



COLORADO

**Division of Environmental
Health & Sustainability**

Department of Public Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

Colorado Nutrient Management Technical Standards

Concentrated animal feeding operations (CAFOs) in the State of Colorado that are covered under the Colorado Discharge Permit System CAFO General Permit are required to develop, implement, and submit a nutrient management plan (NMP) for approval by the Colorado Department of Public Health and Environment's Environmental Agriculture Program (Ag Program).

The Colorado Nutrient Management Technical Standards (Standards) were developed in accordance with 40 C. F. R. § 412.4(c)(2) and 40 C.F.R. § 123.36 and are intended to comply with the Environmental Protection Agency (EPA) 2008 Final Rule for CAFOs.

The Standards provide a framework for the protocol(s) and method(s) that CAFOs must utilize when determining the form, source, amount, timing, placement, and method of manure and wastewater application on each land application site described in the NMP. All permitted CAFOs in the State of Colorado must follow their NMP when land applying manure and wastewater generated by their facility to land application sites owned by or under control of the facility. The Ag Program believes that the Standards represent the best available information for how a permitted CAFO must implement and satisfy the requirements of the NMP. A permitted CAFO must utilize the following 17 standards as a tool to achieve realistic production goals while ensuring appropriate agricultural utilization of the nutrients available in manure, litter, or wastewater while also minimizing the movement of phosphorus, nitrogen, and other water pollutants into the environment. Additionally, non-permitted CAFOs (Registered Facilities) are encouraged to become familiar with the Standards and utilize this document as a resource when developing a facility management plan (FMP).

Housed Commercial Swine Feeding Operations (HCSFOs) that are permitted in the State of Colorado also need to be familiar with these technical standards as many of these Standards have also been identified in individual swine waste management plans.

These Standards will be used by the Ag Program and partnering agencies as a guide for determining when precipitation-related discharges from CAFO land application fields are exempted as agricultural stormwater discharges. CAFOs qualify for this exemption if they can demonstrate compliance with their NMP at the time of a precipitation-related discharge from land application sites.

A CAFO may choose to use standards other than those established in this document, however, the operation must be able to demonstrate that such alternative standards provide both a reliable and a technically valid basis for achieving nutrient management objectives. Use of standards from sources other than CSU-Extension must be identified in the NMP and pre-approved by the Ag Program.



In conjunction with these Standards, the Ag Program developed an NMP template to assist CAFO owners/operators, technical service providers, and consultants in developing and implementing an approvable NMP. CAFOs are encouraged to utilize the NMP template when developing their site- specific NMP to ensure that all necessary items have been properly addressed. The NMP template is referenced in this document to provide additional information related to the technical standard requirements. The NMP template can be found under the forms tab at the Ag Program's web site: www.colorado.gov/cdphe/cafos.

For questions or comments on the Standards please contact the Ag Program at (303) 692-3523 or via email cdphe.cafo@state.co.us.

Determining Application Rates

Manure and wastewater application rates are based on: the risk of nutrient transport; crop needs (based on soil fertility status, nutrient credits and expected yield); nitrogen mineralization and volatilization; and manure, wastewater, and soil analysis.

Technical Standard 1- Field Specific Assessment Tool for Phosphorus (P) Transport

Both the Colorado CAFO General Permit and section 61.17 (8)(b)(xii)(B)(IV)(2) of the Colorado Department of Public Health and Environment Water Quality Control Commission Colorado Discharge Permit System Regulations, 5 CCR 1002-61 (Regulation No. 61) discuss a field-specific assessment of the potential for phosphorus transport to surface water. The Colorado Phosphorus Index (COPI) risk assessment tool was developed by the United States Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS), in cooperation with Colorado State University. The most current version of the COPI risk assessment tool can be accessed at: http://efotg.sc.egov.usda.gov/references/public/CO/COATN_95.pdf.

A COPI risk assessment must be completed for each field and Phosphorus soil test cycle to properly evaluate phosphorus runoff risk from each land application site. Phosphorus runoff to surface water is known to cause degradation of water quality even at low concentrations.

