LARIMER COUNTY

COMMITTED TO EXCELLENCE

Guide for Preparing Resource Stewardship Plans

For Equestrian Operations

First Edition

August 30, 2010

Welcome to the Resource Stewardship Plan Guide

The idea for this guide originated with a group of citizens associated with the horse boarding community and appointed by the County Commissioners. The concept this working group came up with was a guide that could be used by operators whether they require County approval or not. The guide should offer references, referrals and suggested management practices suited to Larimer County climate and environment. Local experts volunteered to suggest some management practices that seem to fit this area of Colorado and to develop a list of resources if more information is desired by operators. The goal is to provide a guide that will lead users to a plan that does not require hiring of consultants or experts.

Best Management Practices
The basic premise of the guide is that each facility is different, and that a one size-fits-all management plan is not practical. Each facility operator can use the guide to review and select those practices that are most appropriate to the number of animals they have, the site lay out that they need to operate and the characteristics of the land they operate on.

Developing a Resource Stewardship Plan:
The completed plan is a separate brief checklist reflecting your choices of best management practices that suit your operation. There is no right or wrong answer to the plan but it will be one more tool along with the site plan that will be used in the approval process if your level of operation requires County approval. The plan is designed, whether required or not, to help business owners:

- Communicate their intent regarding management to customers of the business.
- Provide a clear and adequate management plan to inform decision makers if a land use approval is required.
- Facilitate neighbors understanding of how a facility will be operated
- Limit neighbor complaints or compatibility concerns and
- Be a useful tool to maintain the value of your business

There are three steps to completing a Resource Stewardship Plan:

STEP 1 - **Assess Your Site**: Site assessment will helps you identify your highest priority areas based on your unique site and needs.

STEP 2 – Consider Management Options: The second step is organized into sections related to the potential impacts of equestrian facilities. Each section has been authored by experts in our region and contain a brief description of why that issue is important, Some suggested management practices are considered as basic to all facilities, while others need to be selected to fit the needs of your land and your operation.

STEP 3 - **Complete Your Plan:** Use the information you gathered from step 1 and 2 to complete the Resource Management Plan checklist and turn it in with your application. Keep a copy of the checklist for your use in maintaining an enduring business. If you ever want to amend your plan simply submit a revised Resource Management Plan checklist to the County for review and approval.

STEP 1: Assess Your Site

The first step in preparing a resource stewardship plan is to consider some basic information about your property. This step involves preparing a site plan and project description.

Equestrian facilities that are required to prepare a Resource Stewardship Plan should refer to the application packet that was provided by the Planning Department. Depending on the scale of your operation, that application packet could be for a Public Site Plan Review, Minor Special Review, or Special Review. The application materials for each process include a list of items to include in the project description and site plan.

The project description asks for specific information about the equestrian operation. This includes important details such as the size of the property, the number of horses that will be kept, the number of customers anticipated to visit the property, and whether irrigation water is available for the pastures.

The instructions for the site plan specify the kinds of information that needs to be shown on the drawing. This includes a layout of the proposed operation, the location of structures on your property and on the adjoining neighbors' property, the location of any water courses, wetlands or other sensitive features, and information about important features such as drainage patterns.

The Planning Department can assist by providing mapping data that it has developed about resources such as wetlands that may be present. Soils information is also available through the Natural Resources Conservation Service (NRCS) web soil survey (see additional resources). It is important to complete the initial project description and the site plan first because this information will help indicate the kinds of potential impacts that might be expected to occur with a horse business. Note that in some cases the site plan and project description may need to be updated later to reflect the management options selected in the Resource Stewardship Plan.

Once the project description and site plan are completed, users of this guide should proceed to **Step 2: Consider Management Options**.

STEP 2: Consider Management Options

The next step is to consider ways to manage potential impacts of the business. Management is important for protecting the property and for increasing compatibility with neighbors. This section of the guide provides background information about important resource categories and explains why management is important. It also includes information about how to tell if conditions are being properly managed, and describes best management practices that are available in order to prevent negative impacts. It is organized according to the following resource issues:

MANURE

Why manure is important. Manure management is important for air and water quality, human and horse health, and maintaining healthy plant communities, both native and cultivated. Developing an effective manure management plan is central to creating a successful resource stewardship plan. Horse manure contains nitrogen (N), phosphorus (P), and potassium (K), which are the major nutrients needed by plants. These elements can become environmental pollutants if they are not used by plants. High levels of ammonia (NH_3) from an accumulation of manure can cause respiratory problems for both horses and humans.

Measures of proper manure management. Manure is being properly managed when:

- Manure is removed frequently so it does not accumulate in stalls or confinement areas
- Manure is stored in a way that prevents stormwater that has come in contact with manure from transporting nutrients (including N and P that become water pollutants) off the property or into surface water.
- Manure applied to pastures is done at or below the agronomic rates
- Excessive odors or flies are not present

Best Management Practices (BMP's)

The objective of choosing BMP's from the following list is to manage manure by minimizing its potential negative environmental impacts on water, health, and air quality and to maximize beneficial uses as a soil amendment to promote soil health and plant growth.

Best Management Practices (BMP's) for all facilities:

- **Minimize surface area of confinement areas** with no vegetation; and manage these areas intensively by grading, removing manure frequently, and preventing clean water from entering.
- **Minimize water that comes in contact with manure** by diverting storm drainage or water flows from concentrated use areas. It is particularly important to prevent nutrients from moving into surface water (streams, lakes, irrigation ditches, and rivers).
- **Minimize water containing nutrients from manure from leaching into groundwater.**

Best Management Practices (BMP's) to select:

Apply manure at agronomic rates to insure that nutrients are used by plants and do not move into the environment and become pollutants. See the following section "The Essential Background Information for Choosing Appropriate BMP's **if manure will be land applied on your property"** for information about agronomic rates.

Construct berms or ditches to divert clean water around confinement areas.

Install gutters and downspouts on buildings in animal confinement areas. Design gutters so that the clean water is discharged outside of confinement areas and onto vegetated areas.

Remove manure frequently and regularly from confinement area and store temporarily in a location that is separated from surface water or wells.

Grade confinement areas to keep surface smooth so that water that enters moves off quickly.

Keep horses away from surface water by fencing them out of these areas.

Build berms around manure storage areas to prevent runoff.

Cover manure storage piles to prevent rain or snow accumulation.

Provide vegetated buffer strips at low end of confinement area by establishing border areas that can to trap nutrients and sediments in runoff.

Install a hard impervious surface for manure storage if water table is high.

Apply manure with woody bedding only to pasture surface. When manure is mixed with woody bedding, apply mixture of manure and woody bedding only to the **surface** of established vegetation, like a grass pasture. Do not till it into the ground. This maximizes use of nutrients but prevents the woody bedding from negatively impacting soil fertility. Woody bedding may help water use efficiency if it is applied thick enough to act as surface mulch but not so thick that it smothers grasses.

