete storage structure requirements
        - Use concrete mix that minimizes cracking, with properly spaced joints, adequate reinforcement steel and the use of water stops.
    - Earthen manure storage structures
        - Seepage rate must not exceed 1/16th inch per day.
        - Certified by professional engineer.
        - Additional requirements if necessary to protect the environment.
    - Solid manure storage structure requirements
        - Not constructed in sand or gravel soils unless it has liner.
        - Precipitation directed away from structure unless it can be collected.
    - Other manure storage structure requirements
        - Underground steel tanks are prohibited.
        - Plastic, fiberglass and above-ground steel tanks have design requirements.
    - Vegetative management systems
        - Settling basin or low velocity channel must be between vegetative management system and source of contaminated run-off.
        - Minimum dimensions based upon 25-year, 24-hour precipitation event.
    - Constructed wetlands
        - Discharge of treated effluent must be done in compliance with state and federal law.
        - If there is no discharge of treated effluent, application must be done according to manure application requirements.

- Operational standards
    - Uncovered liquid manure storage must have a minimum freeboard of 2 feet.
    - Documented inspection of waste management structures once per month.
    - Earthen berms for manure storage structures must be stabilized with vegetation or alternative control measures and allow for visual inspection.
    - Pumping, dumping, or leakage of manure from transfer vehicle onto roads and into waters is prohibited.
    - An emergency spill response plan must be created.
- Land application of manure
    - Acreage requirements are based upon agronomic rates of available nitrogen.
    - Manure and litter staged at the application site for more than 72 hours must be covered and applied within 90 days.
    - Staging is prohibited within 300 feet of surface state waters, drainage inlets or wells unless there is a barrier or a surface gradient that contains or directs contaminated water.
    - Staging is prohibited on areas with a slope greater than 6 percent or on standing water or waterways.
- Spray irrigation
    - Conducted to prevent equipment leaks.
    - Not where less than 20 inches of soil are above the bedrock.

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    - Limited application in flood plains.
- No application from the road or onto saturated ground.
- Application to highly erosion-prone land is permitted in limited circumstances.
- Application to frozen ground.
    - Not on land with greater than 2% slope and inadequate residue
    - No spray irrigation
- Setbacks
    - Setbacks may change if filter strips or barriers exist
- Closure requirements

Setbacks for Manure Application

Known feature	Less than or equal to 6% slope; or residue cover-liquid	Greater than 6% slope-liquid	Liquid injection or single pass incorporation	Liquid incorp., application to pasture, solid manure
Public water supply	500	500	500	500
Surface waters of the state	100	200	25	50
Sinkholes	100	200	25	50
Wells	100	200	50	50
Drainage inlets	100	200	5	50
Property lines and roads	50	50	0	10

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Concentrated Animal Feeding Operations
CAFOs 327 IAC 5-4 and 327 IAC 15-15

- Confinement
  - Animals must be stabled or confined and fed for at least 45 days in any 12 month period.
  - Crops, vegetation, forage growth, or post-harvest residue not sustained in the normal growing season over at least 50 percent of the lot or facility.
- Minimum number of animals
  - 700 dairy cows
  - 1,000 veal calves or mature cattle other than dairy or veal
  - 2,500 swine over 55 lbs
  - 10,000 swine under 55 lbs
  - 500 horses
  - 10,000 sheep
  - 55,000 turkeys
  - 30,000 laying hens or broilers (liquid manure system)
  - 125,000 chickens (dry manure system)
  - 8,200 laying hens (dry manure system)
  - 30,000 ducks (dry manure handling)
  - 5,000 ducks (liquid manure handling)
- Types of permits
  - General permits (NPDES)
    - Same requirements for all operations.
    - Based upon size but will change to those who discharge or propose to discharge in response to a 2nd Circuit Court decision.
- Individual permits (NPDES)
  - For those operations who discharge pollutants to waters (regardless of size).
  - Operations who could have general permit but seek individual permit (discharging non contact cooling water is a good example).
- Federal Program under the Clean Water Act
  - Ultimate authority rests with EPA. Indiana has received approval to administer its own version of the rule.
  - IDEM regulates in Indiana but EPA may still inspect farms.
  - Odor is not regulated.
  - A federal air study being conducted to see if regulations need to be developed in relation to the Clean Air Act .
- Public Notice requirement
  - General permit (NPDES)
    - There was a public notice when the general permit rule was drafted and adopted. CAFO general permits do not undergo public comment
    - Applicant submits Notice of Intent (NOI) letter to seek coverage under the general permit rule.
    - Applicant is required to notify each person owning and residing on land adjoining the proposed CAFO site as well as county commissioners.
    - IDEM places a legal notice in the local newspaper regarding the submitted NOI.

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        - The public can only comment on the eligibility of the applicant for general permit coverage.
    - Individual permit (NPDES)
        - Applicant is required to notify each person owning or residing on land adjoining the proposed CAFO site as well as all county commissioners.
        - IDEM places a legal notice in the local newspaper regarding the submitted application.
        - 30 day draft permit public comment period.
        - The permit is valid for 5 years and must be renewed.
- Construction of facilities is based upon CFO rule.
- Operator inspection of the facility
    - Documented weekly inspection of structures.
    - Documented daily inspection of waterlines.
- Extensive record keeping is required.
- Adequate waste storage is considered 180 days per CFO rule.
- Management of manure
    - Manure, litter and process wastewater storage requirements
        - Open storage structures must have minimum freeboard of 2 feet.
        - Documented weekly inspection of manure storage.
        - Earthen berms stabilized with vegetation or alternative erosion control measures.
        - Structures maintained to allow for visual inspection.
        - Manure and litter staged at application site for more than 72 hours must be covered and applied within 90 days.
        - Staging is prohibited within 300 feet of surface state waters, drainage inlets or wells unless there is a barrier or a surface gradient that contains or directs contaminated water.
        - Staging is prohibited on areas with slope greater than 6 percent or on standing water or waterways.
- Soil conservation practice plan
    - In compliance with NRCS conservation practice standards
    - Specify for each field receiving manure how to
        - Reduce soil erosion to a tolerable loss.
        - Minimize nutrient loss through leaching and run-off.
    - The soil conservation practice plan must contain
        - A soil map clearly showing fields subject to conservation practices.
        - A description of soil types.
        - The slope of land application areas.
        - Identification of appropriate site-specific conservation practices to reduce soil erosion and control run-off.
        - Identification of appropriate methods to minimize nutrient leaching.
        - A plan for application to frozen or snow covered ground.
        - A map of erosion-prone land.
- Nutrient management requirements
    - Soil testing for phosphorus every three years.
    - Test manure, litter and process wastewater for nitrogen and phosphorus annually.

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- Follow NRCS 590 standard
  - Sampling and testing of soil, manure, litter and process wastewater.
  - Land application rates based on nitrogen or phosphorus depending on the P level.
- Setback requirements (in feet)

Setbacks for Manure Application

Known feature	Less than or equal to 6% slope; or residue cover	Greater than 6% slope	Injection or single pass incorporation	Solid manure with incorporation within 12 hours
Public water supply	500	500	500	500
Surface waters of the state	100	200	25	50
Sinkholes	100	200	25	50
Wells	100	200	50	50
Drainage inlets	100	200	5	50
Property lines and roads	50	50	0	10

- Setbacks may change if filter strips or barriers exist
- No application from road or to saturated ground
- Application to highly erodible land in limited circumstances
- Weather forecasts must be observed 24 hours in advance and after planned land application in order to avoid applying manure when potential of rain causing run-off is predicted
- Field tiles must be inspected during and following application
- Spray irrigation
  - Conducted to prevent equipment leaks
  - Excessive application not allowed (application rate exceeds infiltration rate of soil)
  - Not where less than 20 inches of soil above bedrock
  - Limited application in flood plains
- Application to frozen ground
  - Not on land with greater than 2 percent slope unless 40 percent residue.
  - Not in flood plain.
  - No closer than 200 feet to surface water.
  - Application rate no more than 50 percent of agronomic rate of nitrogen.
- Storm water pollution prevention plan
  - Description of clean water diversion.
  - Practices to minimize pollutants in storm waste discharges.
  - Monitoring plan.
- Closure requirements.

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CFO and CAFO Myths and Facts

Permitting

Myth: IDEM does not take into consideration any surrounding water bodies or aquifers when reviewing plans for a new building site.

Fact: IDEM takes into consideration all surrounding water bodies and aquifers. For example:

- Surface water bodies
    - The CAFO/CFO facility design requirements include setbacks from surface water bodies, sinkholes and wells. These setbacks were established as pollution prevention setbacks by providing a buffer area between the waste storage and the water source.
    - There are also setbacks within the land application requirements serving as pollution prevention methods. The setbacks increase as the slope of the site increases and liquid manure application setbacks are more stringent than solid or dry manure setbacks.

- Aquifers
    - The CAFO/CFO facility design requirements are intended to protect groundwater by specifying minimal leakage allowance from the storage. Concrete structures must be designed to be structurally sound and water tight and meet the national American Concrete Institute (ACI) Code #318. Earthen lagoons must be equipped with a liner constructed to minimize leakage and not to exceed a rate of loss of $1/16^{th}$ inch per day.
    - Land application activities must be done in a manner that minimizes leaching beyond the root zone of the crop being grown or to be grown. Since nitrogen is mobile in the soil and human health effects occur due to high nitrates in drinking water IDEM established maximum rates of application based on nitrogen. Applications must not exceed the nitrogen requirement of the crop. This effectively minimizes the potential of excess nitrogen remaining in the soil after the crop.

- Sensitive Surface Water Bodies and Aquifers
    - The CFO/CAFO rules allow for IDEM to identify "sensitive areas" near a proposed or existing farm and impose additional or different requirements in order to address the sensitive characteristic of the farm site. The review process for each application includes responding to any site characteristic that results in increased concern and consideration if additional protective measures should be imposed. This has occurred numerous times over the history of the program.

Myth: IDEM never denies a confined feeding permit application.

Fact: IDEM has historically provided three Notice of Deficiencies (NODs) to solicit responses from applicants regarding deficiencies in their applications. If an applicant fails to respond after the third NOD, IDEM will deny the permit request. In virtually all cases, the applicant responds to the NODs and supplements the application to comply with all requirements. Producers either

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meet IDEM's requirements, or if they cannot meet their requirements, they voluntarily withdraw their application. The voluntary withdrawal makes a formal denial unnecessary.

OPERATIONAL REQUIREMENTS

Myth: The Manure Management Plan (MMP) is not an enforceable part of the IDEM permit (i.e. don't know where manure being applied).

Fact: When a CFO / CAFO permit is submitted, it must identify a minimum amount of acreage available for land application. If other land is used for application, this must be documented in the operating record (i.e. land use agreement, map). The operating record must be available at the facility for inspection at all times. However, the CFO / CAFO approval does not need to be amended. IDEM permits are essentially non site specific regarding land application sites. According to IDEM, they do not require amendment because they do not want to make it a burdensome process for producers to apply to as much acreage as possible. MMPs also document procedures for soil and manure testing. If a farm does not test their soil or manure at the frequency reported in their MMP, enforcement can be initiated by IDEM.

Myth: Manure coming from other states is not regulated by IDEM.

Fact: IDEM's authority to regulate CFOs and CAFOs is limited to those operating in Indiana and deals primarily with water quality. Manure brought from out of state from a facility that is not part of a CFO or CAFO program and staged on land is regulated as any other substance brought into the state would be regulated. That is, it may not cause or contribute to a polluted condition. IDEM's general authority includes IC § 13-18-4-5 and IC § 13-30-2-1. Manure brought from out of state that is from a regulated CFO or CAFO and staged on land must be handled and applied in accordance with the requirements of Indiana's CFO or CAFO program, depending on the classification of the operation.

> **IC § 13-18-4-5**
> *It is unlawful for any person to throw, run, drain, or otherwise dispose into any of the streams or waters of this state, or to cause, permit, or suffer to be thrown, run, drained, allowed to seep, or otherwise disposed into any waters, any organic or inorganic matter that causes or contributes to a polluted condition of any waters, as determined by a rule of the board adopted under IC § 13-18-4-1 and IC §13-18-4-3.*
>
> **IC § 13-30-2-1**
> **Specific acts prohibited**
> *Sec. 1. A person may not do any of the following:*
> *(1) Discharge, emit, cause, allow, or threaten to discharge, emit, cause, or allow any contaminant or waste, including any noxious odor, either alone or in combination with contaminants from other sources, into:*
> *(A) the environment; or*
> *(B) any publicly owned treatment works; in any form that causes or would cause pollution that violates or would violate rules, standards, or discharge or emission*

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requirements adopted by the appropriate board under the environmental management laws.

Myth: Producers are not currently required to have a Nutrient Management Plan (NMP).

Fact: Producers with an IDEM CAFO permit are considered to have a NMP.
New Source CAFOs must comply with the NRCS 590 Nutrient Management Standard when manure is first applied from the facility. A Soil Conservation Practice Plan (SCPP) must also be implemented prior to the first land application events on land owned or controlled by the CAFO. Existing facilities that were newly defined as CAFOs have been given until 2009 to develop and implement their SCPP.

As prescribed by the EPA in their 2003 NPDES CAFO rule, a Nutrient Management Plan (NMP) must be implemented by each CAFO that include best management practices and procedures necessary to implement applicable effluent limits and standards. The NMP must, to the extent applicable:

1. Ensure adequate storage.
2. Ensure proper management of mortalities.
3. Ensure that clean water is diverted from the production area.
4. Ensure no direct contact of animals to surface waters.
5. Ensure that chemicals or other contaminants handled on-site are not disposed within manure storage or storm water.
6. Implement site specific conservation practices to control runoff and nutrient migration from the land application sites.
7. Identify protocols for manure and soil testing.
8. Establish protocols to determine site specific application rates to ensure appropriate utilization of applied nutrients.
9. Identify specific records to be maintained to document the implementation of and maintenance of the NMP components.

The following sections of the IDEM CAFO rule address most of these requirements:

1. The CAFO rule, 327 IAC 15-15-7(b), states that design and construction must comply with the CFO rule, specifically 16-5 and 16-8, which require at least 180 days of storage capacity for manure and process waste water.
2. The CAFO rule states in 327 IAC 15-15-4(7) that mortalities may not be placed in the liquid manure storage system and 15-15-10(h) which says that a mortality compost facility must prevent runoff and that mortality compost must be land applied in compliance with the manure land application requirements.
3. The CAFO rule states in 327 IAC 15-15-18(b) that the storm water pollution prevention plan must describe clean water diversion used at the production area, including feed storage areas.
4. The CAFO rule, 327 IAC 15-15-4(b), states that animals in any confinement area cannot have direct access to surface waters.
5. Not addressed in rule.

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6. The CAFO rule, 327 IAC 15-15-11, requires the development of a soil conservation practice plan (SCPP) for land application sites under the control of the CAFO to:
    a. reduce soil erosion to T (tolerable levels)
    b. minimize nutrient loss through leaching and prevent runoff
7. 327 IAC 15-15-12 specifies the frequency of manure and soil testing
8. 327 IAC 15-15-12 (d) and (e) specifies applying manure in accordance with the NRCS 590 Standard
9. 327 IAC 15-15-17 requires an Operating Record be maintained on the farm and specifies the required content.

