Lone Star Healthy Streams

Horses

Endorsed By:

NRCS

TExAS HOrSe

GLCI

Lone Star Healthy Streams
Acknowledgments

• Texas State Soil and Water Conservation Board
• Texas Water Resources Institute
• Lone Star Healthy Streams Program Development Committee
• Lone Star Healthy Streams Steering Committee
• LSHS educates livestock producers on best management practices to reduce bacterial contamination in runoff.
Presentation Outline

• Background

• Best Management Practices
  – Pasture Management
  – Runoff Management
  – Riparian Area Management
  – Manure Management
  – Mortality Management

• Technical and Financial Assistance Programs
Presentation Outline

• Background

• Best Management Practices
  – Pasture Management
  – Runoff Management
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  – Mortality Management

• Technical and Financial Assistance Programs
Water is a finite resource that can be impaired by pollution from sources across landscape.

- No one person, industry, or activity is to blame.

Water pollution has lead to increased regulation in some watersheds in U.S.

Livestock producers need to understand the issues and learn about ways to become part of the solution.
Value of Clean Water

- Clean water is vital to producers in Texas:
  - Irrigating crops
  - Raising livestock
  - Animal health
  - Increased recreational opportunities on ranch
  - $100 billion of food and fiber each year
Value of Clean Water

- Water is second only to oxygen as an essential nutrient to optimize:
  - Animal gain
  - Milk production
  - Reproduction

- Excess levels of bacteria in water can lead to:
  - Degraded ecosystems
  - Limited agricultural production
  - Increased regulation
• **Clean Water Act (1972, 1977):**
  
  – Foundation of surface water quality protection in U.S.
  
  – Restore and maintain chemical, physical, biological characteristics of nation’s waters.
  
  – Requires states to set standards for surface water quality and regulate wastewater discharge.
• EPA has “delegated” responsibility for the CWA to the TCEQ.
Surface Water Quality Standards

- Protect water quality in surface waters:
  - Lakes
  - Streams
  - Rivers
  - Estuaries, etc.

- Designated Uses
  - Aquatic life
  - Contact recreation
  - Public water supply
  - Fish consumption
  - General uses

- Chemical, Physical, and Biological Criteria
  - pH
  - DO
  - BOD
  - Fecal coliform
  - Temperature
  - Toxics

- Antidegradation Policy
  - Protects clean water from impairment
  - Prohibits impaired waters from becoming more impaired
Must define how water bodies will be used

Must develop and enforce WQ standards for each use

Must evaluate these WQ standards every 3 years
Every 2 years, the TCEQ must report the extent to which each water body meets the state’s surface water quality standards:

- **Texas Water Quality Integrated Report**
  - Describes status of ALL surface water bodies in state that were evaluated, tested, and monitored in recent 7 years

- **CWA 303(d) List**
  - Identifies ALL “impaired” surface water bodies not meeting criteria for designated uses
WQ Improvement Projects

- Total Maximum Daily Loads (TMDL)
- Watershed Protection Plans (WPP)
**TMDL Development/Implementation Process**

**DEVELOPMENT**
- TCEQ identifies an impaired water body from 303(d) list
- TMDL is developed for the target pollutant(s)
- TMDL is submitted to EPA for approval

**IMPLEMENTATION**
- Implementation Plan (I-Plan) is developed and initiated
- Water quality monitoring to evaluate progress
WQ Improvement Projects

• Total Maximum Daily Loads (TMDL)
• Watershed Protection Plans (WPP)
9 Elements of Effective WPPs

1. Identification of the causes of impairment and pollutant sources
2. Estimation of the pollutant load reductions that are needed
3. Description of the pollutant source management actions needed to achieve the load reductions
4. Estimation of the technical/financial assistance needed to implement management actions
5. Information and education component to increase public awareness
6. Schedule for implementing the management actions
7. Measurable milestones for tracking implementation of management actions
8. Criteria for determining whether load reductions are being achieved
9. Water quality monitoring component to evaluate plan effectiveness
WPP Development Process