Technical Standard 2 - Quantitative and/or Qualitative Criteria for Determining Whether the Application Rate can be Nitrogen (N)-based, Phosphorus (P)-Based, or Prohibited

The majority of land application sites in Colorado will have application recommendations based on the nitrogen (N) requirements of the crop. However, this may vary depending on the field-specific result of the COPI risk assessment.

The COPI was developed to consider qualitative risk of off-site phosphorus (P) loss at land application sites. The purpose of the tool is to determine when it is appropriate to apply organic nutrients based on N requirements of the crop, P requirements of the crop, P removal in harvested crop biomass, or if the risk for off-site P loss is too great to apply organic nutrients to the land application site. Appendix E of the Ag Program's NMP Template contains applicable information related to the COPI. The tool identifies that land application sites with the following scores will apply nutrients in the manner identified below:

- Land application sites scored as **low** risk may apply organic nutrients based on crop N recommendations. Fields or land application sites that are screened out by the Preliminary Phosphorus Risk Screening Tool may also apply organic nutrients based crop N recommendations.

- Land application sites scored as **medium risk** will have the P application rate restricted to the P requirement for the planned crop and cannot utilize a multi-year phosphorus application.
- Land application sites scored as **high risk** will have the P application rate restricted to the crop P removal for the planned crop if a P draw-down strategy is implemented for the crop rotation (rotational P application rate is less than rotation crop P removal). A land application site scored as a high risk cannot utilize a multi-year phosphorus application.
- Land application sites scored as **very high risk** will have no P application allowed until the risk of P movement off-site is decreased. A land application site scored as a very high risk cannot utilize a multi-year phosphorus application.

A low score does not imply that phosphorus loss will not occur. Poor timing of manure and/or fertilizer application relative to a rainfall or runoff event could result in substantial loss of phosphorus. Although, a low risk ranking will allow a CAFO to manage manure applications to the fields on an N basis, the operation may wish to consider best management practices for addressing potential phosphorus loss.

Technical Standard 3 - Determining Expected Crop Yields

Colorado State University (CSU)-Extension Fact Sheet No. 0.514: Nitrogen and Irrigation Management, May 2011 and CSU-Extension Bulletin 568A Best Management Practices for Manure Utilization, September 1999, discuss how to determine expected crop yields by averaging five actual and successful crop year yields plus an additional five percent for above-average growing conditions. A CAFO should use good and sound judgment when adjusting yield goals for an unsuccessful crop year. An unsuccessful crop yield can be strongly influenced by drought conditions, hail and other weather events, crop disease, insect infestation resulting in crop damage, and other unforeseen or extreme events occurring during the growing season of the crop.

When a land application site's yield history is not available, another referenced source may be used to estimate yield goal. An example of an appropriate reference source is the USDA-National Agriculture Statistical Service (NASS) which provides specific crop yield data by county, region, or state. USDA-NASS data can be accessed at: <http://www.quickstats.nass.usda.gov>.

Further information for determining crop yields can be found in the Ag Program's NMP template Appendix C (Expected Crop Yield Information).

In addition to providing expected crop yields for each land application site, an operation needs to develop a planned crop rotation for the life of the permit. The planned crop rotation specifies which crops will be planted at land application sites covered under the permit. If a land application site will have other uses during the provided crop rotation, this also needs to be identified (i.e. fallow or pasture).

A planned crop rotation can be updated at anytime to take advantage of forecasted

conditions as long as the alternative crop has been properly identified in the NMP.

Technical Standard 4 - Crop-Specific Nitrogen Recommendations

The most current nutrient recommendations (nitrogen fertilizer suggestions) are provided by CSU-Extension for a wide variety of crops typically planted in Colorado and can be accessed at:

<http://www.extsoilcrop.colostate.edu/Soils/cnmp/nutRecs.html>.

More detailed information about individual crops can be accessed at:

<http://www.ext.colostate.edu/pubs/pubs.html>.