Select bedding material to facilitate manure composting. For example, less volume of pelleted wood bedding is needed to accomplish the same effect as coarser wood shaving and pelleted wood bedding is more compostable. Soil fertility and plant growth can be negatively impacted by incorporating manure or compost into the soil that also includes woody bedding.

Use stall mats in barns to minimize the amount of bedding needed and to separate manure and urine from the soil to keep nutrients from moving into the soil.

Compost manure (and bedding) as it is removed from confinement areas, establishing the site according to guidelines for locating manure piles. Simple directions for self-learning on how to compost manure can be found at:http://www.extsoilcrop.colostate.edu/Soils/documents/manure_webviewing.pdf (Elliott, Doesken, and Davis, 2007).

Haul manure off site for proper disposal. Select a hauler to bring the manure to a compost facility rather than the landfill. Manure should be removed at least twice a year, or more often as required by the area you have available for manure storage.

The Essential Background Information for Choosing Appropriate BMP's if manure will be land applied on your property:

1. To estimate the amount (volume and weight) of horse manure you will have to manage, start with table 1. Multiply the number of horses you have by 9 to get tons per year. If your horses spend part of the time grazing, adjust the total amount of time your horses spend in confinement area. Calculate the fraction of time that your horse is confined and multiply by that fraction to obtain the total amount of manure to actively manage. For example, if one horse spends 12 hours per day 4 months out of the year grazing and the rest of the time in a confinement area, that is a total of 2 months of manure you do not have to manage, or 60/365 = 16%. You will be managing 100% - 16% = 84% of the total manure produced by your horse per year, or .84 x 9 tons = 7.6 tons per year.
2. If manure will be land applied to pastures on the property, it is important to consider the proper amount to apply. To determine the correct rate of manure to land apply to fertilize plants, use table 1 to obtain some basic facts about horse manure from you facility.

Table 1. **Horse manure basic facts** (Davis and Swinker, 2010, Tao and Mancl, 2008).

Tons* manure per horse† per year	Cubic yards of manure per horse per year	Nitrogen (N) pounds N per ton in horse manure	Phosphorus (P) pounds P_2O_5 per Ton in horse manure	Potassium (K) Pounds K_2O per Ton in horse manure
9	10	19	14	36

*One Ton = 2000 pounds
†Assume horse = 1000 pound average type horse. Add or subtract for large horses of ponies.
Note: To calculate "per day" amounts of manure, divide amount per year by 365.

3. In order to fertilize the pasture and prevent runoff of nutrients, the amount of manure that can be spread on pastures needs to be calculated. The Agronomic Rate (AR) is amount of manure that satisfies the plant's needs while preventing an accumulation of excess nutrients that can run off into surface water or leach into groundwater.
   To estimate the agronomic rate, determine the following information:
   A. The crop or plants to be fertilized and their estimated yield, which could be based on past experience.
   B. The recommended amount of N and P for optimum plant growth, which is found for representative plants in Colorado by looking through the online publications at the Colorado State University Extension Web site (http://www.ext.colostate.edu/index.html) or by asking at your County Extension Office for this information.
   C. How much N and P are already in the soil, which is part of the nitrogen credit. Sample soil (Self and Soultanpour, 2010, publication no. 0.500, Soil Sampling, http://www.ext.colostate.edu/pubs/crops/00500.html) and test at a local soil testing lab (Self, 2010, Publication no. 0.501, Soil Testing, http://www.ext.colostate.edu/pubs/crops/00501.html).
   D. How much N and P are present in incoming irrigation water, if any, which is part of the nitrogen credit. Sample irrigation after during the season and send to lab for testing to get an estimate. N from municipally treated water will be negligible, but could be significant in irrigation water from ditches or wells.
   E. How much N and P are in manure: estimate from table 1 or test manure at a lab.

   All of the N in most chemical fertilizers becomes available to plants in the first growing season after application. However, only **half** of the N in manure becomes available to plants in the first growing season. Explanation: Most N in manure is in large organic molecules which must be broken down by soil microorganisms into smaller molecules before plant roots can take them into their cells. Microbial activity in soil is dependent on water content, season of year, and climate variations, all of which are difficult to quantify. Research and experience indicate that about **half of the total nitrogen** in manure will become available to plants under most conditions in the first year after application.

4. The essential steps in calculating the agronomic rate of manure after obtaining the information above are:
   A. Subtract the nitrogen credits from the recommended agronomic rate (get from extension publications), which are N in soil and N in irrigation water, to get the agronomic rate of N to add.
   B. Multiply the above amount of N by 2 to account for only half of the N in manure becoming plant available in the first year after application.
   C. From Table 1, determine how many tons of manure to apply to apply the AR of nitrogen. To determine how much volume this is, calculate the volume of a "5 gallon" bucket, fill it a few times with manure, take the average weight, and divide weight by volume to obtain information to convert weight of manure to volume of manure.
   D. In succeeding years, add to the nitrogen credits the nitrogen contained in the half of the manure that did not become available that year to the plants, and so forth.

5. **What about phosphorus, a potent potential environmental pollutant?** The ratio of phosphorus to nitrogen in manure is such that phosphorus is usually applied at a higher rate than what most plants can use in a growing season. In some situations where manure has been repeatedly applied the agronomic rate should be based on the **agronomic rate of phosphorus** needed. A build up of phosphorus in the soil results in its loss through runoff into water where it becomes an environmental pollutant. Test soil for P to check for P accumulation in soil.

WATER RUN-OFF AND DRAINAGE

What is Runoff and Drainage? Storm events or irrigation can produce runoff from horse facilities that can affect adjacent lands, water bodies and sometimes groundwater. When runoff passes through concentrated use areas having manure piles, corrals or holding pens, it is likely to carry nutrients and sediment that can alter water quality.

Why is it Important? If runoff passes through a pasture or runway that does not have adequate vegetative cover, it can carry sediment and nutrients onto other properties or into water bodies. This is especially true if an area has steep slopes. Slow drainage can also be a problem if water accumulates in a way that affects adjacent properties. Inadequate drainage is also associated with an increase in mosquitoes and other insects, mold and fungus as well as the infiltration of nutrients and other substances into ground water. When nutrients enter a stream, lake, pond or other water body, they often increase the amount of aquatic vegetation. The breakdown of aquatic vegetation ties up oxygen leaving less oxygen for naturally occurring species. This changes the species composition of aquatic plants, fish, and invertebrates. This is called "eutrophication" and the effect moves downstream for a considerable distance. If sediment enters a water body, it creates or increases turbidity and sediment that settles to the bottom can alter water quality and life cycles of aquatic organisms in a variety of ways. In some cases, stormwater leaving a livestock facility may require a permit from the State of Colorado if it flows onto the property of others or enters a water body.