1. Local citizens or agency identifies the need for a WPP
2. Local steering committee and work groups are established
3. WPP is developed including EPA’s 9 elements
4. WPP is approved by stakeholders
5. Implementation and water quality monitoring begin
### TMDLs vs. WPPs

<table>
<thead>
<tr>
<th><strong>TMDL</strong></th>
<th><strong>WPP</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Focuses only on pollutant(s) causing impairment.</td>
<td>• Holistic – focuses on all potential pollutant sources in watershed.</td>
</tr>
</tbody>
</table>

**Both** identify management practices to improve and protect water quality and watershed health.
Microscopic organisms found in feces of humans and other warm-blooded animals.

Not all are harmful by themselves.

Indicator organisms: indicate presence of pathogenic bacteria, viruses, parasites.

Fecal coliform and *E. coli* are most commonly tested.
Major sources according to bacterial source tracking (BST)

- Sewage: 11%
- Non-Avian Wildlife: 29%
- Avian Wildlife: 7%
- Cattle: 22%
- Non-Avian Livestock: 12%
- Unknown: 10%
- Pets: 8%
Sources according to bacterial source tracking (*E. coli*)

- Sewage: 11%
- Horses: 36%
- Wildlife: 1%
- Cattle: 20%
- Ducks: 21%
Results of BST in Leon River

Source Contribution (%)

- Domestic Sewage
- Cattle
- Wildlife
# Fecal Coliform Production

<table>
<thead>
<tr>
<th>Animal</th>
<th>Daily fecal production (lbs/day/AU)</th>
<th>Daily fecal production (g/day/AU)</th>
<th>Fecal coliform density (cfu/g)</th>
<th>Fecal coliform (cfu/AU/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef Cattle</td>
<td>82</td>
<td>37,195</td>
<td>2.30E+05</td>
<td>8.55E+09</td>
</tr>
<tr>
<td>Horses</td>
<td>51</td>
<td>23,133</td>
<td>1.26E+04</td>
<td>2.91E+08</td>
</tr>
<tr>
<td>Goats</td>
<td>40</td>
<td>18,144</td>
<td>1.40E+06</td>
<td>2.54E+10</td>
</tr>
<tr>
<td>Sheep</td>
<td>40</td>
<td>18,144</td>
<td>1.60E+07</td>
<td>2.90E+11</td>
</tr>
<tr>
<td>Hogs</td>
<td>65</td>
<td>29,484</td>
<td>3.30E+06</td>
<td>9.73E+10</td>
</tr>
<tr>
<td>Layers</td>
<td>63</td>
<td>28,576</td>
<td>1.30E+06</td>
<td>3.71E+10</td>
</tr>
<tr>
<td>Pullets</td>
<td>63</td>
<td>28,576</td>
<td>1.30E+06</td>
<td>3.71E+10</td>
</tr>
<tr>
<td>Broilers</td>
<td>82</td>
<td>37,195</td>
<td>1.30E+06</td>
<td>4.84E+10</td>
</tr>
<tr>
<td>Turkey</td>
<td>47</td>
<td>21,319</td>
<td>2.90E+05</td>
<td>6.18E+09</td>
</tr>
<tr>
<td>Deer</td>
<td>15</td>
<td>6,804</td>
<td>2.20E+06</td>
<td>1.50E+10</td>
</tr>
<tr>
<td>Feral Hogs</td>
<td>65</td>
<td>29,484</td>
<td>4.10E+04</td>
<td>1.21E+09</td>
</tr>
</tbody>
</table>
Impairments in Texas

Water Quality Impairments in Texas

Bacteria Impairment
Dissolved Oxygen Impairment
Toxicity Impairment

pH Impairment
Dissolved Solids Impairment
Nitrate and Nitrite Impairment
Bacteria Fate and Transport

- **Fate Processes:**
  - Growth (cell division)
  - Death by predation
  - Die-off