Therefore, IDEM's permit and nutrient management requirements are equivalent and acceptable to meet EPA's Nutrient Management Plan (NMP) requirements.

Myth: Producers smaller than a CFO are not regulated by IDEM.

Fact: *327 IAC 16-2-5 "Confined feeding operation" defined*

> *"Confined feeding operation", as defined in IC § 13-11-2-40, means any:*
> *(3) animal feeding operation that causes a violation of:*
> *(A) water pollution control laws;*
> *(B) any rules of the water pollution control board; or*
> *(C) IC § 13-18-10.*

Based on this definition, IDEM has the authority to require a producer smaller than that of a CFO to enter the CFO program if they have a spill. Even absent being required to obtain an IDEM permit, they would fall within the general prohibitions that prohibit any person from polluting waters of the state (see IC § 13-30-2-1 and IC § 13-18-4-5).

Myth: A recipient of manure from the CAFO operator who then applies the manure is not regulated by IDEM.

Fact: Under the marketing requirements at 327 IAC 15-15-15, a CAFO operator must provide an information sheet to the first recipient that must contain a statement that it is unlawful to allow manure to enter any waters of the state and the application requirements in the CAFO rule.

Myth: A recipient of manure who builds a storage structure near the application site does not need to comply with IDEM's manure storage structure design and construction regulations.

Fact: IDEM is not currently regulating these structures. However, this is not a significant area of concern to IDEM because it is predominately dry poultry litter. However, this could pose a greater problem in the case of liquid manure. It is important to note that the recipient must not cause or contribute to a polluted condition of waters (see IC § 13-18-4-5 and IC § 13-30-2-1).

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U.S. Environmental Protection Agency Air Agreement

The U.S. Environmental Protection Agency (EPA) is currently conducting a $9 million livestock air emissions study. On January 31, 2005, EPA published a notice in the Federal Register offering animal feeding operations (AFOs) an opportunity to sign a voluntary Consent Agreement, which establishes a monitoring study for emissions at such operations. In addition, livestock facilities entering into this agreement paid a modest civil penalty and received a final order, liability release and covenant not to sue resolving potential past violations of the Clear Air Act and the hazardous substance release notification provisions of Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and Emergency Planning and Community Right to Know Act (EPCRA). As of January 2005, 2,681 producers had signed agreements and will provide the sample for the monitoring program.

The study is being lead by Professor Al Heber, a Purdue University researcher. Heber's monitoring study plan has been finalized and the monitoring survey will commence this winter. Data collection will take place for 24 months. The study will quantify air emissions and compare them to existing thresholds for dust, ammonia, and hydrogen sulfide. Under the CAA, CERCLA, and EPCRA, a release greater than 100 pounds of ammonia or hydrogen sulfide within 24 hours is a reportable quantity. Climatic conditions, facility size, species, and type of waste system will be considered when evaluating emissions.

The EPA will use the data to develop emissions estimates and new compliance standards, guidelines, and enforcement policies. Within 18 months of completion of the study, the EPA plans to publish the emissions and establish their estimating methodology. This methodology will allow AFOs to estimate their emission and comply with federal regulatory requirements.

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Zoning Regulation versus State Regulation

Local units of government are given the ability to exercise planning and zoning powers through the Indiana Planning and Zoning Law (*Indiana Code Title 36 Article 7 Planning and Development*). Plan commission responsibilities include preparing a comprehensive plan, preparing a zoning ordinance and a subdivision control ordinance, making recommendations to the legislative body on proposals to amend the text of the zoning ordinance or subdivision control ordinance and approving or denying proposals to subdivide land and development plans.

Planning and zoning is essentially about separation of uses, or *where* an activity takes place. Local government plays a critical role in making such decisions, which complement state regulation of *how* that activity takes place. Plan commissions have many responsibilities, but their most important duty is to develop and recommend a plan for the future of the community. Focusing on this fundamental planning responsibility is critical to ensure it is effectively implemented.

Plan commissions must observe the requirements of the state planning law when exercising the power to implement local zoning regulation. In addition, plan commissions must operate within limitations established by the state legislature and judiciary. With regard to livestock production, these limitations apply to state environmental programs administered by IDEM and the Office of the Indiana State Chemist. These agencies comprehensively regulate our states livestock producers to ensure environmental quality. The Indiana Land Resources Council will continue to develop guidance materials that provide clarity regarding the role of local zoning regulation.

For more information about the model ordinances and the Indiana Land Resources Council visit www.in.gov/isda

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Additional Resources

Indiana Department of Environmental Management

Agriculture Liaison: Ryan Westerfeld, 317-232-8587
www.in.gov/idem/agriculture/livestock/cfo/index.html
Table of Contents

- Important Links
  - CFO Guidance Manual (includes the following information)
    - Example of Plot Maps, Farmstead Map, Waste Management System Drawings and Rainfall Map
    - Reference List to Purdue Cooperative Extension Service and natural Resource Conservation Service
    - Purdue Publications on: "Estimating Manure Spreader Capacity" and "Calculating Manure and Manure Nutrient Application"
    - IDEM CFO Inspection Report
    - IDEM CFO Land Application Inspection Report
    - Indiana Statute on Confined Feeding Operations
    - Definitions that apply to the confined Feeding Control Law

  IDEM Approval requirements
  CFO/CAFO Application Submittal
  CFO/CAFO Application Review
  IDEM CAFO Permit Requirements
  Common questions and answers about CAFOs in Indiana
  Additional information and links

Purdue University Publications

www.ces.purdue.edu/extmedia/menu.htm
Agricultural Air Quality

- Methods & Practices to Reduce Odor from Swine Facilities
- Manure Pit Ventilation in Confinement Livestock Buildings
- Methane Generation from Livestock Waste

Building Environment

- Environmental Control for Confinement Livestock Housing
- Natural Ventilation for Livestock Housing

Farm Machinery, Tractors and Field Operations

- Implementing Site-Specific Management: Liquid Manure Application
- Implementing Site-Specific Management: Map-Versus Sensor-Based Variable Rate Application
- Implementing Site-Specific Management: Controlling Application Rate On-the-Go
- Implementing Site-specific Management: Sprayer Technology-Controlling Application Rate and Droplet Size Distribution On the Go

Manure Management

- Animal Manure As a Plant Nutrient Resource
- Runoff Control Systems for Open Livestock Feedlots

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- Design & Operation of Livestock Waste Lagoons
- Swine Manure Management Planning
- Poultry manure management Planning
- Best Environmental Management Practices, Farm Animal Production:
    - Land Application Records and Sampling
    - Mortality management
    - Inspecting Your Confined Feeding Operation
    - Feeding Strategies to Lower Nitrogen and Phosphorus in Manure
    - Manure Nutrient Recycling
    - Land Application of Manure and Environmentally Sensitive Field Characteristics
    - Manure Applicator Calibration
    - Odor Control Options for Confined Feeding
    - Comprehensive Nutrient management Plans (CNMP)

Watershed Protection and Soil Conservation

- On-Farm Soil Monitoring for Water Resource Protection

Water Quality and Supply

- Water Testing Laboratories
- What is Ground Water?
- How to Take a Water Sample
- Animal Agriculture's Effect on Water Quality Pastures and Feedlots
- Animal Agriculture's Effect on Water Quality Waste Storage
- Water Quality for Animals
- Land Application of Manure
- Agriculture's Effect on Environmental Quality: Key Management Issues
- Plugging Abandoned Water Wells: A Landowner's Guide
- Field Assessment for Water Resource Protection
- On-Farm Soil Monitoring for Water Resource Protection

Purdue University Indiana Farmstead Assessment "Drinking Water Well"

https://engineering.purdue.edu/SafeWater/farmasyst/surveys/factsheets/farmassess1.htm
WQ-1 Water Testing Laboratories
WQ-3 How to Take a Water Sample
WQ-4 Why Test Your Water?
WQ-5 Interpreting Water Test Results
Nitrate and Pesticides in Private Wells of Indiana
WQ-21 Plugging Abandoned Wells: A Landowner's Guide

Indiana Administrative Code 13-10-2 Permanent abandonment of wells

IC 25-29-4-6 describes the process to close abandoned wells

Purdue University CAFOs Publications

www.ces.purdue.edu/cafos

Environmental Issues

- Insect Considerations
- Manure Storage Systems

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- The Possibility for Reducing Water Pollution Resulting from CAFO and the Impact of Phytase
- Odors, Dust and Gases
- Water Quality
- Land Application Setbacks
- Nutrient Management

Public Health Issues

- The Issue of Antibiotic Resistance
- The Fate of unabsorbed Antibiotics
- Manure and Pathogens
- Manure and Hormones
- Emissions and Pulmonary Health of Neighbors
- Occupational Health and Safety

General Information

- What is a CFO/CAFO?

NRCS

www.nrcs.usda.gov/technical/nutrient.html
www.nrcs.usda.gov/technical/standards/nhcp.html

592 Standard: Feed Management
590 Standard: Nutrient management

Air Management Practices Assessment Tool

www.extension.iastate.edu/airquality/practices/homepage

Livestock and Poultry Environmental Learning Center

http://lpe.unl.edu

The Learning Center broadens access to new information supporting sound environmental decision making in animal agriculture by using innovative delivery methods such as its national web cast seminar series.

Livestock and Poultry Environmental Stewardship Curriculum

MidWest Plan Service
122 Davidson Hall
Iowa State University
Ames, Iowa 50011-3080
800-562-3618
www.MWPSHQ.org

National Programs

Dairy Quality Assurance Center
www.dqacenter.org

National Cattlemen's Beef Association
www.beef.org

PILOT

National Chicken Council
www.nationalchickencouncil.com

National Pork Board:
www.porkboard.org/environment/home

National Turkey Federation
www.eatturkey.com

United Egg Producers
www.uepcertified.com

U.S. Duck Council
www.impresswithduck.com

PILOT

The following are compliance requirements for CAFO, please verify the following activities are currently practiced on the farm (if applicable) by answering the last question. Then answer the questions and score points.		
The operation complies with local, state and federal regulations.		
There is a written Manure Management Plan.		
Soil tests are taken a minimum of every 3 years.		
Manure samples are tested every year.		
There is a manure test conducted for each type of manure generated.		
Manure application is based on agronomic rates for potentially available nitrogen and documented records are kept at the operation.		
Tile in the field is adequately inspected prior to land application. (i.e. setbacks from standpipes, blowouts)		
Field tile discharge outlets into ditches are identified, marked and observed before and after application.		
Manure application operating records are kept on the following: type of manure, results of manure tests, soil tests for manure application sites, the amount of manure applied, the type of application method used, location and number of acres on which manure is applied, dates of application and determination of agronomic rates for potentially available nitrogen used to apply manure to each field.		
Maintain a minimum of two (2) feet of freeboard for any uncovered liquid manure storage structures.		
The waste management system is constructed to minimize leaks and seepage and prevents spills that could contaminate ground water or surface water.		
All waste management systems are inspected and recorded with weekly self-monitoring.		
Manure that is staged for more than seventy-two (72) hours is covered and applied within ninety (90) days.		
Manure is applied by equipment that has been calibrated and checked.		
The stockpile is located to prevent precipitation from running into and out of the stockpile.		
Equipment is maintained and there is oversight of equipment during land application.		
Transport vehicles are regularly inspected and are free of leaks.		
The land application site meets or exceeds CAFO setback requirements.		
Dead animals are disposed of within twenty-four (24) hours of discovery. (IC 15-2.1-16-20)		
Mortality management is done in a manner that prevents runoff and leachate.		
A list of inventory equipment and emergency phone numbers for contacts are part of a spill response action plan.		
There are signed agreements regarding application of manure on land not owned by the operation.		
There is a storm water pollution prevention plan in place for (CAFO, NPDES requirement).		
Abandoned wells are closed in compliance with Code IC 25-39-4-6, Rule 312 IAC 13-10		
Abandoned gas wells are closed in compliance with Code IC 14-37-8.		
Do you meet IDEM compliance for a CAFO?		
Signature		

ENVIRONMENT
Self Assessment

	Points	Yes answer score points
Directions: Please place the score points in the column for yes responses and put the total score on the Validation Form.		
For CAFO operations that were approved prior to 2003,are crop yields, soil tests and manure tests used to prevent over application of N,P and K? (refer to NRCS 590 Standard)	10	
Do nutrients from the manure replace some or all of purchased fertilizer based on agronomic rates?	10	
Is land application done by incorporation within 24 hours or by injection?	30	
Must score minimum of 40 points from the above questions		
Have you established a wildlife habitat area?	10	
Is ground water (wells) tested every 3 years? (drinking water for house and livestock for bacteria and nitrates)	20	
Is stockpiling done in remote areas away from neighbors?	10	
Is land application from a stockpile done in less than 60 days?	10	
Are there training procedures in manure removal and application?	20	
Are there livestock drinking water conservation production practices in place?	20	
Must score minimum of 40 points from the above questions		
Do you have filter strips along surface waters in land application fields? (streams, ditches, rivers, ponds)	10	
Do you have grass waterways to handle surface water drainage in land application fields?	10	
Are livestock buildings with outside lots guttered to prevent contaminated storm water?	5	
Do you modify the ration as needed in order to minimize nutrients in manure? (refer to NRCS 592 Standard)	10	
Do you modify the ration as needed in order to minimize odor? (refer to NRCS 592 Standard)	10	
Do you consult with a professional advisor (TSP or CCA etc.) for your manure management plan and application?	5	
A soil conservation practice plan and / or CNMP is developed in accordance with NRCS conservation practice standards are in place?	5	
Are people who receive manure from your operation certified with the state applicators license?	N/A	
Are you or your contract "haulers" certified with the state applicators license?	N/A	
Must score minimum of 20 points from the above questions		
Total score		
List any additional actions your farm does to demonstrate excellence in environmental management practices. At this time these additional practices do not score points but we may consider adding them to the assessment in the future.		

We welcome participation in the CLPP program from CFO regulated farms and those that do not have an IDEM Confined Feeding permit. The CLPP program requires the smaller farms to read the enclosed Regulatory Guidance Document for Confined Feeding Operation (CFO) and that these compliance standards are met on the farm.		
The operation complies with local, state and federal regulations.		
The livestock facility and lots are designed and managed to avoid unpermitted discharges into waters of the state and minimize leaks and seepage.		
Manure is applied to prevent run-off, spills, ponding for more than 24 hours or nutrient leaching beyond root zone.		
There is a written Manure Management Plan.		
Manure application operating records are kept on the following: type of manure, results of manure tests, soil tests for manure application sites, the amount of manure applied, the type of application method used, location and number of acres on which manure is applied, dates of application and determination of agronomic rates for potentially available nitrogen used to apply manure to each field.		
Soil tests are taken a minimum of every 3 years.		
Manure samples are tested every 3 years for each type of manure.		
Manure application is based on agronomic rates for potentially available nitrogen and documented records are kept at the operation.		
Maintain a minimum of two (2) feet of freeboard for any uncovered liquid manure storage structures.		
Earthen berms for manure storage structures must be stabilized with appropriate and mowed vegetation or alternative control measures that allow for visual inspection		
The waste management containment system is constructed to minimize leaks and seepage and prevents spills that could contaminate ground water or surface water.		
All waste management systems are inspected and recorded with self-monitoring at least one time per month.		
Manure that is staged for more than seventy-two (72) hours is covered and applied within ninety (90) days.		
Staging is prohibited within 300 feet of surface waters of state, drainage inlets, or wells unless there is a barrier or a surface gradient that contains or directs contaminated water away.		
The stockpile is located to prevent precipitation from running into and out of the stockpile.		
No application from road or to saturated ground.		
No application to frozen ground with greater than 2% slope or inadequate residue.		
No irrigation to frozen ground.		
Pumping, dumping or leakage of manure from transfer vehicle on roads, ditches and into waters is prohibited.		
The land application site meets or exceeds CFO setback requirements.		
There signed agreements regarding application of manure on land not owned by the operation.		
Dead animals are disposed of within twenty-four (24) hours of discovery. (IC 15-2.1-16-20)		
Mortality management is done in a manner that prevents runoff and leachate.		
Have soil survey maps.		
Have Farmstead plans with locations identified of: waste management system, residences, roads, water wells, surface water of the state, drainage patterns, property boundary lines, drainage inlets and karst terrain.		
A list of inventory equipment and emergency phone numbers for contacts are part of a spill response action plan.		
Abandoned wells are closed in compliance with Code IC 25-39-4-6, Rule 312 IAC 13-10		
Abandoned gas wells are closed in compliance with Code IC 14-37-8.		
Please certify with signature that your operation is in compliance with CFO regulations.		