Measurements. Indicators for measuring impacts include **visual or instrument detection of turbidity or water that is discolored by sediment and manure.** If water bodies are affected by nutrients, then **increases in aquatic vegetation** like algae can be visually detected as well. If complaints are made and more technical measurements are called for, these might include using a turbidity meter or sediment traps. **Nutrient levels** (nitrogen and phosphorous in particular) in water bodies can be sampled but samples are usually sent to a lab. Changes in **dissolved oxygen** occur with increases in aquatic vegetation can be easily measured. Small, hand-held instruments are available for both turbidity and dissolved oxygen.

Best Management Practices (BMP's) for all facilities:

- **Manage drainage to avoid surfaces having manure.** As mentioned in the previous section, all facilities should be managed to provide drainage in order to avoid areas with accumulations of manure.

Best Management Practices (BMP's) to select:

Provide vegetated buffer strips for runoff from confined areas. Use buffer strips of vegetation for runoff to pass through in order to trap sediments and nutrients before they move onto other properties or before they enter a water body.

Locate manure piles away from areas where stormwater flows or is concentrated.

Divert runoff from building roofs through the use of proper gutter, downspouts and outlets to prevents additional runoff problems.

Provide detention & water quality structures for cases where large amounts of stormwater are concentrated. The Engineering Department can assist in determining if stormwater detention is needed.

IRRIGATION DITCHES

Ditches. In an arid climate like the Front Range, ditches are the lifeblood of productive rural areas. They enable landowners who own or rent shares of water to intensify the raising of crops, livestock, windbreaks, wildlife habitat and landscaping. The quality of life and the diversity of the landscape are higher in irrigated areas. The care and maintenance of reservoirs and main ditches lies with the ditch company or other entity that owns the ditch. The maintenance of lateral ditches is up to the landowners/shareholders who use a ditch once it leaves an irrigation company's head gate. Under Colorado statutes, if you have either of these types of ditches running through your property, they have legal right-of-way. Impacts to the ditch or routes of access are not acceptable. Even though the tradition in Colorado and much of the west has been for landowners to make decisions regarding fencing livestock, collaboration between equestrian operators and ditch owners makes the most sense due to the potential impacts to ditch operation from horses and the legal standing of the ditch rights-of-way.

Why Ditches are Important to Consider in a Stewardship Plan? Horses that graze, water or cross back and forth over a ditch can begin to erode and change the shape of the ditch. Typically a ditch that is trampled spreads out becoming less efficient because water moves more slowly and more is lost to evaporation/seepage. Soil and other objects that settle in the bottom of a ditch impede its flow. Weeds that grow along a ditch drop seed into the water when it is running and carry the weeds to other properties. All of these potential impacts are costly to correct.

Measurements. Some of the indicators for ditch impacts include: **widening, loss of bank shape and stability, bottom filling, trash or other objects in the ditch, weeds along the ditch.** These can normally be detected visually, photographed and compared with other sections of ditch that are not impacted. Trampling impacts can be tracked using cross-section measurements of width and depth that creates a ditch profile at several points along the ditch. It is in the equine operator's interest to take both photos and ditch cross section at several points in order to have base-line information for any future comparisons.

Best Management Practices (BMP's) for all facilities:

Coordinate with ditch users.

Consider ditch location in facility planning.

Best Management Practices (BMP's) to select:

Use fencing to limit horse access to ditches. The best way to avoid impacts to ditches is to fence horses out of the right-of-way. This is important where ditches bisect a pasture. Both lower cost electric fences and more permanent types fencing can be effective when installed correctly.

Install and maintain a vegetated buffer between a fenced area and ditches.

Utilize hardened water gaps if horses will be watered by the ditch. A "hardened water gap" will allow limited access.

Construct and maintain a ditch crossing for horses. If for some reason fencing is not practical, it is very important to build a crossing for horses. Most horses will use such a crossing and establish a path to that crossing. Any bridge or culvert crossing that is installed however can collect weeds and trash which are the responsibility of the landowners who placed the crossing to clean out. If horses do not have a water source at their corrals or elsewhere in a pasture and depend on water in the ditch to

drink, they are likely to impact it when they step into the ditch to drink. Usually some combination of fencing and crossing points will solve the problem.

Install a pipe where ditch runs through the pasture. Some people with intensive use near a ditch choose to install an adequately sized pipe so that the ditch runs underground and is therefore free from most impacts. Be sure to coordinate with the ditch company and/or water owner.

Coordinate with ditch company on access & maintenance. Irrigation companies or members of lateral ditch associations clean ditches annually and need to access their rights of way to do so. Gates are needed where a ditch enters and leaves a given property and depending on the size of the ditch the right of way can be from 15 to 25 feet from the center line of the ditch. It is common for the irrigators to periodically enter with trucks, a tractor or maintainer when cleaning, burning or spraying the ditch. Meeting with ditch owners to listen to their needs and find out about their maintenance schedules will go a long way to creating harmony. The other old adage in the West is that "whiskey is for drinking and water is for fightin" need not apply where there is good management and communication.

DUST

Dust at equestrian facilities should always be considered an intruder! Dust from unpaved roads, driveways, parking areas, indoor and outdoor arena areas, sacrifice areas, trails, etc. may be a nuisance and can even create potential safety hazards for horses and riders. Dust can affect the health of riders and horses, increases wear-and-tear on vehicles, trailers, buildings and equipment and can annoy neighbors.

Dust management is important in equestrian operations for reasons such as:

- **Disease:** Disease is just one factor that can be attributed to dust and molds present in dust. For instance, the disease in horses called "Heaves" is a common name for Recurrent Airway Obstruction (RAO) and Chronic Obstructive Pulmonary Disease (COPD) that affects the lower part of the lungs and is a hypersensitivity (allergy type reaction) to dust and molds.
- **It's the Law:** Colorado air quality regulations require dust control in areas of livestock confinement.
- **Maintenance and cleanliness:** Operating a clean facility is one sign of professionalism and reflects positively or negatively upon the facility. Dirty dusty areas, poorly maintained arenas, and dusty driveways, trails and service roads are a "mirror" into other areas of the facility's operations.

Acceptable conditions are those that:

- minimize the amount of non-vegetated disturbed areas
- eliminate any visible off-property transport of dust.

Best Management Practices (BMP's) to select:

Dust suppressants come in many forms, but the decision on which you use should always take into consideration the health and safety of the horses or your property as well as other animals and humans.

Limit the expansion of confinement areas and the amount of bare ground on the property. This can be accomplished by designing reasonable size enclosures as 'sacrifice areas', and through the management of pastures to retain good grass cover.

Apply Water as needed for dust suppression. This technique works best in areas such as arenas where the period of most use is limited.