- **Transport Processes:**
  - Advection (horizontal transport)
  - Dispersion
  - Settling
  - Re-suspension from sediment bed

- Processes altered by temperature, pH, nutrients, toxins, salinity, and sunlight intensity.
### Survival of Pathogens

#### Table 2. Potential survival of fecal pathogens in the environment (Olsen 2003).

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature</th>
<th>Cryptosporidium</th>
<th>Salmonella</th>
<th>Campylobacter</th>
<th>Campylobacter (O157:H7)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td>Frozen</td>
<td>&gt;1 year</td>
<td>&gt;6 months</td>
<td>2-8 weeks</td>
<td>&gt;300 days</td>
</tr>
<tr>
<td></td>
<td>Cold (5°C)</td>
<td>&gt;1 year</td>
<td>&gt;6 months</td>
<td>12 days</td>
<td>&gt;300 days</td>
</tr>
<tr>
<td></td>
<td>Warm (30°C)</td>
<td>10 weeks</td>
<td>&gt;6 months</td>
<td>4 days</td>
<td>84 days</td>
</tr>
<tr>
<td><strong>Soil</strong></td>
<td>Frozen</td>
<td>&gt;1 year</td>
<td>&gt;12 weeks</td>
<td>2-8 weeks</td>
<td>&gt;300 days</td>
</tr>
<tr>
<td></td>
<td>Cold (5°C)</td>
<td>8 weeks</td>
<td>12-28 weeks</td>
<td>2 weeks</td>
<td>100 days</td>
</tr>
<tr>
<td></td>
<td>Warm (30°C)</td>
<td>4 weeks</td>
<td>4 weeks</td>
<td>1 week</td>
<td>2 days</td>
</tr>
<tr>
<td><strong>Cattle manure</strong></td>
<td>Frozen</td>
<td>&gt;1 year</td>
<td>&gt;6 months</td>
<td>2-8 weeks</td>
<td>&gt;100 days</td>
</tr>
<tr>
<td></td>
<td>Cold (5°C)</td>
<td>8 weeks</td>
<td>12-28 weeks</td>
<td>1-3 weeks</td>
<td>&gt;100 days</td>
</tr>
<tr>
<td></td>
<td>Warm (30°C)</td>
<td>4 weeks</td>
<td>4 weeks</td>
<td>1 week</td>
<td>10 days</td>
</tr>
<tr>
<td><strong>Liquid manure</strong></td>
<td></td>
<td>&gt;1 year</td>
<td>13-75 days</td>
<td>&gt;112 days</td>
<td>10-100 days</td>
</tr>
<tr>
<td><strong>Composted manure</strong></td>
<td></td>
<td>4 weeks</td>
<td>7-14 days</td>
<td>7 days</td>
<td>7 days</td>
</tr>
<tr>
<td><strong>Dry surfaces</strong></td>
<td></td>
<td>1 day</td>
<td>1-7 days</td>
<td>1 day</td>
<td>1 day</td>
</tr>
</tbody>
</table>
Federal and state natural resource agencies encourage voluntary use of effective conservation practices to improve water quality.

Although implementation requires cost, benefits of having clean water outweigh costs.

LSHS provides information to producers on how to reduce bacterial contributions.
  
  — Producers become part of solution.
Texas Horse Industry

- Approximately 979,000 horses in Texas.
- Industry produces estimated $3 billion in goods and services annually.
- Industry supports more than 32,000 jobs.
- Annual horse sales total $354 million.
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• Best Management Practices
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• Technical and Financial Assistance Programs
Like any other livestock, horses can damage the land on which they are kept.

- Concentrate manure
- Degrade pasture quality
- Degrade water quality
- Develop digestive/behavioral disorders

Owners’ responsibility to manage animals in a way that minimizes impact on surrounding environment.
Primary BMP is prescribed grazing, designed to:

- Maintain adequate vegetative cover
- Reduce soil erosion
- Improve forage production
- Enhance water conservation
- Improve animal performance
- Enhance long-term sustainability of production systems
• Increased soil erosion due to water.
Improper Pasture Management

• Reduced forage production.