Signature of owner **Print name**		
	Points	answer
Directions: Please place the score points in the column for yes responses and put the total score on the Validation Form.		
Are crop yields, soil tests and manure tests used to prevent over application of N,P and K? (refer to NRCS 590 Standard)	10	
Do nutrients from the manure replace some or all of purchased fertilizer based on agronomic rates?	10	
Is land application done by incorporation within 24 hours or by injection?	30	
Is the tile in the field adequately inspected prior to land application? (i.e. setbacks from standpipes, blowouts)	10	
Are field tile discharge outlets into ditches identified, marked and observed before and after application?	10	
Must score minimum of 40 points from the above questions.		
Have you established a wildlife habitat area?	10	
Is there sufficient storage volume to allow spreading of manure at appropriate times of the year?	20	
Is ground water (wells) tested every 3 years? (drinking water for house and livestock for bacteria and nitrates)	20	
Is stockpiling done in remote areas away from neighbors?	10	
Is land application from a stockpile done in less than 60 days?	10	
Equipment is maintained and there is oversight of equipment during land application.	20	
Must score minimum of 40 points from the above questions.		
Are there training procedures in manure removal and application?	10	
Do you have filter strips along surface waters in land application fields? (streams, ditches, rivers, ponds)	5	
Do you have grass waterways to handle surface water drainage in land application fields?	5	
Are there livestock drinking water conservation production practices in place?	5	
Are livestock buildings with outside lots, guttered to prevent contaminated storm water?	5	
Do you modify the ration as needed in order to minimize nutrients in manure? (refer to NRCS 592 Standard)	5	
Do you modify the ration as needed in order to minimize odor? (refer to NRCS 592 Standard)	5	
Do you consult with a professional advisor (TSP or CCA etc.) for your manure management plan and application?	5	
A soil conservation practice plan and / or CNMP is developed in accordance with NRCS conservation practice standards are in place?	10	
Manure is applied by equipment that has been calibrated and checked.	5	
Transport vehicles are regularly inspected.	10	
Are people who receive manure from your operation certified with the state applicators license?	N/A	
Are you or your contract "haulers" certified with the state applicators license?	N/A	
Must score minimum of 20 points from the above questions		
Total score		
List any additional actions your farm does to demonstrate excellence in environmental management practices. At this time these additional practices do not score points but we may consider adding them to the assessment in the future.		

Validation Form: Environment

Please check the box of completed activities:

- □ Reviewed the Environment Section
- □ Environment self assessment score _____

PILOT

Environment: Grazing Animals

The purpose of the Environment Section for grazing animals is to educate and inform producers about the impact that grazing animals have on the environment. Pasture management provides many benefits to the producer, the livestock and the environment. This section includes:

- Educational materials
- Additional resources
- NRCS Midwest Pasture Condition Scoresheet
- A self assessment

PILOT

Environment: Grazing Animals

The quality and quantity of pastures have a direct economic impact on the profitability of grazing animals. Pasture management is needed for the health and stability of the grazing land. The following are topics to consider in pasture management programs.

1. Pasture condition scoring is a visual evaluation of the ten indicators listed and described in the attached NRCS Midwest Pasture Condition Scoresheet. Scoring can be preformed throughout the grazing season; prior to placing livestock on pasture, at peak forage supply periods, at low forage supply periods, as plant stress appears and near the end of the season.

2. Soil testing is an important tool in pasture management to determine fertilizer application.
    a. Generally, a testing facility will test for acidity, phosphorus, potassium, calcium, magnesium, zinc and manganese. Other tests can be requested.
    b. Zigzag across the field to obtain a good sample of soil.

3. Apply fertilizer or lime to the field based upon soil test results. Lime application needs to be done six months to one year prior to pasture establishment or renovation.

4. Seeding and renovating the pasture will protect against runoff. A highly productive forage will slow down manure runoff, entrap the manure and utilize more nutrients. Seeding and renovating should be based on the type of livestock on the pasture, the soil type, soil drainage, soil fertility, soil acidity and seed variety.

5. Weeds will be minimal with good fertility and dense forage grasses to crowd out the weeds. If necessary, use selective herbicides.

6. Fencing is important for animal management as well as pasture management. Provide fencing where needed to prevent soil erosion around ponds and streams. Check for debris build-up on flood gates to prevent back up of waters and erosion.

7. Rotational grazing helps prevent overgrazing and soil erosion. To implement rotational grazing, divide the pasture into smaller cells. Allow the animals to graze in one of the smaller areas for seven days or less. Each cell will need between 25 and 38 days to rejuvenate between grazing cycles.

8. A watering facility can be a permanent or portable watering trough or a device, such as a nose pump that lets cows pump water from a stream or pond. A watering facility improves health of livestock by providing clean, safe, dependable drinking water. Watering facilities also save time and work in hauling water to animals, keep livestock out of ponds or streams and reduce stream bank erosion.

9. The following best management practices can assist producers with grazing animals.
    a. Apply appropriate stocking rate to prevent over grazing.

PILOT

b. Move animals onto the pasture when the forages are approximately eight inches tall.
c. Remove animals when the pasture is grazed to three or four inches.
d. Clip the pasture once seed heads form to stimulate new growth and reduce the risk livestock injury.
e. Provide shade in the summer, using trees or shelters to reduce the need for animals to enter water for heat relief.
f. Locate feeders and water facilities a reasonable distance from streams. Move them to new locations before livestock wear paths by repeated trampling.

PILOT

References

Purdue University Agronomy web site: www.agry.purdue.edu/ext/forages/indes
Contact: Keith Johnson, Purdue extension forage specialist: johnsonk@purdue.edu
Ron Lemenager, Purdue extension beef specialist: rpl@purdue.edu
Matt Claeys, Purdue extension beef specialist: mclaeys@purdue.edu

NRCS Technical Resources "National Range and Pasture Handbook"
NRCS Technical Resources "Guide to pasture Condition Scoring"
NRCS Technical Resources "Watering Facility- Small Scale Solutions for your Farm in Indiana"
NRCS Prescribed Grazing Code 528
NRCS Stream Crossing Code 578
NRCS Watering Facility Code 614
NRCS Fence Code 382
The Progressive Farmer/ October 2007 "10 Steps to Your Best Pasture"
Purdue University Extension Publication: Water Quality WQ-7 "Animal Agriculture's Effect on Water Quality Pastures and Feedlots"

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Producer Resources

Indiana Department of Environmental Management (IDEM)

Agriculture Liaison: Ryan Westerfeld, 317-232-8587
www.in.gov/idem/agriculture/livestock/cfo/index.html

Purdue University Publications

www.ces.purdue.edu/extmedia/menu.htm

Manure Management

- Animal Manure As a Plant Nutrient Resource
- Runoff Control Systems for Open Livestock Feedlots
- Best Environmental Management Practices, Farm Animal Production:
    - Land Application Records and Sampling
    - Mortality management
    - Inspecting Your Confined Feeding Operation
    - Feeding Strategies to Lower Nitrogen and Phosphorus in Manure
    - Manure Nutrient Recycling
    - Land Application of Manure and Environmentally Sensitive Field Characteristics
    - Manure Applicator Calibratior
    - Comprehensive Nutrient management Plans (CNMP)

Watershed Protection and Soil Conservation

- On-Farm Soil Monitoring for Water Resource Protection

Water Quality and Supply

- Water Testing Laboratories
- What is Ground Water?
- How to Take a Water Sample
- Animal Agriculture's Effect on Water Quality Pastures and Feedlots
- Water Quality for Animals
- Land Application of Manure
- Agriculture's Effect on Environmental Quality: Key Management Issues
- Plugging Abandoned Water Wells: A Landowner's Guide
- Field Assessment for Water Resource Protection
- On-Farm Soil Monitoring for Water Resource Protection

National Cattlemen's Beef Association

www.beef.org

PILOT

We welcome participation in the CLPP program from grazing livestock farms. Although there are no legal requirements for grazing animals, the CLPP program requires that grazing livestock operations protect the water and land by being good environmental stewards by using the Natural Resources Conservation Service (NRCS) conservation practice standards as a guide. Please refer to the following NRCS Conservation Practice Standards: Stream Crossing Code 578, Watering Facility Code 614, Fence Code 382 and Prescribed Grazing Code 528.		YES
Stream crossings and watering access points adhere to applicable conservation practice standards and their criteria.		
Watering and feeding facilities and shade areas are sited or constructed so as to prevent or discourage livestock from creating high use loafing areas adjacent to surface water bodies.		
Stream bank and streambed erosion is reduced by providing a stable area to cross.		
Stream crossings shall be located in areas where the streambed is stable.		
Fencing is not necessary at all sites. Stream channel areas above and below the stream crossing are permanently fenced (or otherwise excluded) if needed to prevent livestock access to the stream except at the crossing.		
Coarse rock, used in the crossing, helps to deter loafing time in the stream.		
The stream crossing is inspected at least annually by the landowner or operator and stone replaced as needed.		
The stream crossing and associated fence is inspected after each major storm event and repairs made as needed.		
In areas for potential erosion adjacent to watering facility, the area is graveled, paved or otherwise treated to provide firm footing and reduce erosion.		
Please certify with your signature that your operation uses best management practices and NRCS conservation guidelines for protecting the water and land in your grazing operation.		
Directions: Please place the score points in the column for yes responses and put the total score on the Validation Form.	Points for Yes	YES
Does the operation comply with applicable local, state and federal regulations?	10	
Is rotational grazing done to prevent overgrazing?	10	
Is mowing or clipping the pasture part of your management plan?	10	
Does the pasture contain warm season and cool season grasses?	10	
Is there appropriate stocking rate on the pasture?	10	
Is there a managed weed control program?	10	
Are poisonous plants scouted for and removed from the pasture?	10	
Forage is checked for mold and harmful insects?	10	
Is proper fertilizer applied to the pasture based on soil tests?	10	
Are soil tests taken a minimum of every 3 years?	10	
Are there soil survey maps of the farm?	10	
Must score minimum of 60 points from the above questions		

Is the livestock facility and lot area designed and managed to avoid unpermitted discharges into waters of the state?	10	
Is the silage storage area designed and managed to minimize leaks and seepage?	10	
Is there sufficient storage volume to allow spreading of manure at appropriate times of the year?	10	
Is manure applied by equipment that has been calibrated and inspected for leaks?	10	
Is manure that is staged for more than seventy-two (72) hours covered and applied within ninety (90) days?	10	
Is staging location more than 300 feet from surface waters of state, drainage inlets, or wells unless there is a barrier or a surface gradient that contains or directs contaminated water away?	10	
Is mortality management done in a manner that prevents runoff and leachate?	10	
Are dead animals disposed of within twenty-four (24) hours of discovery? (IC 15-2.1-16-20)	10	
Must score minimum of 30 points from the above questions		
Are watering facility systems in place to eliminate erosion on creek banks?	10	
Is fencing and gates secure?	4	
Is regular inspection of fences part of an on-going management program?	2	
Are floodgates maintained and repaired to allow for free flowing water?	4	
Are abandoned wells closed in compliance with Code IC 25-39-4-6, Rule 312 IAC 13-10?	2	
Are abandoned gas wells closed in compliance with Code IC 14-37-8?	2	
Is ground water (wells) tested every 3 years? (drinking water for house and livestock for bacteria and nitrates)	1	
Do you have filter strips along surface waters in land application fields? (streams, ditches, rivers, ponds)	4	
Have you established a wildlife habitat area?	1	
Is a soil conservation practice plan and / or CNMP developed and in place in accordance with NRCS conservation practice standards?	4	
Must score minimum of 10 points from the above questions		
Total Score		
List any additional actions your farm does to demonstrate programs that influence the environment. At this time these additional practices do not score points but we may consider adding them to the assessment in the future.		

Validation Form: Environment for Grazing Animals

Please check the box of completed activities:

- ☐ Reviewed Environment Section
- ☐ Environment self assessment score _____
- ☐ Pasture condition score_____

PILOT

Midwest Pasture Condition Scoresheet - Standard for Cool Season Grass/Legume Mixed Pasture 30-45" PZ

Cooperator		**Date**	
Conservationist		**Pasture number(s)**	
Forage Suitability Group(s)			
Current Years Precipitation (check one)	Above Normal ☐ Normal ☐	Below Normal ☐	

Evaluate the site and rate each indicator based upon your observations. Scores for each indicator may range from 1 to 5. Multiply the points x the weight to get weighted points. Sum the weighted points to determine overall CSP pasture condition score.