Provide windbreaks or other structural wind protection for dust suppression: Placement of buildings, vegetation (including windbreaks and shelter belts) and fences can restrict fugitive dust generation and provide localized effective and efficient restraints specific to Colorado's dry climate.

Apply chemical applications for dust suppression. While effective, facility owners should take all necessary precautions to keep dust abatement material out of water drainages, ditches streams or wetlands. Dust suppressant ingredients may cause damage to vehicles, trailers, horse or rider. Application of all dust suppressants must comply with federal, state, and local laws and regulations. Available options include:

- Synthetic Organic Polymer Dust Control Fluids specifically designed for the equestrian industry.
- Polyvinyl acetate and polymer emulsions that produce highly effective dust & erosion control and soil stabilization
- Chlorides in the form of "water absorbing products" (deliquescent/ hydroscopic) such as Calcium Chloride brine and flakes, Magnesium Chloride brine, Sodium Chloride (salt)
- Organic nonpetroleum based products, such as animal fats, lignosulfonate (molasses/sugar beet by products), tall oil emulsions and vegetable oils
- Electrochemical products, and enzymes (sulfonated oils)

PASTURE VEGETATION

Grazing management is based on adjusting our harvesting of the grass to the conditions we face in the environment. Our horses are the tools we use to harvest the grass. To assure that the grass stand will continue to thrive we need to observe some rules of thumb so we can have long-term utilization of our forage resources.

Why pasture management is important - Carrying capacity of pastures.
The first step in selecting pasture management practices is to determine the carrying capacity or number of animals that can be maintained on the pasture. Many factors influence the carrying capacity including the following:

- Access to water for irrigation will greatly increase the number of animals that can be pastured over dry-land or pastures that rely on precipitation for growth. Pastures should be allowed to dry for a few days following irrigation before turning out livestock, to prevent soil compaction and plant damage which will reduce the carrying capacity.
- Improved pastures (planted with species to yield more grass and be more tolerant of grazing) may increase the carrying capacity over pastures populated with native plants and grass. Check with the Extension Office, Natural Resources Conservation Service (NRCS) office, or local grass dealer before you plant your pastures.
- Consider the current condition of the pasture. Pasture condition is generally ranked from excellent to poor and is dependent on the species of plants present and number of those plants in a defined area. The more weeds present, the lower quality ranking of the pasture. Consult your Extension Service or NRCS representative for help with pasture rating if you do not have experience with the techniques.
- Grazing practices affect the carrying capacity of a pasture. Rotational grazing or allowing a pasture rest period can increase the carrying capacity of the pasture depending on the level of management. The simplest system is to divide the pasture into two halves and rest one side while the other is grazed. As you feel comfortable, divide each half in half again until the desired number of divisions is reached.
- Grasses fall into one of two groups: cool-season grasses which grow most rapidly in the early spring, and the autumn and warm-season grasses which grow most rapidly in early summer (June and July). Each requires different management. Cool-season grasses tend to be higher in nutrient value, but warm-seasons are growing well when cool-season grass slow in growth. Planting pastures with a combination of both types can provide for more grazing throughout the season.
- During the early growing period of grass growth there can be excess forage that the horses cannot graze fast enough to keep grazed down. During these periods excess forage can be cut for hay to be fed or sold at a later date. If you do not have access to haying equipment, this forage can also be left in the field and set aside for grazing during dry or slow growth periods. Please keep in mind that grass that is set aside (left standing in the pasture or not cut for hay) for later grazing will be mature and be of a lower nutritive value for the horse.

In Larimer County, irrigated pasture will require 2 to 15 acres to carry one horse. For non-irrigated or dry-land pasture, one horse can require 10 to 40 acres. From a practical standpoint, this means that most horses need to be feed hay and other concentrated feed as a primary feed source, with limited pasture time in order to maintain grass cover. Many variables go into these numbers and your circumstances need to be considered, but the key to the number of animals you can carry is primarily based on the availability of

water. Monitoring of the grazing system is important. If weeds are coming in, the pasture may be overstocked. Good Luck and may your horse always be belly high in grass.

Best Management Practices (BMP's) to select:

Allow adequate grass growth before grazing. Animals should not be allowed to graze pasture grass until it reaches a height of 6 to 8 inches (depending on species).

Remove horses before grass is depleted. Animals should be removed when the grass is at a level of 3 to 4 inches, which is best represented by the height of a clinched fist.

Mow pastures to stimulate even utilization of grass as needed. Horses are spot grazers and will repeatedly graze the same grass plants, which will eventually reduce the plant's strength and cause the grass to die during the winter. A less desirable plant reducing the quality of the pasture will replace that plant. Pastures that are mowed or clipped to an even height will cause the animals to graze more evenly.

Harrow or remove manure piles in pastures. Manure piles should be harrowed to break them up or the manure should be picked up and removed. Horses tend not to graze near manure piles, so grazing becomes uneven. In addition this will help also in the control of internal parasites.

Provide adequate confinement and feeding areas. Confinement areas should be maintained to hold animals when the grass is unable to be grazed. Generally these areas should be well drained and should be a **minimum** of 144 square feet per animal.

Protect pasture grasses before fall freeze. Horses should be removed from pastures a minimum of 2 to 3 weeks before the first freeze. This gives time for the roots to adapt for the winter season. Once the grass has been frozen, the material left can be grazed off, but it is best to leave some plant material on the surface to insulate the grass crown and roots.

Limit grazing during the hottest/driest months. August is generally the lowest yielding period for both cool- and warm-season grasses and generally both are low quality or nutritive value. Limiting grazing by using holding areas and feeding alternatives in August can help protect the pasture.

Provide supplemental feed to protect pasture grass. Grazing periods in Larimer County generally last from late May to early October. So feeding with hay will be required for the rest of the year or when there is insufficient water and the grass is unable to be utilized.

Fertilize pastures to increase grass yield. With irrigation water, fertilization can increase the number of animals grazing by increasing the yield of pastures. Chemicals and fertilizers used on pastures should be applied only in accordance with label directions. Care must be taken to prevent nitrate poisoning after fertilizing.

Use rotational grazing. Rotational grazing of a pasture will increase the number of animals that a given area of grass can handle. A good rule of thumb is when a pasture is grazed down to the 4 inches in height a 21 to 28 day rest period should be provided to allow the pasture to grow back to 6 to 8 inches in height. In the early spring this time can be significantly shorter. Rest periods will vary based on precipitation, temperature, species and time of year. Excess forage that may accumulate during the rapid period of growth maybe put up as hay to be used during periods when grass growth is slow or during dry periods.

Manage pastures with wildlife in mind including the following considerations:

Provide wildlife corridors between pastures.

Provide grassy buffers, tree rows or brushy vegetation for nesting birds and upland game along the perimeter of pastures, along bridle trails etc.

Fence pastures so that horses do not have unrestricted access to streams, creeks, ponds, or wetlands that provide wildlife habitat.