• >50% aboveground biomass removed:
  – Photosynthesis slowed
  – Root development reduced
  – Moisture and soil nutrients for plant production reduced.
• Reduced water conservation.
Grazing Management

- **Grazing Management**
  - *Where, when, and how much* livestock graze.
  - Most critical component is stocking rate.
  - Goal is to match availability and nutritional content of forage with nutrient requirements of the animal.
Stocking Rate

• The most critical aspect of livestock production.

• **Stocking Rate**: # of acres/animal for a grazing season that can be sustained without degrading forage, water, or soil resources.

• **Carrying Capacity**: stocking rate sustainable over time per unit of land area.

• **Animal Unit (AU)**: standard measure of livestock equal to 1,000 pound beef cow.
  
  – **Animal Unit Equivalent (AUE)**: used to estimate potential forage demand for different kinds of animals (horses, deer, etc.).
Stocking Rate

- Horses should consume at least 1.5% to 3.0% of their body weight each day on a dry matter basis.
  - At least 70% of this feed should be in long-stemmed forages.

- An appropriate stocking rate ensures animal has enough forage and that adequate ground cover will be maintained.
Stocking Rate

• Benefits of horses grazing on pastures that are properly managed and stocked:
  – Hay costs are reduced by $60 to $100 per month.
  – Fertilizer costs are reduced if composted manure is spread on the pasture.
  – Land aesthetics are improved for horse owners and neighbors.
  – Less time is spent cleaning stalls.
  – Bedding costs are reduced.
  – Problems with parasites such as worms and flies are reduced.
Common equine grazing systems:

- Continuous stocking
- Rotational stocking
- Partial-season stocking
- Limited turnout stocking
• 200% reduction in *E. coli* levels when grazing intensity switched from heavy to moderate.

• 90% - 96% reduction in fecal coliform levels when grazing intensity switched from heavy to no grazing.

• 72% reduction in *E. coli* levels when prescribed grazing implemented with contour farming, grassed waterways, nutrient/pest management.
Other Pasture Management Practices

- Sacrifice lot
- Soil testing
- Mowing/clipping pastures
- Dragging pastures
- Burning pastures
• **Summary:**
  
  – Key is to maintain adequate vegetative cover
  
  – Pay attention to stocking rate and grazeable acres
  
  – Seek an optimum balance of harvest efficiency, resource conservation, water quality, and individual animal performance.
Presentation Outline

- Background
- **Best Management Practices**
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- Technical and Financial Assistance Programs
Runoff Management

• BMPs help control water moving across the landscape:
  – Filter strips
  – Building location
  – Roof runoff structure
  – Rainwater harvesting
• An area of herbaceous vegetation established between a body of water and the surrounding land.
  – Designed to remove sediment, bacteria, organic material, nutrients, and chemicals from runoff.
Note denuded stream banks, sand depositions in creek, and algal bloom.

Note the effectiveness of a vegetative filter strip in trapping sediment that would have wound up in the creek or reservoir. Nutrients, pesticides and bacteria were also trapped.
## Effectiveness of Filter Strips in Reducing Fecal Coliform Levels under Varying Conditions

<table>
<thead>
<tr>
<th>Fecal Coliform Reduction</th>
<th>Slope</th>
<th>Buffer Length</th>
<th>Runoff Source</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.8% – 99.9%</td>
<td>5% - 35%</td>
<td>.1 – 2.1m</td>
<td>Grazing cattle</td>
<td>Tate et al. 2006</td>
</tr>
<tr>
<td>43% - 74%</td>
<td>9%</td>
<td>9m</td>
<td>Poultry litter on no-till cropland</td>
<td>Coyne et al. 1995</td>
</tr>
<tr>
<td>64% - 87%</td>
<td>4%</td>
<td>9m</td>
<td>Manure</td>
<td>Fajardo et al. 2001</td>
</tr>
<tr>
<td>&gt;99%</td>
<td>4%</td>
<td>1 - 25m</td>
<td>Manure on pastureland</td>
<td>Sullivan et al. 2007</td>
</tr>
</tbody>
</table>
### Filter Strip Specifications