Indicator/Weight	1 Points	2 Point	3 Points	4 Point	5 Points	Points	Wt.	Wtd. Pts.
Percent Desirable Plants / 10%	Desirable species <20% of stand. Annual weeds and/or woody invasives are dominant.	Desirable species 20-40% of stand. Mostly weedy annuals and/or woody invasives present and expanding. Shade is a factor.	Desirable species 40-60% of stand. Undesirable broadleaf weeds and annual weedy grasses invading. Some woody species invading.	Desirable forage species 60-80% of stand. Remainder mostly intermediates and a few undesirables are present.	Desirable species exceed 80% of plant community with the remainder being scattered intermediates.		1.0	
Live Plant Cover (Live stems and green leaf cover of all species at adjusted 3-4" height.) **/ 15%**	Canopy: <50% Photosynthetic area is very low. Very little plant cover to slow or stop runoff.	Canopy: 50-70% Photosynthetic area is low. Runoff is fast due to low plant cover.	Canopy: 70-80% Most forages are grazed close, with little leaf area to intercept sunlight. Runoff is moderate due to moderate plant cover.	Canopy: 80-90% Spot grazed so there is some loss of photosynthetic potential. Runoff is low due to good plant cover.	Canopy: 90% Forages are maintained in leafy condition for best photosynthetic activity. Stands are very thick stand with slow or no runoff flows.		1.5	
Plant Diversity (Evaluate as a complete system.) **/ 10%**	More than one dominant (>75% of DM wt.) forage species from one functional group with differing growth habitats. Not evenly grazed - poorly distributed. (ex: jointed grasses and non-jointed grasses)	One dominant (>75% of DM wt.) forage species. Or, over 5 forage species (all <20%) from one dominant functional group, not evenly grazed - poorly distributed.	Two to five forage species from one dominant functional (>75% of DM wt.) group. At least one avoided by livestock permitting presence of mature seed stalks. Species in patches.	Three forage species (each 20% DM wt.) from one functional group. None avoided. Or, one forage species each from two functional groups, both supply 25-50% of DM wt.	Three to four forage species with at least one being a legume (each 20% of DM wt. and total >75% of DM wt.). Well intermixed, compatible growth habit, and comparable palatability		1.0	
Plant Residue / 5%	Ground cover: <1% No identifiable residue is present on soil surface. Or, heavy thatch is evident (>1 inch).	Ground cover: 1-10% is covered with dead leaves or stems. Or, thatch is 0.5 inch to 1 inch thick.	Ground cover: 10-20% is covered with dead leaves or stems. Or, there is slight thatch buildup but <0.5 inch.	Ground cover: 20-30% is covered with dead leaves or stems but there is no thatch present.	Ground cover: 30-70% is covered with dead leaves or stems, but there is no thatch buildup.		0.5	
Plant Vigor / 15%	There is no recovery after grazing. More than 80% of plants are pale yellow or brown, or permanently wilted, or lost due to insects or disease. Yields are regularly more than 30% below site potential; or there is lodged, dark green overly lush forage, often avoided by grazers.	Recovery after grazing takes 2 or more weeks longer than normal, or 50% to 80% of plants are yellowish green leaves, or there is major insect or disease yield loss, or plants are wilted most of day. Productivity is very low, 20-30% below site potential.	Recovery after grazing takes 1 week longer than normal, or the urine/dung patches are dark green in contrast to rest of plants, or there is minor insect or disease loss or mid-day plant wilting. Yields are regularly 10-20% below site potential.	Recovery after grazing takes 1 to 2 days longer than normal; 50 to 80 % of plants are of healthy green color for the crop. There is minor insect or disease damage. No plants are wilting. Yields are near site potential.	Rapid recovery after grazing. More than 80% of the plants are of healthy green color for the crop. No signs of insect or disease damage. No leaf wilting. Yields are at site potential for the species adapted to the site's soil and climate. Desirable plants competitive with invading species.		1.5	
Percent Legume / 5%	Legumes are <10% by wt. Or, greater than 60% bloating legumes.	Legumes are <10% by wt. Or, 40-60% spreading legume with grass loss occurring.	10-19% legumes.	20-29% legumes.	30 – 60 % legumes by weight.		0.5	
Uniformity of Use / 5%	Over 50% of the pasture. Mosaic pattern found throughout pasture or identifiable areas of pasture avoided.	No more than 30-50 % of the pasture spot grazed either in a mosaic pattern or obvious portion is not frequented. . Urine and dung patches are avoided.	No more than 20-30 % of the pasture spot grazed either in a mosaic pattern or obvious portion is not frequented. . Urine and dung patches are avoided.	No more than 10-20 % of the pasture spot grazed. Urine and dung patches are avoided.	No more than 10 % of the pasture spot grazed. 90% of the pasture falls within the minimum and maximum grazing heights for cool season grass/legume mixtures (3 – 8").		0.5	
Livestock Concentration Areas / 10%	Cover >10% of the pasture; or concentrated areas convey contaminated runoff directly into water channels.	Livestock conc. areas and trails cover 5-10% of pasture; most close to water channels and drain into them unbuffered.	Isolated livestock concentrated areas and trails cover 5-10% of area.	Some livestock trails and one or two small concentration areas cover <5% of the pasture. Buffer areas are between concentrated areas and water channels.	No untreated livestock concentration areas in the pasture. (Ex. Gravel pad around waterers, possibly at gates, no evidence of trails in pasture).		1.0	
Soil Compaction / 10%	Unable to push survey flag into soil. Infiltration capacity and surface runoff severely affected by heavy compaction. Excessive livestock traffic killing plants over wide areas.	Hard to push survey flag past compacted layers. Infiltration capacity is lowered and surface runoff increased due to large areas of bare ground and dense compaction layer at surface.	Soil resistant to survey flag at one or more depths within soil depth. Infiltration capacity lowered and surface runoff increased due to plant cover loss and soil compaction by livestock hooves.	Survey flag enters soil easily except at rocks. There are scattered signs of livestock trails and hoof prints, confined to lanes or small, wet areas.	Survey flag pushes easily into ground except for rocks. Soil is friable, earthworm and dung beetle activity should be evident, especially around manure piles.		1.0	
Erosion / 15%	Erosion is active throughout pasture; rills are 3-8 inches deep at close intervals and/or grazing terracettes are close-spaced with some slope slippage. Active gullies are present caused by livestock trailing. Pediceling is apparent.	Most erosion is confined to steepest terrain of unit; well defined rills are 0.5-3 inches deep at close intervals and/or grazing terracettes are present. Trails are evident causing concentrated flows.	Most erosion is confined to heavy use areas, especially in loafing areas, concentration area, and water sites; rills are 0.5-3 inches deep. Debris fans are found at downslope edge. Livestock trailing is evident.	No current formation of rills. There is some evidence of past rill formation, but they are grassed. Scattered debris dams of litter are occasionally present.	No evidence of current or past formation of sheet flow or rills.		1.5	

Overall Pasture Condition Score	Individual Indicator Score	Management Change Suggested
45 to 50	5	No changes in management needed at this time.
35 to 45	4	Minor changes would enhance, do most beneficial first.
25 to 35	3	Improvements would benefit productivity and/or environment.
15 to 25	2	Needs immediate management changes, high return likely.
10 to 15	1	Major effort required in time, management and expense.

Overall Pasture Condition Score =

Comments/Notes

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Fence

(Feet)

Code 382

DEFINITION

A constructed barrier to animals or people.

PURPOSES

This practice is applied to facilitate the application of conservation practices by providing a means to control movement of animals and people.

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied on any area where management of animal or people movement is needed. Fences are not needed where natural barriers will serve the purpose.

CRITERIA

The intended purpose of the fencing system will determine the appropriate design criteria to be used. General construction standards for fences are grouped into either permanent or temporary categories**.** All planned work shall comply with federal, state, and local laws and regulations.

Permanent Fences:

Permanent exterior fences are used to exclude livestock from all areas needing permanent protection, to establish permanent grazing system boundary areas or be used to regulate or restrict access to areas by people.

Material used in permanent fence shall have a minimum life expectancy of 20 years.

A. <u>Posts</u>

All wooden posts shall consist of high quality species with a high resistance to decay such as untreated black locust, red cedar (diameter shall be at least 50% heartwood), catalpa, osage orange, iron bark eucalyptus or other wood of equal life and strength and approved by NRCS. Pressure treated posts shall have one of the following treatments or equivalent: pentachlorophenol (0.4 lbs/ft^3), chromated copper arsenate (0.4 lbs/ft^3) or creosote solutions (6.0-8.0 lbs/ft^3). Wood posts shall be sound and free of decay with all limbs trimmed substantially flush with the body. They shall be relatively straight throughout, free from heat checks or any other damage or defects that would impair their usefulness or durability. The use of “S” irons is not permitted.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service State Office, or download it from the electronic Field Office Technical Guide for your State.

All wood posts will be at least two (2) inches higher than the top wire of the fence to prevent splitting when attaching insulators.

All steel posts shall have a minimum weight of 1.33 pounds per foot, exclusive of the anchor plate. Steel posts shall have studs or grooves that allow for a suitable means of supporting the wire. Steel posts will be "T" or "U" type and painted or galvanized. Steel posts without flanges shall not be used. Steel posts shall be alternated in the fence with wood posts at a maximum ratio of 4:1.

Fiberglass (minimum diameter of 3/4 inches for internal fence and 7/8 inches for external fence) and polyvinylchloride solid round sucker rod (minimum diameter of 5/8 inches) used as line posts shall be alternated in the fence with wood posts at a maximum ratio of 8:1 and placed a minimum of 20 inches in the ground.

Stays used to stabilize high tensile wire between posts shall be made of fiberglass or non-conductive wood.

In place of line posts, fencing may occasionally be fastened to healthy low value trees. Trees must be properly aligned and spaced. If trees are used, the trees must be of sufficient size that swaying and other movement will not affect the efficient operation of the fence. When trees are used instead of posts, a buffer shall be installed between the wire and the tree to keep the tree from growing around the wire. A treated or rot resistant wooden board of at least 1.5 inches thickness attached securely to the tree makes a good buffer. In this case, the wire is stapled to the board rather than the tree. Spring grip clips on 3/8 or ½ inch diameter fiberglass rods driven into drilled holes are a good alternative and will not hamper tree harvest in the future.

Wood posts shall be driven or set in holes and backfilled with concrete, tamped earth, or tamped crushed limestone. Steel and fiberglass posts shall be driven.

Steel posts will be placed in the ground to a depth that the flange is buried a minimum of 2 inches below ground level.

Post holes shall be at least 6 inches larger than the maximum diameter or side dimension of the posts when set in concrete or tamped crushed limestone. Post holes shall be at least 4 inches larger than the maximum diameter or side dimension of the posts when tamped with earth.

Earth and limestone backfill around posts shall be thoroughly tamped in layers not thicker than 4 inches and shall completely fill the post hole up to the ground surface. Concrete backfill around posts shall be rodded into place in layers not thicker than 12 inches and shall completely fill the post hole up to the ground surface. All backfill types shall be crowned up around the posts at the ground surface.

No stress shall be applied to posts set in concrete until at least 24 hours after the concrete has set.

B. Wire

The minimum total height for external fence will be 48 inches.

High Tensile Wire fence shall meet the following specifications:

Tensile Strength - 140,000 minimum psi
Galvanizing - Type III
Gauge - 12 1/2
Tension shall be maintained at a minimum of 200 pounds pressure on each wire. The appropriate springs, fasteners, clips, pin and other materials used during construction must also conform to the product qualities and assembly methods as specified by the manufacturer.

See Table 1 for recommended wire spacing and charge.

Warning: When overstretched, wire may break and recoil. Eye and hand protection should be worn.

Standard Woven Wire - 9 gauge or heavier for top and bottom. 12 1/2 gauge or heavier in between and 14 gauge for stays not more than 12 inches apart.

High Tensile Woven Wire – 12.5 gauge or heavier Class III galvanized high tensile for all wires with stays not more than 12 inches apart.

Barbed Wire - 12 1/2 to 15 1/2 gauges with 4 point barbs spaced not more than 10 inches apart. Barbed wire under no circumstances shall be electrified.

All wire will be galvanized. Woven and barbed wire will be selected according to information on Table 2.

C. Wire Attachment

Staples used to fasten fence to wooden posts will be class III galvanized, 9 gauge or heavier with a minimum length of 1 1/4 inches. Staples will be driven as nearly as possible at right angles to the grain. Fencing will be fastened to steel posts by galvanized wire clips or as according to recommendations of manufacturer. Exterior fencing should be placed on the livestock side of the post for all livestock. On curves and corners, fencing may be placed on the outside.

D. Brace Materials

Wood - A minimum of 4 inches diameter or 4 inches square at the small end and a minimum of 84 inches long for the horizontal brace piece.

Steel - A minimum of 2 1/2 inch diameter tubular or 2 inches x 2 inches x 3/16 inches or heavier for angular and a minimum of 84 inches long for the horizontal brace piece.

Wire for bracing shall be 1 or more strands of 9 gauge or heavier wire or 2 or more strands of 12 ½ gauge High Tensile wire.

Corner, gate and brace/pull posts shall be eight feet long or longer with a six-inch minimum diameter. Pull, gate and corner posts will be placed a minimum 36 inches in the ground and be a minimum seven feet apart.

Use a corner post assembly for fence alignment changes of greater than 45 degrees. Sweep corners can be used for alignment changes less than 45 degrees on high tensile and barbed wire fences. Sweep corners shall have a maximum post spacing of 8 feet and consist of a minimum of three posts. Sweep corner posts shall be set with a 2 inch lean against the curve and shall have a 2 inch by 4 inch by 8 inch lug attached on the bottom of the post outside the curve in fragipan soils. A wedge shaped lug with the larger portion on top is best to ease driving posts.

External corner, gate and brace/pull posts shall be wood unless otherwise approved by the state conservation engineer. Steel and fiberglass posts can be used for end or brace posts for permanent internal fence. **Landscape timbers shall not be used for posts or bracing.** Brace pins shall be class III galvanized steel with a minimum diameter of 3/8 inches. Horizontal bracing for "H" type braces shall be placed between 6 and 12 inches of the top of the post.

Braces and end assemblies shall be used at all corners, gates, and angles in the fence line unless otherwise indicated in this standard.

A single 10 foot long, 6 inch minimum diameter post may be substituted for end panel, corner, and vertical change bracing, and pull post assembly. The 10 foot long post shall extend a minimum of 5.5 feet into the ground and be backfilled with gravel or crushed limestone to the ground level. The posts may also be driven.

E. Energizers

Electronic energizers or power fence controllers will meet the following criteria:

High power, low impedance with a minimum 5,000 volt peak output with a short pulse that is less than 300 mAmps in intensity, finished within 300-millionths of a second (0.0003 seconds) at a rate of 35-65 pulses per minute and a high impact weather resistant case.

Be powered by a 12-volt battery powered system (capable of operating 3 weeks without recharging), solar cell or household electric current (110 or 220 volt).

The accepted figures for minimum voltage for livestock control are: cattle-1600 volts; sheep and hair goats-2000 volts; hogs, horses and meat goats-1200 volts. Higher voltage may be required for training, livestock concentrated areas and where excessive vegetation growth may occur.

Have a lightning arrestor and surge protector.

Fence chargers and other electric equipment will be used and installed consistent with manufacturer's guidelines.

All energized fences must be grounded. **All manufacturers' recommendations will be followed for grounding energizers.**

Energized ground wire must be connected to a galvanized pipe or brass or copper rod 5/8 inch or larger. Ground wire, ground rod or pipe and

connections shall be of the same material and placed below the ground surface. Ground rods shall not be placed inside buildings. The grounding system when applicable shall be heading towards the center of the energized acreage.

Do not put ground stakes near milking barns, water pipes or any other metal items leading into barns or working areas. Lightning arrestors shall be placed no closer than ten feet from the energizer.

Additional criteria for Permanent Exterior Fence - Non-energized - Standard Type Wire

Wooden line posts will be 84 inches long or longer with a four-inch minimum diameter. Wooden line posts will be placed on a maximum of 16.5-foot spacing and set in the ground to a minimum depth of 24 inches. Spacing will be ten to 16.5 feet for steel posts. Additional posts will be used as needed between the line posts as an added livestock barrier or for inclines or otherwise uneven ground. Total fence height shall be a minimum of 48 inches.

Additional criteria for Permanent Exterior Fence – Energized - High Tensile

Wooden line posts will be 84 inches long or longer with a four-inch minimum diameter. Line posts shall be spaced at a maximum spacing of 33 feet apart and set in the ground to a minimum depth of 24 inches. Additional posts will be used as needed between the line posts as an added livestock barrier or for inclines or otherwise uneven ground. Double bracing shall be used on external fence stretches over 1320 feet in length.