NOXIOUS WEEDS AND POISONOUS PLANTS

The experienced horse owner recognizes there are plants growing in Colorado that degrade pastures, do not provide nutritional value to their horses or can even be poisonous to their horses. However, less experienced horse owners or those new to the area may not understand and recognize which plants in their pastures are noxious weeds or poisonous plants which degrade their pastures, can cause illness or even death to their horses and can infest neighboring properties.

The objective of this section of the Resource Stewardship Plan is to help you identify what plants may exist in your pasture that are noxious and/or poisonous to your horses, what the best management practices are to help you reach your goal of a healthy pasture, and to provide you with a valuable list of resources to maintain a healthy pasture for your animals.

Noxious Weeds:
Noxious weeds are non-native plants that disrupt our native vegetation and ecosystems. They out compete our native plants, threaten our drinking water supply, agricultural crops, pasture lands, native habitats, and wildlife. According to the Colorado Noxious Weed Act, it is the duty of all persons to use integrated methods to manage noxious weeds if they are likely to be materially damaging to the land of neighboring landowners. To see a list and pictures of Colorado's noxious weeds visit the Colorado Department of Agriculture's website http://www.colorado.gov/ag/weeds.

Larimer County has identified 19 noxious weeds to be problematic in the county and requires suppression, containment or eradication, depending on distribution and density. A complete list of noxious weeds found in Larimer County can be obtained from the Larimer County Weed District office at 2649 E. Mulberry, #6, Fort Collins, CO 80524, (970) 498-5768 or on their website at www.larimer.org/weeds.

Measurement:
The best measurement practice is to monitor your pastures in order to recognize when new plants arrive or when plant populations increase or decrease. The best method to measure the diversity of plant life on your property and whether you are meeting your goals of reducing noxious and undesirable weed populations is by taking pictures of the area of concern at the same time each year and then comparing to previous years. Your goal should be to see a diversity of desirable of plants in an area with minimal weeds.

Best Management Practices (BMP's) for all facilities: Many methods exist to prevent and control noxious weeds. Comprehensive weed management is a fluid plan that should be created, evaluated and modified over time based on site observations. The following are best management practice recommendations to assist you in providing a healthy pasture for your horses.

- **Set management objectives** for your property. Be willing to evaluate and modify your plan and objectives over an extended period of time to be successful.
- **Monitor pastures for weed growth**. Develop an accurate map of weed infestations to include locations and weed species.
- **Identify plants on property**. Correctly identifying a weed is the first step in forming a weed management plan. There are links to excellent resources available at the end of this guide to help you with plant identification.

- **Treat weed growth early.** Early detection is the best defense to successfully manage weeds. Treat intensely when a new or small weed patch is found. If you are dealing with a large, existing weed population, treat the perimeter of the infestation first.
- **Manage weeds according to type.** Understanding the biology of a weed will help you determine the best management practice to use to control it. Is the plant an annual, perennial or biannual? Does it reproduce by seeds, the root system or both? For example, Canada thistle is an aggressive perennial weed found in great numbers throughout Larimer County that reproduces by seed and its extensive, creeping root system. Pulling this weed will not immediately kill it because the buds on the root system will generate new shoots to replace the plant pulled.
- **Manage weeds during the proper growth stage.** Know which growth stage the plant is in to implement control measures in order to maximize your control method. For example, it is crucial to control annual weeds before they go to seed.
- **Provide on-going weed management.** Weed management is a long-term process and commitment on your part. Don't give up! Persistence is the key to control unwanted weeds. A multifaceted approach is necessary.

Best Management Practices (BMP's) to select:

Keep records for weed management. Create an accurate map of weed infestations. Note location, weed species and type of infestation. For example, scattered, light, moderate, or large, dense infestations. Keep track of your progress in reducing or eliminating weeds.

Integrate two or more weed control methods to prevent, slow or reduce plant growth, as well as prevent and slow seed production (select those methods below):

Chemical control uses herbicides to control weeds.

Cultural controls use desirable and competitive vegetation to prevent or slow the invasion of non-native plants.

Biological control is the use of insects, bacteria, fungi, or grazing animals such as sheep, goats, cattle and horses to help control the spread of a targeted noxious weed.

Mechanical control consists of methods that kill or suppress weeds through physical disruption such as mowing, digging, plowing, and hand pulling.

Use weed free hay. Purchasing weed free hay reduces the risk of bringing in unwanted weeds. Equally important is to clean equipment and machinery after working in a weed infested area to prevent its spread.

Reseed disturbed areas promptly. Weeds will be the first plants to invade a heavily disturbed area. Reseeding with desirable grasses that compete with undesirable weeds will help reduce weed establishment in your pasture.

Poisonous Plants:

Many plants in Colorado are poisonous to horses. As a responsible landowner, knowing which plants may harm your horses will save you time, money and problems in the future. The main reasons horses are harmed by poisonous plants is that these plants are common in the state, horse owners often do not recognize which plants are poisonous, and poor pasture management practices. Horses usually must eat large quantities of a plant before they are affected. With rare exceptions, a single mouthful or two of a plant is not likely to cause the horse harm. The one exception to this is water hemlock, where a few ounces of the roots can be lethal to a horse. The following book and websites are excellent sources to learn more about poisonous plants to horses. *A Guide to Plant Poisoning of Animals in North America,* Anthony P.

Knight, BVSc, MS, and Richard G. Walter, MA. Teton New Media, Jackson, Wyoming. http://www.vth.colostate.edu/poisonous%5Fplants/ , http://southcampus.colostate.edu/poisonous_plants/
Being proactive is the best defense you can take to ensure poisonous plants do not get established in your pastures. By not overgrazing your pastures, you will help reduce the stress on your desirable grasses allowing them to out compete undesirable plants.

A reference to a list of the most common poisonous plants found in Colorado and their affects on horses can be found in the appendix.

Measurement:
The best method to measure the diversity of plant life and whether you are meeting your goals of reducing poisonous plant populations from your land is to take pictures of an area at the same time each year and compare to previous years. Your goal should be to see a diversity of desirable grasses in your pastures.

Recommendations for all facilities: The following is a comprehensive list of poisonous plant management recommendations to assist you in providing a healthy pasture for your horses.

- **Inspect** pastures before turning horses out for the first time in the season. Do you notice new plant populations that are unfamiliar to you? If so, identify them to determine whether or not they may harm your horses.
- **Identify species and location of poisonous plants**. Correctly identifying poisonous plants is the first step in protecting your horses. There are a number of excellent resources available at the end of this section to help you identify poisonous plants.
- **Monitor and keep records.** Include procedures used, dates applied, weather conditions, and growth stages. Take digital images at regular intervals to monitor pasture health. Create an accurate map of poisonous plant infestations. Note location, weed species and type of infestation. For example, scattered, light, moderate, or large, dense infestations.
- **Provide supplemental feed.** Drought conditions may cause horses to eat anything they can find when they are hungry. In drought conditions, supplemental feeding your horses may be necessary to provide your horse with the required nutrients, thus sparing your pastures from overgrazing.