<table>
<thead>
<tr>
<th>Slope</th>
<th>Minimum width of buffer strip</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3%</td>
<td>25 ft.</td>
</tr>
<tr>
<td>4-7%</td>
<td>35 ft.</td>
</tr>
<tr>
<td>8-10%</td>
<td>50 ft.</td>
</tr>
</tbody>
</table>
Building Location

• Location of all barns, storage areas, and compost piles:
  – On higher ground away from water bodies
  – On well-drained soils

• Direct stormwater away from buildings toward filter strips.
• Gutters, downspouts, and outlets that collect, control, and transport water from roofs.
• Direct water away from buildings to rain barrels, cisterns, or storage tanks.
  • 1 inch of rain can yield at least 0.6 gallons of water for every square foot of collection surface.
  • 2,000 ft² roof = 1,200 gallons of water from 1-inch rain.
• Horses drink 3 to 8 gallons a day.
• Texas Water Development Board Manual of Rainwater Harvesting
Costs

- **Gutters/downspouts:** $6.70/linear foot
- **Collection pipes:** $20.60/linear foot
- **Storage tanks:** $.50/gallon for large fiberglass tank to $4.00/gallon for welded steel tank.

A system to provide drinkable water will be more expensive because it requires roof washer, pressure tank, pump, disinfection system, and other components.
Runoff Management

- **Summary:**
  - BMPs help control runoff across property, protect health of horses, and minimize level of contaminants that enter water bodies.
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• Technical and Financial Assistance Programs
Riparian areas are environmentally sensitive areas along streams and rivers.

- Require special protection from horses and other livestock.

Riparian protection BMPs alter amount of time livestock spend in riparian areas.

- Shade structure
- Watering facility
- Exclusionary fencing
- Access control
Shade Structures

- Can be permanent or portable.
- Horses sensitive to temperatures above 77°F.
- May improve nutrient distribution and recycling in the pasture.
Shade Structures

- Horses require about 60 ft$^2$ of shade per animal.
  - Structure needs to be at least 8 ft. tall.
- Encourage development of natural shade away from riparian area when preparing pastures.
- Studies done with cattle:
  - 85% reduction in *E. coli* with shade and alternative water sources.
- Pre-fabricated structures cost about $1,200.
Encourages livestock to obtain water away from the stream.

Easy to implement.

NRCS cost-share programs reduce costs.

Consider solar-powered wells.
Without an alternative water source, this producer is out of business...
## Alternative Water Source

<table>
<thead>
<tr>
<th>Bacteria Reduction</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E. coli</strong></td>
<td>Byers et al. 2005</td>
</tr>
<tr>
<td>85%</td>
<td></td>
</tr>
<tr>
<td><strong>Fecal coliform</strong></td>
<td>Hagedorn et al. 1999</td>
</tr>
<tr>
<td>94% (when combined with other practices)</td>
<td></td>
</tr>
<tr>
<td><strong>Fecal streptococci</strong></td>
<td>Sheffield et al. 1997</td>
</tr>
<tr>
<td>77%</td>
<td></td>
</tr>
</tbody>
</table>
Costs of Alternative Water

• **Watering troughs:** $450 to about $7,600, depending on the size and material (plastic, galvanized metal, fiberglass, or concrete)

• **Electric water pumps:** $1,900 to $4,000, depending on the size

• **Solar water pumps:** $5,700 to $12,000, depending on well depth

• **Windmills:** $8,200 to $17,800, depending on fan diameter

• **Pond:** $2.08 to $10.08 per cubic yard, depending on size
Exclusionary Fencing