In addition to CSU-Extension fact sheets and guidance information, a facility may utilize crop fertility recommendations from adjacent states, the most current nutrient management planning guidelines for Colorado published by USDA-NRCS, or a method approved by the Ag Program. Use of crop fertility recommendations from sources other than CSU-Extension must be identified in the NMP and pre-approved by the Ag Program.

Please note, many of the formulas developed to provide crop recommendations for nutrient requirements from both CSU-Extension and other land grant universities take into account nitrogen credits from the nitrate levels and organic matter present in the soil. Results from the most recent soil analyses are necessary to determine crop nutrient recommendations utilizing the above described resources.

Technical Standard 5 - Nitrogen Credits

During any crop year where manure and/or wastewater from the facility is applied to a land application site, total nitrogen applications from both organic and inorganic fertilizers shall not exceed the nitrogen requirement of the crop(s), with adjustments made for any nitrogen in the field that will be plant-available. Adjustments for plant- available nitrogen in the field shall include credits for the profile soil test nitrogen but may also include credits for organic mineralization (N-Mineralization), past manure applications, previous crops including legume crops and sugar beets (tops), and/or irrigation water nitrate nitrogen (NO₃-N). CSU-Extension Bulletin 568A (pages 14-18) and the CSU-Extension specific crop fact sheets provide additional information when making adjustments for nitrogen credits. A facility may utilize other equivalent databases or publications if approved by the Ag Program.

Technical Standard 6 - Nitrogen Mineralization Rates

The total amount of nitrogen in manure is not immediately plant available after application. This is due to the slow release of nitrogen that is bound in organic forms. This process is commonly referred to as mineralization and will occur over several years after the application of manure. Organic nitrogen will become available to crops as soil microorganisms decompose and breakdown the organic compounds.

The mineralization process is greatly influenced during the first year after application by the manure source, soil temperature, soil moisture content, and manure handling practices. Approximately 15 to 55 percent of the organic nitrogen in manure will be crop available in the first year depending on manure source and type. CSU-Extension Bulletin 568A (pages 14-15 and Table 9) provides the following percentages of nitrogen mineralized for various manure sources over the first three years after application:

Manure Source	Manure Type	Percent of Organic N Available		
		1 st Year	2 nd Year	3 rd Year
Beef and Dairy Cattle	Solid	30-40%	10-15%	5-10%
	Liquid	25-35%	5-10%	2-7%
Swine	Solid	45-55%	3-8%	2-7%
	Liquid	35-45%	4-9%	2-7%
Sheep	Solid	20-30%	10-15%	5-10%
Horse	Solid	15-25%	5-10%	2-7%
Poultry	Solid	30-40%	10-15%	5-10%

Source: CSU-Extension Bulletin 568A *Best Management Practices for Manure Utilization*, September 1999 (Bulletin 568A) -Table 9.

Annual soil sampling for residual soil NO₃-N, and organic matter can be used to estimate nitrogen credit in subsequent years after the initial manure application. A permitted CAFO that does not identify mineralization percentages in their NMP must assume that 100% of the nitrogen is plant available upon land application.

Technical Standard 7 - Nitrogen Volatilization

Ammonia (NH₃) volatilization is the escape of nitrogen from manure and/or wastewater as ammonia gas. The rate of ammonia volatilization increases under warm, dry, or windy conditions. CSU-Extension Bulletin 568A describes that surface applied manure should be incorporated as soon as possible to minimize nitrogen nutrient loss by volatilization to the atmosphere. Accurate measurements of volatilization are difficult to obtain because of many variables associated with this process. CSU-Extension Bulletin 568A (pages 14-16 and Table 10) identifies the following calculations for a CAFO to consider when calculating ammonia volatilization rates:

- If solid manure is broadcast without cultivation occurring, the estimated NH₃

loss to the atmosphere is 15 to 30 percent after 96 hours (four days).