Best Management Practices (BMP's) to select:

Provide good quality forage when pastures are stressed to decrease the possibility horses will browse plants not normally eaten.

Maintain a healthy pasture. Overgrazing or poor pasture management increases the probability that undesirable plants will invade a pasture.

Reseed disturbed areas. Disturbed areas are the first to attract unwanted plants. When an area is disturbed, be sure to reseed with desirable grasses to help compete against less desirable weeds. Protect this area from grazing until the plants are well established.

Avoid fertilization of native rangelands and non-irrigated pastures. Fertilization of native rangeland and pastures causes changes in the native plant types and aids weed growth.

Fertilize improved pastures that have competitive plants which are adapted to high fertility to improve vigor.

FENCES

Fences. Fences are valuable resources for almost all rural landowners.
They are significant investments and can cost $1500 - $2000 / quarter mile for woven wire or barbed wire fences http://www.extension.iastate.edu/agdm/livestock/html/b1-75.html. An old adage reminds us that "Good fences make good neighbors".

Why are Fences Important to Consider in a Stewardship Plan? When pastures are heavily grazed or have a less palatable species composition, livestock will press against a fence attempting to reach forage on the other side. When the fence is a "line fence" or one shared by two or more landowners and customarily maintained by both/all landowners, this often creates conflict. Horses may also try and reach horses on the other side of a fence for breeding. Both stud horses and mares may attempt to join up. If horses on one side of a fence reach through the fence for forage that is on the other side or push on a fence to see if they can cross over, damage can occur. Damage to the fence includes spreading, bending, raising or breaking of wires, stays or other fencing material. In a short period of time, the pressure this puts on fence posts can cause them to lean away from the side having pressure from horses and onto the other landowner's property. Clips and staples work loose and then come out of posts etc. Fences are expensive and time consuming to repair. Fencing that is in poor condition can also lead to serious injury of your horses. Fences are an integral part of proper grazing use. Electric or other portable power fencing can facilitate a rotational grazing scheme that can provide rest/recovery periods for vegetation. Fencing and stock water development go hand in hand. Portable fencing also allows for multiple pasture configurations.

Measurements. Indicators for measuring this type of impact can be **visual evidence of damage.** Photos may be used to document damage, original fence conditions and compare fence condition over time. Fences should be vertical, tight, and in good repair. This is an easy resource to measure. There should be no need for an adjacent landowner to have to brace their fence against pressure from your side.

Best Management Practices (BMP's) to select:

Manage pastures to keep horses from seeking forage across the fence. Managing pastures so that stock will not want to reach through to feed is key. Fertilization and irrigation of exercise areas or pastures as well as rotational grazing will greatly reduce fence pressure and reduce other related impacts like weeds and blowing dust.

Separate stallions and mares when needed. Managing stallions and mares in heat is required where there are neighboring horses. Building a sturdy fence to begin with will make damage less likely.

Install woven wire or electric fence. If horses do reach through, the installation of woven wire or an electric fence wire or wires at the level where stock reaches over or through are all ways to address this problem.

Build adequate fences and maintain fences regularly. Most fences need some annual maintenance. Talking to neighbors to express your intentions and set a time for a workday when both can participate is good practice. Broken wires, clips, rotten posts or bent stays should be repaired annually at a minimum.

Create a non-vegetated strip along fence line. In difficult cases, a 30 inch strip of forage under the fence may be mowed or removed altogether by spraying with Glycophosphate (Roundup). This practice must be repeated in order to control the invasion of weeds in the vegetation free strip.

Build wildlife friendly fences. Refer to CDOW manual *Fencing with Wildlife in Mind.*
http://www.wildlife.state.co.us/NR/rdonlyres/20D5C775-55DD-4C6D-A5CF-C9B83FCEA69E/0/DOWFencingWithWildlifeInMind.pdf

PESTS: FLIES, MOSQUITOES, PARASITES AND RODENTS

For the most current information regarding disease transmission contact authorities including: Colorado Division of Wildlife, Colorado Department of Public Health and Environment, your veterinarian and Larimer County Health Department.

Flies:

Flies can cause serious problems in horses. Irritation and discomfort are only two of the minor problems. The transmission of diseases can occur. Equine boarding facilities should take measures to eliminate the breeding grounds of flies and mosquitoes. Individual horse owners can then support this by personally being responsible for additional prevention and protection of their individual horse(s).
Remember when there is more rain, especially in warm weather; we have more flies and mosquitoes.

The follow is a list of some of the most prevalent diseases flies may transmit:

- Pigeon Fever: results in abscesses which form mainly in the chest or lower abdomen and are very contagious. This disease has been prevalent in Colorado and is spread by flies.
- Equine infections anemia: identified by Coggins test. There is no cure for this disease and the horse must be destroyed.
- Parasites
- Potomac Horse Fever is transmitted by insect bites.

The following is a reference list of the most prevalent flies we have in our area:

- Wohlfarthia fly larvae penetrate skin and form abscess like bumps
- Stable flies: suck blood. These can carry the internal parasite larvae of Habronema.
- House flies: do not suck blood but can transmit severe diseases, including Habronema. They lay eggs in manure and straw.
- Face flies: irritate eyes. Similar to the house fly.
- Horse fly: large and black. Their bite is painful and can draw blood.
- Deer fly: a smaller fly with stripped wings. Bites hurt and can cause welts. These flies burrow into the mud to reproduce.
- Blow flies: deposit eggs into wounds, which develop into maggots. Keep wounds clean and use fly repellents.

Best Management Practices (BMP's)

While it is recognized that to be completely "fly free" is not possible, prudent measures should always be taken so a facility is not overwhelmed with these pests. What you choose to do will depend on your finances and preferences regarding the use of pesticides or a more natural approach. There are many choices of fly prevention and control. Treatment and management of the property will require a continued and ongoing routine of prevention and control.

Best Management Practices (BMP's) to select: Some of the most popular and successful methods include but are not limited to the following. When two or more methods are used in combination the results are greatly improved.

Install fly traps/catchers in barns and shelters

Follow best management practices for manure management. Manure is a primary attractant and breeding ground for insects.

Locate manure piles downwind from the barn. Consider the distance from water sources, ditches and neighbors.

Enlist horse owners participation control of bot flies, insects and parasites. Individual horse owners should be encouraged to clean bot fly eggs off their own horse, use fly masks, sprays and spot-on fly control to support the efforts of the barn owner. There are even light weight, summer sheets that are permethrin treated, which will repel flies from landing on horses

Provide adequate ventilation (such as fans) in barns. Providing good ventilation and moving air in barns will lower the number of flies and mosquitoes.