- Eliminates horse access to streams.
- Permanent fences are expensive to construct and maintain.
  - Cost-share from NRCS.
- Not feasible to fence-off entire stream in many cases.
- Electric fencing may provide a lower-cost alternative.
<table>
<thead>
<tr>
<th>Type of Bacteria</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em></td>
<td>37% - 46%</td>
</tr>
<tr>
<td>Fecal coliform</td>
<td>30% - 94%</td>
</tr>
<tr>
<td>Fecal <em>streptococci</em></td>
<td>30% - 76%</td>
</tr>
<tr>
<td>Fecal <em>enterococci</em></td>
<td>57%</td>
</tr>
<tr>
<td>Total coliform</td>
<td>81%</td>
</tr>
</tbody>
</table>
Excluding livestock, people, or vehicles from environmentally sensitive areas.

- Fences, gates, signs, rip-rap, or other barriers.

Rip-rap:

- 4-8” diameter rocks were slightly effective at hindering livestock movement.
- >12” diameter rocks were highly effective.
• **Summary:**
  
  – If you own land next to a body of water, it is critical you protect riparian area.
  
  – Use practices to protect vegetation, minimize erosion, and improve water quality.
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• **Technical and Financial Assistance Programs**
Manure Management

• Manure is a good soil amendment and valuable source of nutrients.
  – It contains pathogens and can contaminate water.
  – Average 1,000 pound horse produces 51 pounds of manure per day.

• Manure management BMPs include:
  – Waste storage structure
  – Waste utilization
  – Soil testing and nutrient management
  – Composting
Waste Storage Structure

- An impoundment or a sheltered concrete slab area designed to temporarily store wastes.
  - Allows manure to be stored until it can be applied at proper time rather to the same field based on convenience.

- Locate 50-100 feet from nearest waterway.

- Most common storage system is dry stack system.
### Waste Storage Structure

- **Long-term manure storage (6 to 30 weeks)**

<table>
<thead>
<tr>
<th>Type of Bacteria</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>E. coli</em></td>
<td>97% - &gt;99%</td>
</tr>
<tr>
<td>Fecal coliform</td>
<td>44% - &gt;99%</td>
</tr>
<tr>
<td>Fecal <em>streptococci</em></td>
<td>46% - &gt;99%</td>
</tr>
<tr>
<td>Total coliform</td>
<td>81%</td>
</tr>
</tbody>
</table>
# Waste Storage Structure

<table>
<thead>
<tr>
<th>Type of Waste Storage Facility</th>
<th>Cost</th>
<th>Practice Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small storage tank (storage limited to 2,000 gallons)</td>
<td>$2.00/gallon</td>
<td>20 years</td>
</tr>
<tr>
<td>Waste storage pond</td>
<td>$2.30/yd³</td>
<td>20 years</td>
</tr>
<tr>
<td>Dry stack facility (earthen floor)</td>
<td>$10/ft²</td>
<td>20 years</td>
</tr>
<tr>
<td>Dry stack facility (concrete floor)</td>
<td>$13.76/ft²</td>
<td>20 years</td>
</tr>
<tr>
<td>Dry stack facility (concrete/earthen floor combo)</td>
<td>$13.76/ft²</td>
<td>20 years</td>
</tr>
</tbody>
</table>
Concerns proper use of agricultural wastes.

- Manure can improve soil structure and fertility, but degrade water quality if improperly applied.

Manure depth:

- ½ to 1 inch on pasture
- 2 inches on cropland
- Use shallow disk or harrow to incorporate manure into soil to prevent loss of nutrients and bacteria.
Waste Utilization

• Critical to apply manure at appropriate time and rate:
  – Calibrate your manure spreader.
  – Apply in spring to actively growing pasture.
  – Runoff has most bacterial contamination within 48 hours of manure application.

• Cost (includes soil test, nutrient budget, record keeping, transportation, and application):
  – $20.45/acre (on farm)
  – $44.74/acre (off-farm)
• Managing amount, source, placement, form, and timing of application of nutrients and soil amendments.
  – Requires soil and manure test.