Line posts shall be of wooden, steel, PVC, fiberglass or other materials as recommended by the manufacturer and approved by the Natural Resources Conservation Service.

Permanent High Tensile fences will consist of at least four wires with a total height of the fence to top wire not less than 48 inches. The need for additional wires will be determined by animal size, age and the species to be held.

Wire spacing from the earth will begin at five to ten inches and continue upwards at random spacing that conforms to the animal sizes and species being held. See Table 1 for recommended wire spacing. Closer wire spacing and adjustments to the location and number of energized wires will be needed to accommodate variable vegetation, terrain and soil conditions, and some livestock species etc. Two wires minimum will be energized; of which the 30-inch wire and the top wire shall be energized. Additional wires shall be energized as needed according to livestock species, age and use.

High tensile barb wire shall conform to all the criteria for smooth high tensile except it shall not be energized.

Additional criteria for Permanent Exterior Fences – Non-energized High Tensile

Fence assembly will be consistent with the recommended specifications for Permanent Exterior –Energized –High Tensile fence with the following exceptions.

Fence for large animals will consist of at least 8 wires with a minimum height of 48 inches. Wire spacing from the earth will begin at five to ten inches and continue upwards at random spacing that conforms to the animal sizes and species being held. The need for additional wires will be determined by animal size, age and the species to be held.

Additional Criteria for Wooden Fences

A wooden board fence shall have a minimum of 4 boards. The maximum board spacing shall be 16-inches center to center. The top edge of the uppermost board shall be at least 48 inches above the ground line for all external fences, and the top edge of the lowest board shall be no greater than 16 inches above the ground line. Each board shall be attached to each post with a minimum of two 16 d. hot dipped galvanized steel, stainless steel, copper, silicon bronze, or equivalent proprietary coated nails. For better holding power, use ring-shank, spiral, or screw-shank instead of common nails. Two 3-inch decking screws with like treatments may be used instead of nails. Unless painting is selected, lumber shall be treated with a minimum treatment of 0.4 lbs/ft^3 of chromated copper arsenate or equivalent treatment. (Use Category UC4A).

Posts for wood fence shall be a minimum diameter of four (4) inches and embedded a minimum of three (3) feet in the ground. The

maximum post spacing shall be eight (8) feet on center. Wood fences for cattle, bison and equine in a corral situation shall have a minimum of four (4)-2”x 6” (nominal) boards. The boards shall be placed on the livestock side in corrals and other high pressure areas. A minimum of four (4) – 1” x 6” (nominal) boards may be used in a pasture situation for cattle and equine. The boards may be placed on the non-livestock side in a pasture situation. Wood fences for small ruminants and swine shall have a minimum of four (4)-1”x 6” (nominal) boards. The spacing of the boards starting at the ground shall be capable of controlling the planned livestock.

Permanent Interior Fences:

Permanent interior fences are used for long-term subdivisions for planned grazing systems or to provide exclusion from sensitive areas.

Permanent interior fences shall conform to the specifications for permanent external fence except fence for large animals will consist of at least one wire at a height of 30 inches. The need for additional wires will be determined by animal size, age and the species to be held. See table 1 for more information.

Line posts shall be spaced at a maximum spacing of 50 feet apart except as noted below:

High tensile woven wire which will have a maximum spacing of 25 feet and high tensile wire with stays will be a maximum of 100 feet. Standard fence used for internal use shall conform to the specifications of the like external fence, i.e. standard woven wire. Additional posts will be used as needed between the line posts as an added livestock barrier or for inclines or otherwise uneven ground. High tensile internal fences with more than 3 wires or high tensile woven wire shall use double bracing with stretches that are over 1320 feet in length.

For 1 and 2 wire fences, corner, gate, end and brace post assemblies shall consist of one of the following:

- Steel posts that are a minimum of 1.3 pounds per one foot of length with appropriate knee, dead-man, angle, anchor, or H brace.

- Wood posts with a minimum top diameter of 3.5 inches set 36 inches in the ground with an appropriate knee, dead-man, angle, anchor, or H brace.

- Wood, steel pipe or fiberglass post with a minimum top diameter of 5 inches, set to a depth equal to or greater than the height of the post above the ground without any bracing.

- Steel pipe or fiberglass post with a minimum diameter of 2 inches, set 36 inches in the ground with appropriate angle, H bracing, knee brace, dead-man or anchor plate.

Temporary Interior Fences:

Used to subdivide land on a temporary basis within grazing areas to permit the implementation of a planned grazing system or to provide for the temporary exclusion of livestock from sensitive areas or to temporarily exclude livestock from areas needing grazing protection until seedling establishment.

Temporary fence shall consist of at least one energized wire with a total height of the fence not less than 30 inches. The need for additional wires will be determined by animal size, age and the species to be held. The additional wires may be used as a ground, if needed. Insulators and other attachments to posts must be installed as needed and in conformance with manufacturer’s recommendations.

High tensile, U.V. stabilized high-density polyethylene (poly-wire, tape or rope) with a minimum of 4 strands of stainless steel wire filament, 14 gauge steel or 19 gauge stainless steel wire shall be used. Electrified netting shall be installed as needed for small livestock use and for training purposes and in conformance with manufacturer’s recommendations. Low impedance energizers shall be used with all polyethylene type wires.

Reels used for polyethylene products shall be complete with carrying handle, rewind crank, ratchet lock and steel and plastic construction to allow for tension on wire and ease of attachment to conductive source.

Posts used with temporary fence shall be spaced a maximum of 50 feet apart on level terrain or as

needed on inclines or otherwise uneven terrain or as needed by livestock species or age.

Posts shall be steel, polyvinylchloride solid round sucker rod, non-breakable plastic, fiberglass or other materials as recommended by the manufacturer and approved by the Natural Resources Conservation Service.

Gates

Electrified gates may be constructed of a single straight wire, poly-tape or wire or an expandable, coiled, high tensile, 12.5 gauge wire each attached to an insulated handle. The number of wires shall be determined by the fence objective. The gate shall be constructed so that it non-electrified when the gate is open. Over head or underground transmission lines will be used to carry electricity past the gate to the remainder of the fence. Galvanized or painted steel tube gates may also be used.

Flood Gates

An electrified floodgate may be used in lieu of a non-electrified floodgate if desired. The electrified floodgate is constructed by stretching an electrified wire across the drainage above high water flow level. Attach droppers of the 12.5 gauge high tensile fence wire or drop chains to the electrified wire at a horizontal spacing of 6-inches, stopping above average normal water level. Connect gate to electric fence with double insulated cable through a cut-off switch and floodgate controller. If flooding is expected to last some time, switch the floodgate off.

CONSIDERATIONS

Consider installing a hot wire on the livestock side of the post if the exterior fence is installed on the non-livestock side of the post.

Consider installing fences in locations that will facilitate maintenance avoiding irregular terrain and/or water crossings.

Consider wildlife movement needs when locating fences.

Consider livestock management, handling, watering and feeding when locating fences.

Where applicable, clear right-of-ways should be established which would facilitate fence construction and maintenance.

The energizer should have the capability to produce 1 joule of energy for each mile of planned electrified fence wire.

Driven posts can have high tensile wire attached the same day. Set posts need to “rest” and settle in before attaching and tightening high tensile wire.

Consider soil erosion potential when planning and constructing a fence on steep slopes.

Fences can frequently be arranged to provide for one livestock water facility to serve two or more fields.

Type and size of livestock should be considered when choosing the appropriate type and design of fence, i.e. horses need very visible fence.

Easily repaired fences such as high tensile should be used in areas where flooding may occur or where debris may collect.

Manufacturer’s guidelines should be followed during installation of each type of fence to assure that all components are assembled properly.

Safety guidelines for each type of fence should be strictly adhered to particularly if the fence is to be constructed to restrict human access.

Fences constructed in fragile soils and uneven landscapes may require additional bracing.

Fence posts may need to be set deeper in soils subject to serious frost heave.

A continuous vertical 1” x 4” face board can be used at each line post to cover and help to secure the horizontal boards (rails) to the line posts on wooden board fences. They should be attached with four 4-inch long hot dipped galvanized steel, stainless steel, copper, silicon bronze, or equivalent proprietary coated nails or decking screws. This extra board extends the life of the board fence by providing some extra protection for the ends of the boards.

The Natural Resources Conservation Service recommends the use of new technology with concurrence of the state conservation engineer.

PLANS AND SPECIFICATIONS

Plans and specifications are to be prepared for site-specific job. Plans shall include a map indicating location of fence and gates as appropriate, drawing of planned fence type, purpose, estimate of materials needed, specifications and operation and maintenance. These plans and specifications shall be consistent with this standard and shall describe the requirement for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Regular inspection of fences shall be part of an on-going management program. Inspection of fences after storm events is needed to facilitate the function of the intended use of the fence.

Maintenance and repairs will be performed as needed to facilitate the intended operation of the installed fence.

Fence lines and adjacent areas shall not be burned.

Fence repairs shall be made with materials that equal or exceed the quality of the original materials.

REFERENCES:

National Standard Material Specifications – Part 642 – National Engineering Handbook - Material Specification 585 – Wood Preservatives and Treatment. 2001

National Standard Material Specifications – Part 642 – National Engineering Handbook - Material Specification 591 – Field Fencing Material. 2001

Premier Fence Systems, A Guide to Fencing that Works. 2004

USDA Forest Service. Fences. Technology and Development Program. USDI Bureau of Land Management.

Structures and Environmental Handbook, MWPS – 1, Eleventh Edition, Iowa State University 1983

American Society for Testing and Materials, Standard D 1760-96, Pressure Treatment of Timber Products, 1996

Indiana Fence Law; Indiana Code, Article 10 of Title 32 (lC 32-10-9-2)

Table 1. Recommended High Tensile Wire Spacing and Charge (+/-)

WIRES	ANIMAL TYPE	FENCE HEIGHT (inches)	SPACING FROM GROUND (inches)
1	Cattle Hogs	26 to 32 12	26 to 32+ 12+
2	Cattle, Cattle w/calves Cattle, Sheep & Goats Hogs	24 to 36 20 to 30 18	18 to24+/-, 24 to 36+ 8 to 10+, 20 to 30+ 6+, 18+
3	Cattle w/calves Sheep, Goats Cattle, Horses Hogs	34 to 44 32 46 18	11 to 18+/-, 23 to 30-, 34 to 44+ 10+, 20+/-, 32+ 20+, 34+/-, 46+ 6+, 12+, 18+
4	Cattle Sheep, Goats	40 30 to 38	8+/-, 18+, 28+/-, 40+ 6 to 16+/-, 12 to 22+,18 to 30+/-, 30 to 38+
5	Cattle, Horses Sheep, Goats	48 to 50	10+, 20+/-, 30+, 40+/-, 48 to 50+
6-8	Deer, Predator Control	52 to 62	4-6+, 6-8-, 12+, 18-, 24+, 30+/-, 40+/-, 52+

*** External Fences must be 48 inches in total height**

Table 2. Recommended Standard Fence Heights and Wire Spacing

ANIMAL TYPE	WIRE TYPE	WIRE SPACING
Cattle, Horses, Sheep, Swine and Goats	Woven wire with 1 or 2 barbed wires on top or 1 barbed wire on top and 1 on bottom.	On ground or slightly higher for larger animals.
Cattle and Horses	4 wire barbed	10, 22, 38, 46+
Cattle and Horses	5 wire barbed	10, 20, 30, 40, 48

*** External Fences must be 48 inches in total height**

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Prescribed Grazing

(Acre)

Code 528

DEFINITION

Managing the harvest of vegetation with grazing and/or browsing animals.

PURPOSES

This practice may be applied as part of a conservation management system to achieve one or more of the following:

- Improve or maintain desired species composition and vigor of plant communities.
- Improve or maintain quantity and quality of forage for grazing and browsing animals' health and productivity.
- Improve or maintain surface and/or subsurface water quality and quantity.
- Improve or maintain riparian and watershed function.
- Reduce accelerated soil erosion, and maintain or improve soil condition.
- Improve or maintain the quantity and quality of food and/or cover available for wildlife.
- Manage fine fuel loads to achieve desired conditions.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where grazing and/or browsing animals are managed.

CRITERIA

General Criteria Applicable to All Purposes

Follow all federal, state and local laws and regulations.

Removal of herbage will be in accordance with production limitations, rate of plant growth, the physiological needs of the forage plants and the nutritional needs of the animal using Table 1 and 2 of this standard as a guide. Minimum grazing heights will be the decisive evaluation for compliance of this standard and shall be

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maintained on a minimum of 80% of the grazing system.

Table 1. Rest periods for cool-season pastures

Season	Weather Conditions	Growth Rate	Rest Period
Spring	Cool, moist	Fast	10-14 days
Spring	Warm, dry	Medium	14-20 days
Summer	Hot, moist	Slow	30-35 days
Summer	Hot, dry	Very slow	40-60 days
Fall	Cool	Medium	14-20 days

Duration, time (season), required rest periods, and optimal starting and ending grazing heights will be based on desired plant community goals, expected productivity of key species, and management unit objectives. Tables 1 and 2 of this standard shall be used as guides.

Adjust intensity, frequency, timing and duration of grazing and/or browsing to meet the desired objectives for the plant communities and the associated resources, including the grazing and/or browsing animal.

Manage the kind of animal, animal number, grazing distribution, length of grazing and/or browsing periods and timing of use to provide grazed plants sufficient recovery time to meet planned objectives. The recovery period of non-grazing can be provided for the entire year or during the growing season of key plants. Deferment (non-grazing period less than one year) and/or rest (non-grazing period equal or greater than one year) will be planned for critical periods of plant needs.

Grazing duration shall provide for management system and production objectives. The length of the grazing period shall be determined by the length of the rest period needed for recovery of the forage resource.

Number of paddocks in a grazing system shall be determined by the following formula:

(Average Rest Period/Grazing Days) +1

Example: (30 rest days/ 3 grazing days) +1 = 11 paddocks needed.

Appropriate stocking density will be calculated and used as a guide to optimize utilization of the forage resource.

Adjust livestock numbers and/or grazing time to match forage demand to forage yield as indicated in Exhibit A below.