- If solid or liquid manure (wastewater) is immediately incorporated, the estimated NH₃ loss to the atmosphere is only one to five percent after 96 hours (four days).
- If liquid manure (wastewater) is injected into the soil, the estimated NH₃ loss to the atmosphere is only zero to two percent after 96 hours (four days).
- If liquid manure (wastewater) is applied through sprinkler irrigation, the estimated NH₃ loss to the atmosphere is between 25 and 65 percent after 96 hours (four days). Atmospheric loss through sprinkler irrigation application can vary widely depending upon weather conditions at the time of application.

A permitted CAFO that does not identify volatilization losses in their NMP must assume that 100% of the ammonia is plant available upon land application.

Technical Standard 8 - Phosphorus Removal Rates and Recommendations

While most manure and wastewater application in Colorado are based on a crop's nitrogen needs, land applications sites that receive a medium, high, or very high score on the COPI risk assessment need to base manure and wastewater applications on phosphorus removal rates and recommendations. A land application site that is scored as low on the COPI risk assessment may utilize a multi-year phosphorus application strategy.

The following phosphorus removal rates and a discussion of phosphorus management practices for crops in Colorado can be found in CSU-Extension Bulletin #XCM-175 Best Management Practices for Phosphorus Fertilization, 2011.
<http://www.ext.colostate.edu/pubs/crops/xcm175.pdf>

Crop	Yield (per acre)	P Removed (lbs)
Alfalfa	4 tons	40
Corn (grain)	190 bu	70
Corn (silage)	30 tons	120
Barley	100 bu	40
Bromegrass/fescue	4 tons	40
Potatoes	400 cwt	55
Sugarbeets	25 tons	35
Sunflowers	2000 lbs	80
Wheat	100 bu	85

Source: CSU-Extension Bulletin #XCM-175 *Best Management Practices for Phosphorus Fertilization*, 2011 -Table 1.

Nutrient recommendations (fertilizer suggestions) for phosphorus are provided by CSU- Extension for a wide variety of crops typically planted in Colorado and can be

accessed at: <http://www.extsoilcrop.colostate.edu/Soils/cnmp/nutRecs.html>

More detailed information about individual crops can be accessed at:
<http://www.ext.colostate.edu/pubs/pubs.html>.

In addition to CSU-Extension, a facility may utilize crop fertility recommendations from an adjacent state, the most current nutrient management planning guidelines for Colorado published by USDA-NRCS, or a method approved by the Ag Program. Use of crop fertility recommendations from sources other than CSU-Extension must be identified in the NMP and pre-approved by the Ag Program.

Technical Standard 9 - Multi-Year Phosphorus (P) Application

Both, Section 61.17(3)(h) of Regulation No. 61 and the Colorado CAFO General Permit define a Multi-Year Phosphorus Application as a phosphorus application applied to a field in excess of the crop needs for that year. In multi-year P applications, no additional manure, residual solids, process wastewater, or swine feeding process wastewater is applied to the same land in subsequent years until the applied phosphorus has been removed from the field via harvest and crop removal. A permitted CAFO is required to consider multi-year phosphorus applications in their NMP.

Only land application sites scoring low on the COPI can utilize a multi-year P application strategy where P is being applied at a rate to meet the recommendation for multiple crop years. For example, with a 3-year limit, a grower could apply manure in a single year to meet 3 years of crop P need, as long as crop N recommendations are not exceeded. In this example, no additional P is applied in the current year or the 2 additional years or until the P has been removed through harvest and crop removal rates that is discussed in Technical Standard 8 of this document.

The NRCS-Colorado Nutrient Management Conservation Practice Standard (Code 590, November 2012) provides some additional considerations and requirements for a multi-year P application that include the facility completing the Colorado Phosphorus Index (COPI) risk assessment if the phosphorus application rate exceeds CSU fertility recommendations for the planned crop.

The NRCS-Colorado Nutrient Management 590 Standard stipulates that when multi-year P applications are made, the facility must comply with the following:

- a) The application rate must not exceed the COPI phosphorus risk assessment criteria that is described in Technical Standard 2 of this document;
- b) The application rate must not exceed the recommended nitrogen application rate during the year of application or harvest cycle; and,
- c) No additional phosphorus may be applied in the current year and additional years for which the single application of phosphorus is supplying nutrients

until the P removed is greater than P applied in the multi-year phosphorus application.