Harrow the ground to break up clods of manure. This will expose the eggs and larvae to the sun and drying.

Rotate pastures and paddocks (if possible) to break up the cycle of infestation.

Implement Weed control. Flies will rest in the cool shade of the weeds.

Utilize fly parasites

Install a whole barn spraying system

Use safe sprays when needed. Permethrin sprays, to get to the hard to reach places in barns and these sprays can be used on horses.

Provide horses with internal feeding treatments

- Some are natural, such as garlic
- Individual horse owners may prefer to use a "feed through" fly control

Mosquitoes

Mosquitoes may carry West Nile disease. Humans as well as horses, dogs, cats, birds and other animals may become infected with West Nile. We do have ponds in Larimer County that have tested positive for mosquitoes that carry West Nile disease. While there is a vaccination for this disease in horses, preventing the possible breeding of mosquitoes is highly recommended. If you have a wetland or pond, on or near your property, you may want to research having the area sprayed.

The follow is a list of some of the most prevalent diseases mosquitoes may transmit:

- West Nile disease
- Encephalomyelitis/Sleeping sickness
- Eastern Equine Encephalomyelitis has a 90% death rate in horses
- Western Equine Encephalomyelitis has a 50% death rate in horses

Best Management Practices (BMP's) to select:

Eliminate areas of stagnant water. Old tires, empty cans or water tanks catch and hold rain water. These should be emptied as often as necessary.

Install bat boxes. Bat boxes are also a possible choice. There are pros and cons regarding bats and their possible transmission of rabies.

Use repellant. Using a product that contains DEET is one of the most effective ways to prevent Mosquitoes bites.

Parasites

One horse, left untreated, can create a major problem to other horses on the property. Not to mention the danger parasites have on a horse's health. Horses kept in confined areas with several other horses are being constantly re-infested. While it is up to the individual horse owner to de-worm their own horses, it is a wise barn owner who is aware of the treatment each horse receives. If you are moving in from another

state you will need to familiarize yourself with species in our area. A veterinarian is always the best source of information and yours should be consulted to develop a parasite control plan that best fits your facility.

The following is a quick reference list of parasites prevalent in our area.

- Ascarid (large round worms) bots and strongyles (bloodworms) are the three most serious internal parasites.
- Round worms or nematodes: non-segmented, cylinder-shaped worms are one of the most serious.
- Bot flies are the size of a honeybee with a curved tail. They deposit a yellowish, small egg on the horse's hair. These eggs are activated by the horses licking of them.
- Strongyles: There are three species.
    - Single-tooth strongyles which burrow through the intestine wall and get into arteries. It prefers the blood in the intestinal tract. Can cause severe colic and death.
    - Toothless strongyle will leave the intestines and go to the liver and kidneys and back to the large intestines. These carry bacteria and can cause serious infections.
    - Large strongyles also leave the intestines and go to the liver and pancreas. These can cause infections of the internal tissues.
- Pinworm: The female leaves the intestines to lay her eggs on the anus. Tail scratching can be a sign of these.
- Habronema are stomach worms. One type of habronema species causes benign tumors in the stomach wall.
- Other parasites are lungworms, tapeworms, live flukes and small roundworms. While not as common as the above, prevention is always prudent.

Best Management Practices (BMP's)

The treatment, management and prevention of parasites are similar to fly control. This requires continual prevention and treatment to avoid a serious infestation in your facility. An educational talk by your vet may provide excellent information for your boarders.

BMP's to select: For the greatest protection possible it is recommended to use all of the following.

Encourage or require regular (as recommended by your veterinarian) de-worming medications on all horses.

Rotate the types of medication used to treat the widest variety of parasites.

Harrow paddocks frequently to break up manure.

Quarantine any severely infested horse until the problem has been treated.

Quarantine new, incoming horses for a minimum of 10 days and watch for signs of disease and infections.

Mice

Mice transmit diseases and can ruin grain. They may carry Hantavirus in their feces, which when inhaled could create severe flulike symptoms and death in some humans. Mice are also one of the sources for tapeworms. Operators should wear a face mask when cleaning heavily infested areas, and wash hands and clothing when finished.

BMP's to select:

Remove dead mice to a trash receptacle that will be emptied quickly.

Keep grain in closed containers. Feed rooms incorporate rodent resistant wire, or traps or similar items to prevent/ exclude rodents.
Use traps, bait and predators to control mice**.**
Clean up spilled grain daily
Keep bags of grain off the ground.
Store and dispose of trash and garbage in a way that discourages rodent and insect infestation**.**

Additional Resources:

Prairie Dogs and other **rodents**
These small animals can destroy pastures. Check with the Colorado Division of Wildlife for control information: www.Wildlife@state.co.us

Reference sources:
Colorado State University Extension
www.larimer.org/ext
4-H Horse Project Manual MA1500E
LuAnn Goodyear, Last Resort Equestrian Center

WILDLIFE

The purpose of this section is to help equestrian facility owners, operators and managers understand and correctly interact with wildlife that coexists on and adjacent to the equestrian facility. Most wildlife interactions at equestrian facility will hopefully be considered as a positive benefit to the equestrian property owners, operators, managers and guests; however, at times wildlife may pose a nuisance or other unwanted consequences and thereby require professional intervention.

Why wildlife and wildlife interactions are important considerations:

There are many reasons why wildlife interactions are important in equestrian operations:

- **Beneficial interactions/overall enjoyment:** For most people seeing wildlife in an outdoor setting is an enjoyable experience that enhances one's quality of life. Operating a clean well maintained equestrian facility that attracts wildlife may enhance the owners, managers, boarders, visitor and guests' quality of life and may be one sign of broad professionalism. Providing minor enhancements that complement wildlife may therefore directly reflect and emulate professionalism into other areas of for facility's care and maintenance operations.

- **Nuisance wildlife:** Sometimes the exact same wildlife may be enjoyed by many or may be considered a nuisance by others. For instance prairie dogs may be considered by some as a beneficial keystone species and by others as a destructive rodent pest.

- **Dangerous wildlife:** Some wildlife may present dangerous conditions for both horses and humans and may require professional intervention by the Colorado Division of Wildlife or by the Colorado Department of Agriculture.

- **Disease:** Sometimes wildlife and horses may interact and negatively affect the health of horses and/ or wildlife. Therefore, you, the equestrian facility owner, operator and manager should always CONSULT YOUR VETERINARIAN (DVM) for general and specific advice regarding horse health and disease.

Best Management Practices. Many of the practices outlined in the previous resource sections are also applicable to wildlife. The chart on the following pages shows which practices are also relevant to address wildlife issues. Consult with the Colorado Division of Wildlife for more information: http://wildlife.state.co.us/

Step 3 – Complete Your Plan.