Exhibit A. General formulas to estimate animal numbers or grazing days:

$$AN = \frac{TFP/Ac. \times Ac. \times \%\ HE}{AW \times IR \times Days} \qquad Days = \frac{TFP/Ac. \times Ac. \times \%\ HE}{AW \times IR \times AN}$$

AN = Animal Number
TFP = Total Forage Production (Total above ground biomass in lbs/acre dry weight)
Ac. = Acres
% HE = Percent Harvest Efficiency (same as % grazing efficiency)
Guide: Continuous grazing = 25%-50%
3-7 days grazing (8-12 paddocks) = 50%-60%
0.5-3 days grazing (24+ paddocks) = 60%-75%
AW = Animal weight (pounds)
IR = Intake Rate in % body weight
Guide: 2.0% for maintenance
2.6% for annual average production
3.0% for lactating and fast growing animals
4.0% for high production
Days = Days of grazing planned (160-210 days within growing season in Indiana which may be extended with additional management options such as stockpiling)

Table 2. Species Harvest/Rest Information

Species	Start Grazing	Start Grazing Regrowth	Remove Livestock Height	Rest Period	When to Cut for Hay, Silage or Balage	Over-Wintering Height	Approximate Date to begin Rest for Winter Protection[3]	
	(inches)	(inches)	(inches)	(days)		(inches)	(North)	(South)
Kentucky Bluegrass, Perennial Ryegrass	4-6	4-5	2-3	14-30	Boot	2-3	N/A	N/A
Orchardgrass, and other non-jointed grasses Tall Fescue (See restrictions in General and Fish & Wildlife Criteria before using)	6-8	6-8	3-4	14 spring 30--45 summer	Boot & Peak re-growth	3-4	[4]	[4]
Smooth brome, Timothy, and other jointed grass Reed Canarygrass (See restrictions in General and Fish & Wildlife Criteria before using)	8	8	4	14 spring 30--45 summer	Boot & Peak re-growth	5-6	9/1-10/1	9/20-10/20
Alfalfa	12	8-10	3-4	24-32	Late bud to early bloom	6	9/1-10/1	9/20-10/20
Birdsfoot Trefoil	10-12	10-12	5-6	24--45	¼ bloom to full bloom	5	9/1-10/1	9/20-10/20
White Clover	6-10	8-10	2	24-32	Early to ½ bloom	4	9/1-10/1	9/20-10/20
Red & Alsike Clover	10-12	8-10	3-4	24-45	Early to ½ bloom	5	9/1-10/1	9/20-10/20
Sudangrass	18-20	18	8-10	14-30	Boot	N/A	N/A	N/A
Sorghum-Sudangrass Hybrid	24-30	24	8-10	14-30	Boot	N/A	N/A	N/A
Pearl Millet	8-10	8-10	4-6	14-30	Boot	N/A	N/A	N/A
Japanese Millet	12-18	12-18	4-6	14-30	Boot	N/A	N/A	N/A
Small Grains	8-10	8	2-3		Early head	4-6	10/15-11/1	11/1-11/15
Switchgrass, Big Bluestem and Indiangrass	12-18	12-18	8[1]	21--45	Boot to early head	8-12	9/1-10/1	9/20-10/20
Little Bluestem & Sideoats Grama	12-14	12-14	6-8[1,5]	21--45	Boot to early head	6-10	9/1-10/1	9/20-10/20
Brassicas	12-14	12	4-6	14--45	N/A	N/A		
Annual Lespedeza	6-8	6-8	3-4	14-30	Early bloom	[2]	9/1-10/1	9/20-10/20

N/A – Not Applicable

[1] Leave an 8-10 inch stubble at end of season until after killing frost.

[2] Allow to set seed during season.

[3] Protection from fall grazing is recommended. WSG's can have limited grazing after killing frost when applicable.

[4] No restrictions with fescue and orchardgrass.

[5] 4 inches above lowest node best indicator.

Boot: Most heads in upper leaf sheath, but prior to emergence.
Early Head: Tips emerging on not more than 10% of stems.
Medium Head: About 50% of the heads emerged or emerging.
Full Head: Most of heads fully emerged but prior to flowering.

Provide deferment or rest from grazing or browsing to ensure the success of prescribed fire, brush management, seeding or other conservation practices that cause stress or damage to key plants.

Manage grazing and/or browsing animals to maintain adequate vegetative cover on sensitive areas (i.e. riparian, wetland, habitats of concern, karst areas).

Manage livestock movements based on rate of plant growth, available forage, and allowable utilization target.

Develop contingency plans to deal with expected episodic disturbance events (i.e. insect infestation, drought, wildfire, etc). Periodic rest from grazing will be needed to maintain or restore the desired plant community following episodic events, such as severe drought.

Adequate quantity and quality drinking water will be supplied at all times during period of occupancy. The water requirements for all grazing livestock shall be a minimum 30 gallons per animal unit (1000 pound live weight) per day.

Pasture layout and distance to water for all grazing livestock shall provide for the even distribution of grazing pressure. The closer and more accessible water is to the animals the more even the demand.

Walking distance to water shall be minimized in all systems with a maximum walking distance goal of 1200 feet unless restricted by unalterable site conditions. Minimizing the walking distance to water reduces trailing, increases efficiency of the pasture, can allow for smaller sized tanks and can increase animal performance.

Due to potential environmental hazards, reed canarygrass will not be recommended except where no other species will meet the intended purpose. Low-alkaloid varieties shall be seeded/utilized when reed canarygrass is the desired forage species. Regardless of site, reed canarygrass shall be harvested or grazed prior to seed formation.

Low-endophyte or endophyte friendly fescues will be recommended when tall fescue is the desired cool-season grass species to be seeded.

Additional Criteria to Improve or Maintain the Health and Vigor of Plant Communities

Duration and intensity of grazing and/or browsing will be based on desired plant health and expected productivity of key forage species to meet management objectives.

Livestock will be rotated among pastures based on rate of plant growth, available forage, and minimum proper grazing height for the forage species, and not on a fixed time schedule or by calendar dates.

Fragile or sensitive plant communities or soils will receive particular attention in order to avoid overgrazing, soil compaction, or animal traffic induced erosion.

Non-scheduled rest from grazing and/or browsing will be needed to restore the desired plant community following episodic events such as severe drought.

Soil test periodically for nutrient status and soil reaction and apply fertilizer and/or soil amendments according to soil test to improve or maintain plant vigor.

Stockpiled forages will be deferred from grazing until the desired stockpiled forage is dormant to reduce stress on carbohydrate reserves of those species to ensure long term productivity of the pasture.

Rest periods in Table 1 will only be used as a guide. Livestock will be rotated into paddocks based on the vegetative condition and re-growth of the forages. Forages will be allowed to re-grow to reach a height that allows the replenishment of carbohydrate reserves.

Grazing management shall be accomplished according to forage growth. Animals should be introduced to a paddock when the forages reach the planned height and remove them from that same paddock when the planned residual stubble

height is attained. Table 2 contains a list of suggested forage heights for management of livestock turn-in and removal.

Additional Criteria to Improve or Maintain Quantity and Quality of Forage for Animal Health and Productivity

Plan grazing and/or browsing to match forage quantity and quality goals of the producer within the capability of the resource to respond to management.

Enhance diversity of pasture plants to optimize delivery of nutrients to the animals by planning intensity, frequency, timing and duration of grazing and/or browsing.

Plan the intensity, frequency, timing and duration of grazing and/or browsing to reduce animal stress and mortality from toxic and poisonous plants.

Supplemental feed and/or minerals will be balanced with the forage consumption to meet the desired nutritional level for the kind and class of grazing and/or browsing livestock.

Dietary needs of livestock will be based on the National Research Council's Nutrient Requirements of Domestic Animals or similar scientific sources with appropriate adjustments made for increased energy demand required by browsing or grazing animals foraging for food including travel to and from pasture site.

Bio-security safeguards will be in place to prevent the spread of disease between on-farm classes of livestock and between other livestock farm units.

Shelter in the form of windbreaks, sheds, shade structures, and other protective features will be used where conditions warrant to protect livestock from severe weather, intense heat/humidity, and predators.

Systems shall be developed that subject animals to a minimum amount of handling stress.

Interior fences shall give control required to ration forage as planned according to Indiana (IN) Natural Resources Conservation Service (NRCS) Electronic Field Office Technical Guide (eFOTG) Standard (382) Fence.

All livestock on pasture shall have free choice access to water within water requirements listed in Table 3. Testing of water supplies should be advised when there are any problems or if the source is questionable.

Table 3. Water quality restrictions for water provided to livestock

Contaminant	Concentration
Nitrate	<100 ppm
Sulfate	<350 ppm
Total Dissolved Solids	<3000 ppm
Blue-green algae	Very low presence
Coliform bacteria	For Grade A dairy, meet milk inspection standards.

Additional Criteria to Improve or Maintain Surface and/or Subsurface Water Quality and Quantity

Minimize concentrated livestock areas to enhance nutrient distribution and improve or maintain ground cover.

Plan intensity, frequency, timing and duration of grazing and/or browsing to:

1. Minimize deposition or flow of animal wastes into water bodies.

2. Minimize animal impacts on stream bank or shoreline stability.

3. Provide adequate ground cover and plant density to maintain or improve infiltration capacity and/or filtering capacity of the vegetation.

Livestock shall be excluded from flowing streams, spring seep areas and from ponds and lakes except when designated in the prescribed grazing plan when limited access or flash grazing (very short duration, i.e., ½-2 days) is permitted.

Grazing shall be limited to the planned time periods.

Do not graze riparian areas when soils are saturated.

Watering and feeding facilities and shade areas shall be sited or constructed so as to prevent or discourage livestock from creating high use loafing areas adjacent to surface water bodies.

Minimize concentrated livestock areas to enhance nutrient distribution and improve or maintain ground cover. Locate loafing areas, feeding locations, and sacrifice areas away from watercourses, and maintain adequate, vegetative buffers between these concentration areas and water courses.

Ensure optimum water infiltration by preventing compaction and reduce evaporation by maintaining plant cover.

Woodlands with greater than 30% canopy shall be excluded from livestock to maintain the natural vegetative cover, under-story and humus. Woodlands with less than 30% canopy that are grazed shall be managed to maintain adequate vegetative cover.

Additonal criteria to Improve or Maintain Riparian and Watershed Function

Minimize concentrated livestock areas to enhance nutrient distribution and improve or maintain ground cover and riparian/floodplain plant community structure and functions.

Plan the intensity, frequency, timing and duration of grazing and/or browsing to:

1. Provide adequate ground cover and plant density to maintain or improve infiltration capacity and reduce runoff.

2. Provide adequate ground cover and plant density to maintain or improve filtering capacity of the vegetation.

3. Maintain adequate riparian community structure and function to sustain associated riparian, wetland, floodplain and stream species.

Additional Criteria to Reduce Soil Erosion and Maintain Soil Condition.

Minimize concentrated livestock areas, trailing, and trampling to reduce soil compaction, excess runoff and erosion.

Plan the intensity, frequency, timing and duration of grazing and/or browsing to provide adequate ground cover, litter and canopy to maintain or improve infiltration and soil condition.

Ground cover provided by grasses and legumes shall be maintained above 80 percent surface cover at all times during the grazing season on permanent vegetation.

When crop residues are grazed, the percent ground cover shall be monitored during the grazing period and livestock removed when ground cover and residue mass approach the specified minimum amount needed to keep soil loss and soil organic matter to the specified level using current approved erosion prediction and soil conditioning index procedures.

Pasture fencing layouts shall provide laneways that are least prone to livestock trail erosion.

If hayland is available and needed for grazing, it will be utilized for grazing when minimum forage heights on regular pastures are present. This may include grazing initial spring growth and aftermath growth after last mechanical forage harvest. This will be employed yearly as part of a grazing management plan or as needed in event of emergency shortages of grazable forage.

Grazing shall be deferred on all somewhat poorly, poorly, and very poorly drained soils, unless artificially drained, during the time of high water table occurrence. Refer to Section II of the FOTG for additional drainage information.

Woodlands with greater than 30% canopy shall be excluded from livestock to maintain the

natural vegetative cover, under-story and humus. Woodlands with less than 30% canopy that are grazed shall be managed to maintain adequate vegetative cover.

Additional Criteria to Improve or Maintain Food and/or Cover for Fish and Wildlife Species of Concern

Identify the species of concern in the objectives of the prescribed grazing plan.

Endophyte-infected tall fescue and reed canarygrass will not be planted when wildlife use is the primary purpose. Refer to IN NRCS eFOTG Standard (645) Upland Wildlife Habitat Management for appropriate seeding recommendations.

Plan intensity, frequency, timing and duration of grazing and/or browsing to provide for the development and maintenance of the plant structure, density and diversity needed for the desired fish and wildlife species of concern.

A portion of the grazing system during the critical nesting period (April 1st – August 1st) will be utilized to provide essential nesting habitat for the applicable targeted species. Blocks of undisturbed nesting habitat are preferred over linear strips.

Develop grazing plans that will provide adequate food, water and cover for the target wildlife species.

CONSIDERATIONS

Native grasses, legumes and forbs will be considered in the planning process as applicable to enhance the wildlife value of the plant community.

Supplemental feed may be necessary to meet the nutritional requirements of grazing livestock or to meet the producer's performance goals.

Feed rations should be balanced with pasture forage to provide the energy, protein, and minerals necessary to meet the production objectives of the producer and the nutritional requirements of the livestock type and class.

When pasture forage is supplemented with other feed sources, the general equation shall be modified to decrease pasture forage demand by the amount of supplemental feed consumed. Early in the growing season when crude protein and digestible organic matter are excessively high, the addition of fiber source may be needed to better utilize and absorb nutrients and balance the rumen.

Shade should be considered on days where relative humidity levels exceed 75 percent and air temperatures exceed 85°F of ambient air temperature. Livestock may need to have access to shade, natural or artificial, during these periods where sufficient cooling is not occurring at night (generally when there is less than 10 degrees difference between night and daytime temperatures).

Endophyte-infected tall fescue and high alkaloid reed cannarygrass pastures should not be prescribed for grazing brood mares, especially the last 60 days before foaling. Test all tall fescue-dominated pastures for level of infection as warranted. Diversity of forages and addition of legumes will reduce severity. Fescue alkaloids have been implicated in decreasing palatability and intake. Low endophyte and endophyte friendly varieties are available and should be considered over endophyte-infected varieties to help improve animal performance and production. Anti-quality factors associated with alkaloids can also be found associated with some perennial ryegrass and reed canarygrass.

Many old reed canarygrass stands have high concentrations of indole alkaloids, (above 0.2% by dry weight) and should not be prescribed for sheep grazing. All livestock should be conditioned to graze it.

Evaluate any hay that might have mature reed canarygrass as a component and avoid feeding this hay within close proximity of any water bodies, wetlands, or floodplains.

Alsike clover should not be used for horses because of increased photosensitivity.

Ruminants grazing "bloat-causing legumes" should do so only under one or more of the following conditions:

1. Pure Legume Stands or Grass Legume stands with > 40% bloating legumes.

   Provide poloxalene free choice prior to first time on pasture each season.

   Feed livestock dry hay prior to first time on pasture each season.

   Allow livestock to graze only when water from dew, rain, or irrigation has evaporated from foliage and dry hay is available free choice.

2. Grass-Legume Stands - The legume makes up no more than 40 percent of the available pasture forage.

Poisonous plants should be scouted for and removed if found at levels that would cause illness or death. Consult with your local extension educator with assistance in identification and control.

Grass tetany is a serious problem and in most cases indicates an insufficiency of magnesium. Where grass tetany is a problem, pastures should be fertilized to produce forage with at least 0.2 percent magnesium, or ruminants should be fed a magnesium supplement.

Cyanogenic forages (sorghum, sudangrass, sorghum-sudangrass, volunteer johnsongrass, and white clover) should not be grazed when hydrogen cyanide content of the forage dry matter exceeds 200 ppm (drought or frosted or stressed plants). For sudangrass or sudangrass-sorghum hybrids, defer grazing until plants are 18 inches tall.

When grazing periods per livestock class are less than 2 days and percent utilization of available forage is less than 50 percent by the first grazers, directly follow high performance livestock (first grazers), such as lactating dairy and meat production livestock, with maintenance livestock (second grazers), such as non-lactating females, on the same paddock to utilize remaining forage. Time on the paddock should be equal for both groups.