Sampling and Analysis (Manure/Wastewater & Soil)

Sampling and analysis of manure, wastewater, and soil is essential to ensure that nutrients are applied at an agronomic rate and to reduce the likelihood of runoff from land application sites impacting water resources.

Technical Standard 10 - Frequency and Requirements of Manure Analysis

Section 61.17 (8)(b)(xiv)(B) of Regulation No. 61 and the Colorado CAFO General Permit require annual sampling and analysis of a representative sample of manure, litter, and/or wastewater that will be applied to land applications sites or transferred to a third party. At a minimum, the manure, litter, and/or wastewater will each need to be sampled and analyzed for total nitrogen and total phosphorus.

Technical Standard 11 - Method for Collecting Manure Samples

Section IX (Sampling & Testing of Manure, Process Wastewater, and Soil) of the Ag Program's NMP template identifies that the sampling protocol for the collection of manure samples can be found in CSU-Extension Bulletin 568A (Pages 11 and 12).

CSU-Extension Bulletin 568A describes that the appropriate method for collecting solid manure samples should be completed with a representative sample due to manure being an extremely variable material. A representative sample must include a minimum of six samples mixed together for analysis. When collecting a representative sample from a manure stockpile, the initial dried crust from the outer portions of the pile should not be included in the sample.

A representative sample should be composed from all sides of the manure stockpile by taking a core type of sample with a narrow apparatus (e.g. shovel). A solid manure sample should be delivered to the laboratory immediately or, if immediate delivery is not possible, freeze the sample in a freezer-type heavy duty plastic bag.

Similar sampling principles also apply to collecting a wastewater sample from a lagoon or impoundment. At least six samples should be collected from around the impoundment to obtain a proper representative sample of wastewater. In addition, a sample may also be gathered from a valve in the irrigation line used for land application from the lagoon or impoundment.

A CAFO should contact their laboratory prior to conducting the sampling of manure or wastewater to determine if any specific bottles or containers are necessary.

The laboratory may also have specific instructions on the size or amount of the sample that is needed to properly conduct the analysis.

Technical Standard 12 - Methods for Conducting Manure Analysis

Laboratories utilized for manure analysis that are currently certified by the Minnesota Department of Agriculture's Manure Testing Laboratory Certification Program are approved by the Ag Program as using appropriate analytical techniques. Please use the following link for a list of laboratories that are certified by the Minnesota program: <http://www2.mda.state.mn.us/webapp/lis/manurelabs.jsp>.

The Ag Program's NMP template, Section IX (Sampling & Testing of Manure, Process Wastewater and Soil), also includes information on methods for conducting proper manure analysis. In addition, CSU-Extension Fact Sheet No. 0.520 Selecting an Analytical Laboratory, October 2010 contains useful information when selecting a laboratory to conduct manure analysis.

Technical Standard 13 - Frequency and Requirements for Soil Analysis

Soil nitrates sampling and analysis must be conducted, at a minimum, annually and that soil phosphorus sampling and analysis must be conducted at least once every five years. These requirements for soil analysis are identified in the Ag Program's NMP template, Section IX (Sampling & Testing of Manure, Process Wastewater and Soil), Section 61.17(8)(b)(xiv)(A) of Regulation No. 61 and in the Colorado CAFO General Permit

Technical Standard 14 - Methods for Collecting Soil Samples

CSU-Extension Bulletin 568A (page 11) and CSU-Extension Fact Sheet No. 0.500 Soil Sampling, March 2010 both discuss the following methods to be utilized for collecting soil samples:

A composite soil sample should represent a uniform field area that has a similar crop and fertilizer history for at least the last two years. The field area represented by a single composite sample should be no more than 40 irrigated acres or 100 dry land acres. A systematic scheme (e.g. grid) should be used to compile a representative sample. Collect 15 to 20 samples from the zero to 1-foot depth interval and six to eight samples from the zero to 2-foot depth interval over the above-described field area. The soils from these unique sampling depths should be composited separately, thoroughly mixed, and either air-dried or delivered to the lab immediately after sampling.