The completed Resource Stewardship Plan will be used in the process of evaluating and approving a permit to operate under the County's Land Use Code. By increasing the quality of information submitted as part of the review process, the resource stewardship plans prepared with this guide will help applicants to:

- communicate their intent regarding management,
- allow the Planning Commission and County Commissioners to make informed land use decisions for each application based on clear management plans,
- facilitate neighbors' understanding of how a facility will be operated,
- limit neighbor complaints or compatibility concerns, and
- maintain the value and quality of the equestrian business and adjacent properties.

Use the separate Resource Stewardship Plan for Equestrian Operations: Best Management Practice checklist to identify the selected best management practices for your operation.

The completed checklist is the Resource Management Plan for your facility.

Regulations & Technical Requirements.

The requirement for the preparation of a resource stewardship plan is contained in the Larimer County Land Use Code. The information available in this guide, along with your knowledge of livestock management, will assist in the completion of a plan that meets the County's Code requirement for addressing the potential impacts that could affect neighbors or the environment.

Other county, state or federal regulations may also apply to your operation, and this guide has not been designed to address them. Examples include the Clean Water Act on the federal level, and state regulations concerning animal feeding operations. Information about those regulations can be found in the reference section of this guide.

ADDENDUM

Appendix x: Larimer County Horse Facilities Working Group Members
(The Horse Facility Working Group was appointed by the County Commissioners in 2009 and charged with developing recommendations related to equestrian operations)

Name	Affiliation
Amy Allen	Large stable owner
Suzanne Bassinger	Equine Professional
Wendy Chase	Equine Professional
Jill Cook, DVM	4-H Representative
Sonja Craighead	Large stable owner
Kathy Doesken	Equine Professional
Barry Feldman	Small stable owner
Dennis Goeltl	Small stable owner
LuAnn Goodyear	Small stable owner
Mary Hattendorf	Boarder
Renae Hupp	Realtor Representative
Joe Andrews/Keith Jacobson	Larimer County Horseman's Association Representative
Kathleen Kilkelly	Neighbor
Polly Lauridsen	Neighbor
Lisa Oppenheimer	Equine Professional
Chuck Peterson	CSU/Ranch Sorting National Championships Representative
William Scebbi	Colorado Horse Council Representative
Trisha Swift	Equine Professional
Andrea Throckmorton	Large stable owner

Appendix y: Resource Stewardship Guide Development Committee

Name	Affiliation
Karen Crumbaker	CSU/Larimer County Extension
Kathy Doesken	Equine Professional
LuAnn & Jim Goodyear	Small stable owners
Brett Kirch, PHD, DVM	CSU/ Youth Extension Specialist- (Equine & Livestock)
Russell Legg	Larimer County Planning Department
Karin Madson	Larimer County Planning Department
Doug Ryan	Larimer County Department of Health & Environment
George Wallace	Agricultural Advisory Board member

Appendix z: Resources for more information:

1. Manure

Davis and Swinker, 2010. http://equineextension.colostate.edu/content/view/170/57/

Tao and Mancl, 2008. http://ohioline.osu.edu/aex-fact/pdf/0715.pdf

Regulation 81: What does it mean for Colorado AFOs?
http://www.cdphe.state.co.us/oeis/eap/eapdocs/afofactsheet.pdf

Regulation 81 in its entirety, includes definition of agronomic rate:
http://www.cdphe.state.co.us/regulations/wqccregs/100281confinedanimalfeedingregs.pdf

Elliott, Doesken, and Davis. Manure Management for 4-H Livestock Projects. 2007
(?)http://www.extsoilcrop.colostate.edu/Soils/documents/manure_webviewing.pdf

1. Water Runoff and Drainage

Soils Information:
http://websoilsurvey.nrcs.usda.gov/app/
USDA- Natural Resources Conservation Service
Fort Collins Field Office
2150 Centre Ave Bldg A-116
Fort Collins CO 80526
970-295-5655

2. Irrigation Ditches

http://larimer.org/engineering/ditchco/DitchCompanyDirectory.htm

3. Dust

http://www.epa.gov/pm/

http://www.epa.gov/air/caa/

http://www.epa.gov/ttn/naaqs/

http://www.epa.gov/pm/pdfs/pm-color.pdf

http://www.cdphe.state.co.us/ap/down/SIPfortcolCO.pdf

http://equineextension.colostate.edu/content/view/161/57/

MSDS on Chloride Products:
http://www.peterschemical.com/magnesium-chloride/msds-sheet-magnesium-chloride-pellets-flake/

http://www.sciencelab.com/msds.php?msdsId=9927214

4. Pasture Vegetation

USDA- Natural Resources Conservation Service
Fort Collins Field Office
2150 Centre Ave Bldg A-116
Fort Collins CO 80526
970-295-5655

5. Weeds and Poisonous Plants

Larimer County Weed District
2649 E. Mulberry, #6, Fort Collins, CO 80524
(970) 498-5768
www.larimer.org/weeds

Colorado Department of Agriculture
Noxious Weed Management Program
www.colorado.gov/ag/weeds

Colorado Department of Agriculture
Biological Pest Control Program
750 37.8 Road
Palisade, CO 81526
970-464-7916
http://www.colorado.gov/cs/Satellite/Agriculture-Main/CDAG/1167928159775

USDA Natural Resources Conservation Service Plants Database
www.plants.usda.gov/

Colorado State University
Larimer County Extension
1525 Blue Spruce Drive
Fort Collins, CO 80524
970-498-6000
www.larimer.org/ext

USDA Agriculture Research Service
Poisonous Plant Research
www.ars.usda.gov/Services/docs.htm?docid=9861

Best Management Practices for the Noxious Weeds of Mesa County, Jude Sirota, Mesa County Horticulture Pest and Weed Inspector, Tri River Area, CSU Extension, Grand Junction, CO.

A Guide to Plant Poisoning of Animals in North America, Anthony P. Knight, BVSc, MS, and Richard G. Walter, MA. Teton New Media, Jackson, Wyoming.
Website: http://www.vth.colostate.edu/poisonous%5Fplants/
http://southcampus.colostate.edu/poisonous_plants/

6. Fences

http://www.extension.iastate.edu/agdm/livestock/html/b1-75.html

7. Flies, Parasites, Mosquitoes and Other Pests

Colorado State University Extension
www.larimer.org/ext
4-H Horse Project Manual MA1500E
LuAnn Goodyear, Last Resort Equestrian Center

8. Wildlife

http://wildlife.state.co.us/

http://www.wildlife.state.co.us/NR/rdonlyres/20D5C775-55DD-4C6D-A5CF-C9B83FCEA69E/0/DOWFencingWithWildlifeInMind.pdf

9. Other

CSU Extension Small Acreage Management website
http://www.ext.colostate.edu/sam/