The following are suggested ranges for optimal grazing periods. These systems are based on average forage production.

Cow/calf operation	3-7 days
Stocker operation	1-3 days
Dairy operation	0.5-1 day
Ewe/lamb operation	2-5 days
Feeder lambs	1-3 days
Horses	5-7 days

When soil-borne parasite cycles need to be broken, defer grazing long enough to break cycle or defer grazing for one or more grazing seasons when practical or treat livestock. Sheep especially need to "top graze" as much as possible to lessen the impact of parasites residing on lower plant parts.

It is a good practice to graze only half of the designated paddocks in the spring during rapid growth to keep the forage under control. Clip or hay the other half to keep in a vegetative form. Start grazing all paddocks when hayed or clipped paddocks have regrowth ready to graze. Reduce number of paddocks again in early fall to set aside paddocks for stockpiling if desired.

Many soils in Indiana are selenium deficient and supplementation may be needed for grazing livestock.

Begin grazing sequence each year in a different paddock as practical to help reduce parasite load, maintain a dense forage stand and to help nutrient distribution.

Grazing programs should be tailored to meet the cooperator's goals and resources. Animal husbandry requirements, such as handling, feeding and breeding programs, may affect the design of the grazing prescription and must be resolved during the planning process.

When suppression or elimination of weeds and sapling woody species by grazing is feasible and desired, select livestock species that will utilize

those woody species. Stocking density, timing, and duration shall achieve desired level of control and prevent seed production, or be supplemented with other control methods.

When the suppression of forage plant re-growth is desired on individual pastures to be over-seeded or completely renovated, then graze to the minimum stubble height possible and document in assistance notes and/or grazing plan. This will normally be shorter than prescribed in Table 2. Utilize livestock that can tolerate reduced intake during this time period, for example, dry cows.

Prescribed grazing should consider the needs of other activities that may utilize the same land base, such as wildlife and recreational uses.

When available and applicable, crop aftermath can be included in the grazing system to allow time for forage re-growth before a killing frost to increase the forage supply to extend the grazing season. Crop residues are best used for non-lactating or mature animals which can do better on lower energy feeds.

Consider improving carbon sequestration in biomass and soils through grazing management.

Consider the following when developing a prescribed grazing plan:

- Landowner's Objectives – In order for any prescribed grazing plan to work, this primary objective must be considered.

- Livestock Producer's Time – Consider available time when developing a grazing system.

- Livestock Producer's Management Skills – Consider the management skills of the landowner/operator when developing a grazing system because a prescribed grazing plan requires good management skills.

- Soils – Where possible, avoid placing fields/paddocks across different soil types to reduce differential grazing.

- Topography – Strive for topographical uniformity in field/paddock layout to promote uniform grazing. Consider aspect when planning early spring grazing.

- Special Features – Consider roads, streams, ponds, and wooded areas.

- Source and Location of Water – Strive to reduce the distance animals travel to water. Locate water to reduce negative impacts. Desired walking distances to water should be 800 feet or less for most grazing livestock.

- Location of Supplemental Feeding Areas – Consider effects on resource base and grazing distribution when locating feeding areas. Also consider storage requirements, labor, access and use of heavy use area protection.

- Fencing – Consider the location, condition, and type of existing fences.

- Working Facilities – Consider location of working facilities when laying out a prescribed grazing system.

- Weather Conditions – Consider the use of shade when designing a grazing system. Shelter may be needed for livestock in inclement weather.

- Impact on wildlife that may utilize the grazing areas.

A prescribed grazing plan may include one or all of the following types of grazing methods. Each plan should contain the method(s) needed to meet the goals of the livestock producer and general criteria of this standard:

Continuous Grazing – A method where livestock are grazed on a specific unit on land with unrestricted access through out the time period when grazing is allowed.

Rotational Grazing – A method that utilizes recurring periods of grazing and rest among two

or more paddocks in a grazing management unit throughout the period when grazing is allowed.

Rotation of animals is through two or more pastures. A rest period follows each grazing period. Refer to Table 1 for suggested rest periods.

Management-Intensive Grazing – Allocates a small amount of forage in a short time (several hours to one or two days). May involve large pastures offered to animals in strips with the use of temporary fencing.

Follower-Leader – Involves two livestock groups. First grazers utilize one half or less or available forage and then rotate to another paddock followed by the last grazers who graze the remaining forage to a desired residual height.

Co-grazing- Two or more species of livestock grazing the same unit of land at the same time.

Stockpiling or deferred grazing – Grazing is delayed during part of the grazing season to provide later grazing. Tall fescue is very well suited for this type of grazing. The grazing season can be extended by stockpiling, planting summer or winter annual grasses and legumes for grazing, and planting brassicas either for summer, fall, or early winter grazing as the forage species allow and need dictates.

Creep Grazing – Allows passage by smaller animals to higher quality forage.

There are many modifications and variations of the grazing methods and all are important in the development of the prescribed grazing plan. All of the methods must have enough grazing units and acreage to allow for appropriate rest periods. The fewer the paddocks available, the more difficult it is to manage for proper rest resulting in a lower harvest efficiency. If the number of grazing units is not sufficient for proper rest periods, then the animals must be totally or partially removed at necessary intervals to insure adequate forage and ground cover.

PLANS AND SPECIFICATIONS

Prepare a prescribed grazing plan for all planned management units where grazing and/or browsing will occur according to state standards and specifications.

Grazing plans will be organized in a manner that is readily understood and useable by the producer in their daily operations. The manner of documentation will depend on the size and complexity of the grazing management unit. Included in the documentation will be the elements needed for achieving the production and environmental goals of the grazing management unit. The plan will be revised, as necessary, to meet management needs.

The grazing plan/folder shall include the following information:

- Goals and objectives of producer. (Can be achieved by filling out Pasture/Livestock Inventory Worksheet)

- Inventory of livestock, forages and resources (Can be achieved by filling out Pasture/Livestock Inventory Worksheet) including existing resource conditions and concerns, forage suitability groups if available, opportunities to enhance resource conditions and location and condition of structural improvements such as fences, water developments, etc. including seasonal availability and quality of watering sites.

- Forage inventory of the expected forage quality, quantity and species in each management unit(s).

- Forage-Animal balance development for the grazing plan, which ensures forage produced or available meets the forage demand of livestock and/or wildlife.

- Grazing plan developed for livestock that identifies periods of grazing and/or browsing, deferment, rest, and other treatment activities for each management unit.

- Contingency plan developed that details potential problems (i.e., severe drought, flooding, insects) and serves as a guide for adjusting the grazing prescription to ensure resource management and economic feasibility without resource degradation.

- Monitoring plan developed with appropriate records to assess whether the grazing strategy is resulting in a positive or upward trend and is meeting objectives. Identify the key areas and key plants that the manager should evaluate in making grazing management decisions.

- Plan map or maps with the following information:

  1. Property description.
  2. Land available for grazing.
  3. Field/paddock boundaries.
  4. Primary land use identification.
  5. Vegetation.
  6. Soils.
  7. Environmentally sensitive areas.
  8. Fences, lanes, watering systems, and sacrifice areas, if used.

- Strategies for harvesting or controlling forage during periods of excess growth, such as mechanical harvest or clipping.

- When one of the purposes of the grazing plan is to improve or maintain the quantity and quality of food and/or cover available for wildlife, the following will be included in the plan:

  - Primary species of concern

  - How the plant height, structure and density will be managed for the targeted wildlife species

  - What portion of the grazing system will be utilized during the critical nesting period for the targeted species

  - All seeding recommendations

OPERATION AND MAINTENANCE

Operation – Prescribed grazing will be applied on a continuing basis throughout the occupation period of all planned grazing units. Adjustments will be made as needed to ensure that the goals and objectives of the prescribed grazing strategy are met.

Maintenance – Monitoring data and grazing records will be used on a regular basis within the prescribed grazing plan to insure that objectives are being met, or to make necessary changes in the prescribed grazing plan to meet objectives.

All facilitating and accelerating practices (e.g. fence, pasture planting, etc.) that are needed to effect adequate grazing and/or browsing distribution as planned by this practice standard will be maintained in good working order and operated as intended.

Stocking rates are based on targeted forage yield goals. When soil tests indicate soil pH and nutrient levels are lower than needed to meet the targeted forage yield goal, apply lime and fertilizer according to University recommendations or the Indiana NRCS 528 Excel Pasture Fertility Program.

Clip pastures as needed to promote vegetative re-growth and/or control certain weed invasions. Refer to IN NRCS eFOTG Standard (595) Pest Management for more information.

Renovate or overseed pasture to reintroduce desired forage species into the pasture according to IN NRCS eFOTG Standard (512) Pasture and Hayland Planting. Check compatibility with any existing species being retained.

Remove or eliminate any hazard from a pasture that may injure livestock, such as loose wire, other hardware, holes in the ground, and downed trees or heavy limbs.

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NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Stream Crossing

(No.)

Code 578

DEFINITION

A stabilized area or structure constructed across a stream to provide a travel way for people, livestock, equipment, or vehicles.

PURPOSE

- Improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream.
- Reduce streambank and streambed erosion.
- Provide crossing for access to another land unit.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where an intermittent or perennial watercourse exists and a culvert, bridge, or ford type crossing is desired for livestock, people, and/or equipment.

CRITERIA

General Criteria Applicable to All Purposes

All planned work shall comply with all federal, state and local laws, rules, and regulations.

Location

Stream crossings shall be located in areas where the streambed is stable or where grade control can be provided to create a stable condition. Avoid sites where channel grade or alignment changes abruptly, excessive seepage or instability is evident, overfalls exist, or large tributaries enter the stream. Wetland areas shall be avoided if at all possible.

Crossings shall be installed perpendicular to the direction of flow of the stream. Crossings at an angle should be avoided on all but the smallest streams.

Stream crossings shall provide for normal passage of water, fish and other aquatic animals within the channel during all seasons of the year.

Access Roads

Where high rates of erosion of the adjacent roadways that slope towards the crossing threaten to deliver an excessive amount of sediment to the drainage, install measures to minimize erosion of the roadside ditch, road surface, and/or cut slopes. Where the stream crossing is installed as part of a roadway, the crossing shall be in accordance with Indiana (IN) Electronic Field Office Technical Guide (eFOTG) Standard (560) Access Road.

Width

The stream crossing shall provide an adequate travel-way width for the intended use. A multi-use stream crossing shall have a travel-way no less than ten (10) feet wide. “Livestock only” crossings shall be no less than 6 feet wide. Width shall be measured from the upstream end to the downstream end of the stream crossing and shall not include the side slopes.

Side Slopes

All cuts and fills for the stream crossing shall have side slopes that are stable for the soil involved. Side slopes of earth cuts or fills shall

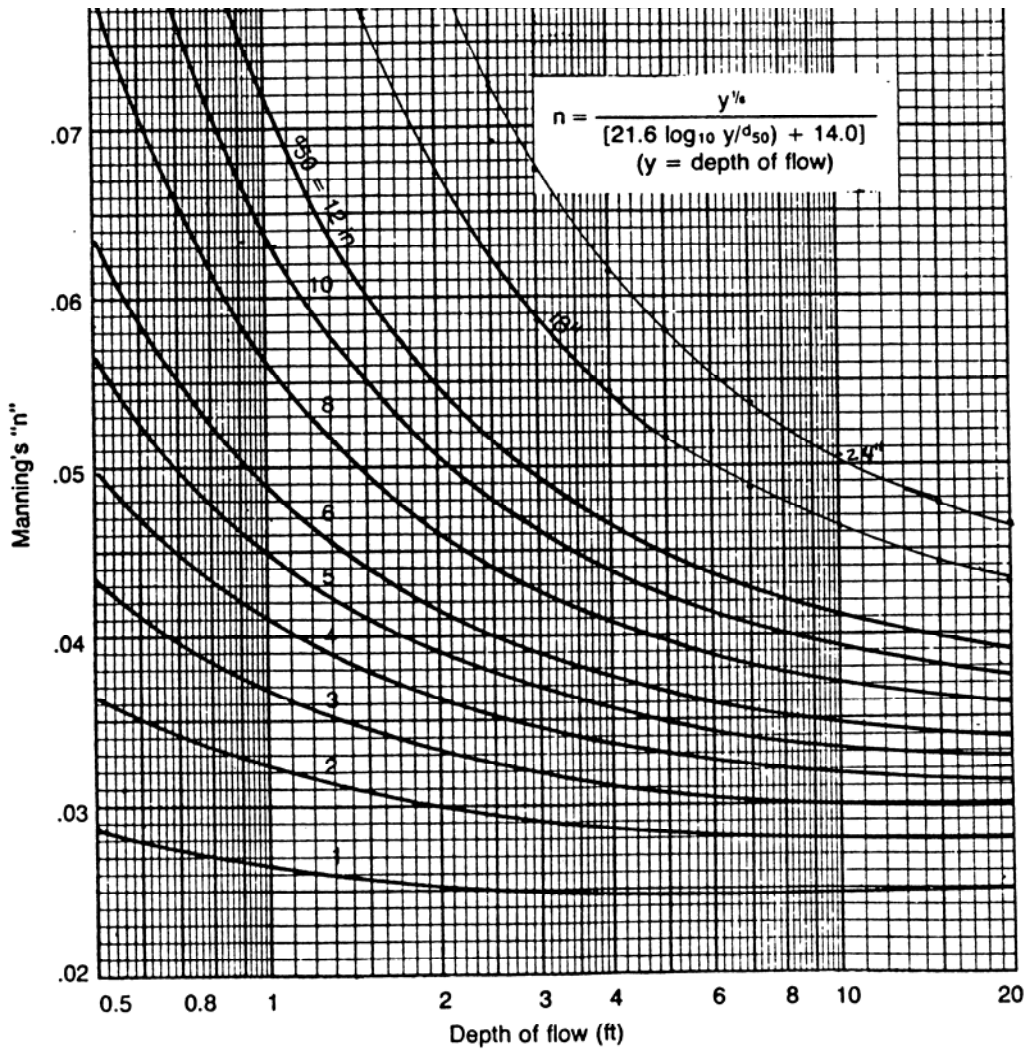
be no steeper than 2 horizontal to 1 vertical. Rock cuts of fills shall be no steeper 1.5 horizontal to 1 vertical.

Stream Approaches

Approaches to the stream crossing shall blend with the existing site conditions where possible, and shall not be steeper than 5 horizontal to 1 vertical. Unless the foundation geology is otherwise acceptable, the approaches shall be stable, have a gradual ascent or descent grade, and be underlain with suitable material, as necessary, to withstand repeated and long term use. The minimum width of the approaches shall be equal to the width of the crossing surface.

Surface runoff shall be diverted around the approaches to prevent erosion of the approaches. Roadside ditches shall be directed into a diversion or away from the crossing surface.

Figure 1. Values of n for riprap-lined channels, d_{50} size vs. depth of flow



Rock
All rock shall be chosen to withstand exposure to air, water, freezing and thawing. When rock is used, it shall be of sufficient size, density and gradation so it is not mobilized by design flows. Figure 1 will be used to size the riprap.