• Soil, Water, and Forage Testing Laboratory at Texas A&M University.
  – http://soiltesting.tamu.edu
Composting

• Managed process that accelerates decomposition and conversion of organic matter into stable humus.
  – Can take 30 to 60 days, or as long as 6 months if bedding material is added to compost.

• Composting depends on:
  – Air
  – Moisture
  – Particle size
  – Temperature
  – Pile size
  – Nutrients

• Completely eliminates bacteria.
Manure Management

• Summary:

  – Properly store, handle, apply, recycle, and dispose of manure.
  
  – Ensures protection of water quality, environment, animal health and human health.
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• Best Management Practices
  – Pasture Management
  – Runoff Management
  – Riparian Area Management
  – Manure Management
  – Mortality Management

• Technical and Financial Assistance Programs
Mortality Management

- Rendering
- Composting
- Incineration
- Sanitary landfills
- Burial
Recycles nutrients contained in dead animals, most often as ingredients for food for pets and other animals.

Rendering market has changed due to falling prices of meat, bone meal, and concerns over BSE (bovine spongiform encephalopathy) or mad cow disease.

Costs range from $25 to $200 per animal depending on distance to the facility.

http://nationalrenderers.org
Composting uses the natural decomposition process to break carcass down into organic matter.

Proper composting destroys most pathogenic bacteria and viruses.

Large carcasses can be composted in bins or static windrows.

Cost of composting a whole animal is about $4 per carcass.
Incineration process burns carcasses using fuel.

- Burning carcasses on site is also an acceptable method of disposal.

Incineration can cost $600 to $1,000 depending on location and price of fuel.

Despite cost, incineration is one of the most environmentally friendly ways to dispose of a carcass.

- Air and water quality are protected because of strict state and federal regulations that apply to incinerators.
• Not all municipal landfills accept animal carcasses.
  – Contact your local landfill for information.
  – Some will not take remains of chemically euthanized animals.
• Disposal cost at landfill is approximately $80 to $150.
Burial

• According to TCEQ, burial site should be located in an area with high water table or with permeable soils.
  – Burial can harm surface and groundwater is done improperly.

• Animals should be buried at least:
  – 300 ft. from nearest surface water
  – 300 ft. from nearest drinking water well
  – 200 ft. from adjacent property lines
Most studies on pathogen reduction and mortality management focus on composting and incineration:

- *Salmonella* and fecal coliform undetectable after 9 months of composting (Mukhtar et al. 2003).

- High temperatures of incineration eliminates pathogens.
• Background

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• Technical and Financial Assistance Programs
Soil and Water Conservation Districts (SWCD):

- Offer technical assistance to farmers and ranchers in preparing soil and water conservation plans to meet each land unit’s specific capabilities and needs.

Texas State Soil and Water Conservation Board (TSSWCB):

- Offers technical assistance to SWCDs.

Natural Resources Conservation Service (NRCS):

- Helps landowners and managers improve and protect their soil, water, and other natural resources.

Texas AgriLife Extension Service:

- Offers technical assistance to citizens of Texas on natural resources issues, as well as many other topics.
Financial Assistance

- **Texas State Soil and Water Conservation Board (TSSWCB):**
  - Senate Bill 503 Program: Water Quality Management Plans
  - Clean Water Act 319 Nonpoint Source Grant Program

- **Natural Resources Conservation Service (NRCS):**
  - Environmental Quality Incentives Program (EQIP)
  - Wildlife Habitat Incentives Program (WHIP)
  - Grassland Reserve Program/Wetland Reserve Program
  - Conservation Security Program

- **USDA Farm Service Agency (FSA):**
  - Conservation Reserve Program
  - Conservation Reserve Enhancement Program
  - Source Water Protection Program
Livestock can contribute bacteria to water bodies.

Best management practices exist to help prevent bacterial contamination of water resources.

Know your options and decide which practices to implement.
QUESTIONS?