The rock riprap gradation will be:

- Maximum rock size (d_{100}) = two times the d_{50} (18" maximum).
- Maximum d_{50} = as selected from Figure 1.
- Maximum d_{15} = one-third d_{50}.

Cutoff Trench
A cutoff trench shall be provided at the upstream and downstream edges of ford-type stream crossings when needed to protect against undercutting.

Fencing
Fencing is not necessary at all sites. Areas adjacent to the stream crossing shall be permanently fenced or otherwise excluded as needed to manage livestock access to the crossing.

Cross-stream fencing at fords shall be accomplished with breakaway wire, swinging floodgates, hanging electrified chain or other devices to allow passage of floodwater debris during high flows.

All fencing shall be designed and constructed in accordance with IN eFOTG Standard (382) Fence.

Vegetation
All areas to be vegetated shall be planted as soon as practical after construction. All disturbed areas shall be vegetated according to IN eFOTG Standard (342) Critical Area Planting.

Culvert and Bridge Crossings
Design of culverts and bridges shall be consistent with sound engineering principles and shall be adequate for the use, type of road, or class of vehicle. Culverts and bridges shall have sufficient capacity to convey the design flow without appreciably altering the stream flow characteristics.

Culverts shall be sized to handle at least the bankfull flow or the peak runoff from the 2-year, 24-hour peak discharge, whichever is less. Crossings shall be adequately protected so that out-of-bank flows safely bypass without structure or streambank damage, or erosion of the crossing fill. Additional culverts may be used at various elevations to maintain terrace or floodplain hydraulics.

The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes. At least one culvert shall be placed on or below grade with the existing stream bottom.

Acceptable culvert materials include concrete, corrugated metal, corrugated plastic, new or used high quality steel and other materials approved by the engineer.

Acceptable bridge materials include concrete, steel, and wood.

Compacted fill will be used to form the crossing. The minimum depth of compacted fill over the culvert shall be 12 inches. However it is recommended to use one-half the diameter of the culvert, or 24. The compacted fill shall be built up over the culvert so that any stream overflow will cross the road at a point away from the culvert. Follow the manufacturer's recommendations for the material used.

Ford Crossings
When ford crossings are used, the cross-sectional area of the crossing shall not be less than the natural channel cross-sectional area. A portion of the crossing shall be depressed at or below the average stream bottom elevation when needed to keep base flows or low flows concentrated.

The finished top surface of the ford type stream crossing in the bottom of the watercourse shall be no higher than the original stream bottom at the upstream edge of the ford crossing. If the downstream edge of the ford crossing is above the original stream bottom, the ford crossing shall be stabilized in accordance with IN eFOTG Standard (584) Channel Stabilization.

Where rock is used for ford-type stream crossings for livestock, use a hoof contact zone

or alternative surfacing method over the surfacing rock.

Concrete Fords
Concrete ford crossings shall be used only where the foundation of the stream crossing is determined to have adequate bearing strength.

Concrete shall have a minimum compressive strength of 3,000 psi at 28 days. Concrete ford crossings shall have a minimum thickness of placed concrete of 5 inches with minimum reinforcement of 6-inch by 6-inch, 6 gauge welded wire fabric. The concrete slab shall be poured on a minimum 4-inch thick rock base, unless the foundation is otherwise acceptable.

Precast concrete panels may be used in lieu of cast-in-place concrete slabs. Precast concrete units shall comply with American Concrete Institute (ACI) 525, Minimum Requirements for Thin Section Precast Concrete Construction as Modified or ACI 533, Guide for Precast Concrete Wall Panels, or as otherwise acceptable for local conditions.

When heavy equipment loads are anticipated, the concrete slab shall be designed using an appropriate procedure as described in ACI 360, Design of Slabs on Grade.

Geocell, Geotextile, and/or Rock Ford Crossings
Rock ford crossings with geotextile shall be used when the site has a soft or unstable subgrade. Ford crossings made of stabilizing material such as rock riprap are often used in steep areas subject to flash flooding, where normal flow is shallow or intermittent.

The bed of the channel shall be excavated to the necessary depth and width and covered with a geotextile material. The geotextile material shall be installed on the excavated surface of the ford and shall extend across the bottom of the stream and at least up to the 10-year, 24-hour peak discharge elevation.

The geotextile material shall be covered with at least 6 inches of crushed rock. If using geocells, the cells shall be at least 6 inches deep. All geosynthetic material shall be suitably durable and shall be installed in accordance with the manufacturer's recommendations, including the use of staples, clips, anchor pins and recommended velocities.

At a minimum, all rock ford stream crossings shall be designed to remain stable during the 10-year, 24-hour peak discharge.

CONSIDERATIONS

Avoid or minimize stream crossings, when possible, through evaluation of alternative trail or travel-way locations.
Stream crossings can be a direct source of water pollution and they can be expensive to construct and maintain.

Consider rock crossings for livestock use to have a hoof contact zone over the surfacing stone or gravel for animal comfort. This zone could include ground limestone, rock screenings, crusher run, or similar materials. This layer is expected to be replaced periodically by the landowner as livestock traffic or runoff events erode the surface material. Coarse rock, though, will deter loafing time in the stream.

Locate crossings, where possible, out of shady riparian areas to discourage livestock loafing time in the stream.

For heavily used areas, consider using a culvert instead of a ford. However, culverts are not recommended for large drainage areas. When a culvert is utilized, consider using riprap outlet protection since culverts concentrate flow and often create streambed scour.

Ford crossings have the least detrimental impact on water quality when crossing is infrequent. Ford crossings are adapted for crossing wide, shallow watercourses with firm streambeds.

Stream crossings should be located where adverse environmental impacts will be minimized and considering the following:

- Effects on up-stream and down-stream flow conditions that could result in increases in erosion, deposition, or flooding.

- Short term and construction-related effects on water quality.

- Effects on fish passage and wildlife habitats.
- Overall effect on erosion and sedimentation that will be caused by the installation of the crossing and any necessary stream diversion.
- Construction should be done during the driest part of the year.

Where stream crossings are used, evaluate the need for safety measures such as guardrails at culvert or bridge crossing, or water depth signage at ford crossings.

PLANS AND SPECIFICATIONS

Plans and specifications for stream crossings shall be in keeping with this standard and shall describe the requirement for applying the practice to achieve its intended purpose. Minimum requirements in the plans are:

- Plan view of the crossing.
- Profile and cross sections with soil boring.
- Elevations, side slopes, bottom width.
- Materials to be used.
- Quantities and bill of materials.
- Seeding and fertilizing requirements if applicable.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed and implemented for the life of the practice.

The stream crossing, appurtenances, and associated fence should be inspected annually as a minimum, but especially after each major storm event. Make repairs as needed and as quickly as possible.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WATERING FACILITY

(No.)

CODE 614

DEFINITION

A device (tank, trough, or other watertight container) for providing animal access to water.

PURPOSES

To provide watering facilities for livestock and/or wildlife at selected locations in order to:

- Protect and enhance vegetative cover through proper distribution of grazing;
- Provide erosion control through better grassland management; or
- Protect streams, ponds and water supplies from contamination by providing alternative access to water.

CONDITIONS WHERE PRACTICE APPLIES

Practice applies to all land uses where there is a need for new or improved watering facilities.

CRITERIA

General Criteria Applicable to All Purposes

All planned work shall comply with federal, state, and local laws and regulations.

A trough or tank shall have adequate capacity to meet the water requirements of the livestock and/or wildlife, including the storage volume necessary to carry over between periods of replenishment. The trough or tank shall have a capacity to provide seasonal high daily water requirements of 30 gallons per day per 1000 pounds live weight for the number and species of animals to be supplied.

Requirements of Individual Watering Facilities

Kind of Livestock	*Minimum Water Facility Capacity (gallons)*	*Minimum Depth (inches)*	*Height above Normal Ground (inches)*
Beef, Dairy, Horses	***25***	***12***	***4-30***
Sheep, Goats, Swine	***5***	***6***	***4-18***

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

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The site shall be naturally well drained or drainage measures shall be provided. Areas adjacent to the trough or tank that will be trampled by livestock shall be graveled, paved, or otherwise treated to provide firm footing and reduce erosion. Design of the protective surface around the trough shall be in accordance with Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) Standard 561, Heavy Use Area Protection. A pad will be optional on sites where no erosion problems are predicted, when the watering facility is planned as a part of a Prescribed Grazing Plan and where the livestock will be moved in four days or less. Locate the watering facility in such a manner that runoff from the facility does not have the potential to enter wells at the well head.

Watering facilities that have a potential to cross-connect with the public water supply shall have a properly installed back-flow prevention device as required by the local water utility.

Watering facilities connected to potable well systems shall include measures to prevent back-flow or back-siphonage to the well. A check valve is an acceptable measure to prevent back-flow. Automatic water level control and/or overflow facilities shall be provided as appropriate. Valves or pipes shall be protected by shields or covers or specifically located to prevent damage by livestock. Overflow shall be piped to a stable or suitable point of release. The trough/ tank and outlet pipes shall be protected from freezing and ice damage or drained when not in use.

Freeze-proof troughs or electric heaters if used shall be used as recommended and according to manufacturers instructions and guidelines.

The watering facility shall be equipped with a suitable water supply pipe, drainage outlet, and overflow outlet, either as individual outlets or a combination of outlets. Drainage outlets for systems with flow-through water must extend at least ten feet from the watering facility. Plumbing shall be new galvanized steel, copper, bronze, or plastic pipe and fittings in conformance with NRCS FOTG Standard, 516 Pipeline. Water supply pipelines are to have a minimum inside diameter of 1-¼ inches for gravity flow systems or ¾ inch for pressurized systems. The supply lines shall be connected in a manner to prevent leakage and provide proper sanitary protection (i.e., back-flow prevention).

Watering facilities with a capacity larger than 100 gallons shall be equipped with a minimum 1-inch drain plug to facilitate maintenance of the watering facility.

All exposed pipes, fittings, etc., shall be galvanized or ultraviolet protected as appropriate.

Gravity flow systems shall have sufficient head to supply the water for the designed number of animals. Minimum elevation head shall be four feet (planned permanent water surface of pond or spring box to lip of watering facility), when a valve controls water level. Minimum elevation head shall be one foot, when water flows through the watering facility.

All materials shall have a life expectancy that meets or exceeds the planned useful life of the installation. Common construction materials are reinforced concrete, freeze-proof plastic, steel, ***fiberglass, and large equipment tires***. All designs shall meet the industry standards for the material being used. Generally applicable design requirements and procedures can be found in the documents listed under references.

Concrete structures shall be constructed from a concrete mix producing a minimum compressive strength of 4,000 psi at 28 days and shall have at least three-inch thick walls and three-inch thick floor with a minimum of 14-gauge welded wire reinforcing.

Galvanized steel tanks shall have a minimum thickness of 20 gauge.

Plastic and fiberglass structures shall be made of ultraviolet resistant materials or shall have a durable coating to protect the structure from deterioration due to sunlight.

When a large equipment tire is used as a watering facility, it shall be of suitable quality to perform as intended for the useful life of the practice. The tire shall be free of chemicals injurious to livestock. An approved standard drawing shall be used to prepare site-specific designs for this type of tank.

Nose pumps shall be anchored to concrete or other approved devices to prevent damage by livestock. Nose pumps shall be located within 500 feet of the grazing livestock and at least one pump per 25 cattle shall be provided.

CONSIDERATIONS

The Watering Facility practice may adversely affect cultural resources.

Water quality for livestock should meet the standards listed in the NRCS National Range and Pasture Handbook, Chapter 6, Table 6-8.

Livestock facilities should be sized as follows:

Where livestock are rotational grazing within 600 feet of the water facility:

- ***Cattle, horses and dairy:***
  Round or oval troughs or tanks should provide a minimum of 15 inches per head of perimeter tank space for 1/10 of the herd. ***(Diameter equals circumference divided by 3.1416)***

  Square or rectangle troughs or tanks should provide 20 inches per head of straight side tank space for 1/10 of the herd.

- ***Sheep, goats and swine or similar livestock:***
  Round or oval troughs or tanks should provide a minimum of 10 inches per head of perimeter tank space for 1/10 of the herd.

  Square or rectangle troughs or tanks should provide 14 inches per head of straight side tank space for 1/10 of the herd.

Where livestock are grazing over 600 feet from the water facility:

- ***Cattle, horses and dairy:***
  Round or oval troughs should provide a minimum of 15 inches per head of perimeter tank space for 1/3 of the herd.

  Square or rectangle troughs or tanks should provide 20 inches per head of straight side tank space for 1/3 of the herd.

- ***Sheep, goats and swine or similar livestock:***
  Round or oval troughs or tanks should provide a minimum of 10 inches per head of perimeter tank space for 1/3 of the herd.

  Square or rectangle troughs or tanks should provide 14 inches per head of straight side tank space for 1/3 of the herd.

Consider effects on erosion, movement of sediment, pathogens, and soluble and sediment –attached substances carried by runoff.

Watering facilities should be installed in a manner that will prevent the facility from leaking or being overturned.

Consider effects on wetlands and water-related wildlife habitats.

Grazing systems may include several sources of livestock water and thus reduce

demand on one source of water and potential erosion problems.

Watering facilities should be accessible to small animals. Escape ramps for birds and small animals should be installed.

Where rotational grazing is practiced, use portable watering facilities that can be relocated to disperse impacts from trampling vegetation. To ensure uniform grazing and waste distribution in the field, livestock should not travel more than 600 feet to the watering facility. For lactating animals, watering facilities should be located within 500 feet of where they are grazing.

Where possible, a watering facility can provide water for two to four pastures. Watering facilities when possible should be located to aid in additional subdivisions. Gates or gaps may be placed adjacent to the watering facility to allow livestock access to the entire watering facility from any one paddock at one time. Avoid placing feeding areas or other concentrated animal activities above a water source.

PLANS AND SPECIFICATIONS

Plans and specifications for installing watering facilities shall be in keeping with the standard and shall describe the requirements for applying the practice to achieve the intended purpose. If the watering facility is a component of a system that includes additional conservation practices, the information necessary to construct these additional practices will also be conveyed on the plans.

Development of plans will be guided by Engineering Field Handbook, Chapter 5, and shall be in accordance with National Engineering Manual, Parts 541 and 542.

OPERATION AND MAINTENANCE

An operation and maintenance plan specific to the type of installed watering facility shall be provided to the landowner. The plan shall include, but not be limited to, the following provisions:

- Check for and remove debris, algae, sludge or other materials in the watering facility which may restrict the inflow or outflow system;
- Check for leaks and repair immediately if any leaks are found;
- Check the automatic water level device to ensure proper operation;
- Check to ensure that adjacent areas are well protected against erosion;
- Check to ensure the outlet pipe is freely operating and not causing erosion problems; and
- Prepare guidance for winter weather, such as adding material in the storage area to allow for ice expansion without damage.

Algae and iron sludge accumulation should be addressed in areas that have that problem. Chemicals such as copper sulfate and chlorine can be recommended as needed, as long as local rules and regulations are followed.

REFERENCES

National Range and Pasture Handbook

Engineering Field Handbook

National Engineering Manual

Manual of Steel Construction, American Institute of Steel Construction

Concrete, ACI 318, American Concrete Institute

Masonry, Building Code Requirement for Masonry Structures, ACI 530, American Concrete Institute.