Soil sampling at deeper depths may be necessary to document that nutrients are not leaving the root zone. Section IX (Sampling & Testing of Manure, Process Wastewater, and Soil) of the NMP template contains additional information related to the collection of soils samples.

Again, a CAFO may want to contact the laboratory where the soil sample will be submitted for any additional instructions on sampling size and necessary containers.

Technical Standard 15 - Methods for Conducting Soil Analysis

A facility utilizing a laboratory for soil analysis accredited through the North American Proficiency Testing Program's Proficiency Assessment Program will be considered an approved testing protocol for soil analysis. Please use the following link for a list of laboratories that are accredited by this program:

<http://www.naptprogram.org/pap/labs>.

The Ag Program's NMP template, Section IX (Sampling & Testing of Manure, Process Wastewater and Soil), also includes information on methods for conducting soil analysis.

In addition, CSU-Extension Fact Sheet No. 0.520 Selecting an Analytical Laboratory, October 2010 contains useful information when selecting a laboratory.

Application of Manure and/or Wastewater

When, where, and how manure and wastewater is applied is critical in preventing runoff from land application sites and protecting water quality.

Technical Standard 16 - Timing, Soil Conditions, and Placement of Manure and Wastewater during Application

The timing, soil conditions, and placement of all manure and wastewater applications shall meet the following criteria for site specific conservation practices that have been identified:

- a) Solid manure shall be incorporated as soon as possible after application, unless the application site has perennial vegetation or is no-till cropped, or in cases where the nutrient management plan adequately demonstrates that surface water quality will be protected where manure is not incorporated [Section 61.17 (8)(b)(vii)(A) of Regulation No. 61 and the Colorado CAFO General Permit].
- b) Process wastewater to furrow- or flood-irrigated land application sites shall be applied in a manner that prevents any process wastewater runoff into surface waters [Section 61.17(8)(b)(vii)(B) of Regulation No. 61 and the Colorado CAFO General Permit].
- c) When process wastewater is sprinkler-applied, the soil water holding capacity of the soil shall not be exceeded [Section 61.17(8)(b)(vii)(C) of Regulation No. 61 and the Colorado CAFO General Permit].
- d) Process wastewater shall not be applied to either frozen or flooded land application sites [Section 61.17(8)(b)(vii)(D) of Regulation No. 61 and the Colorado CAFO General Permit].

- e) Manure or process wastewater shall not be land-applied within 150 feet of domestic water supply wells and within 300 feet of community domestic water supply wells [Section 61.17(8)(b)(vii)(E) of Regulation No. 61 and the Colorado CAFO General Permit].
- f) No application of manure or process wastewater shall be made to a land application site at a rate that will exceed the capacity of the soil, and the planned crops to assimilate nitrate-nitrogen within 12 months of the manure or process wastewater being applied [Section 61.17(8)(b)(x)(A) of Regulation No. 61 and the Colorado CAFO General Permit].
- g) Manure and process wastewater shall be applied as uniformly as possible with properly calibrated equipment [Section 61.17(8)(b)(x)(B) of Regulation No. 61 and the Colorado CAFO General Permit].
- h) Equipment that is utilized for land application of manure or process wastewater must be periodically inspected for leaks by the CAFO. At a minimum, such inspections shall be made annually and within the six month period prior to the first application of manure or process wastewater, and at least once daily when process wastewater is being applied [Section 61.17(8)(f)(iii) of Regulation No. 61 and the Colorado CAFO General Permit].

In addition to the above-listed items related to timing, soil conditions, and placement of manure or wastewater, a permitted CAFO is responsible for the following setback requirements at land application sites [Section 61.17 (8)(f)(iv) of Regulation No. 61 and the Colorado CAFO General Permit]:

- a) Manure and process wastewater shall not be applied closer than 100 feet to any down gradient surface waters, open tile line intake structures, sinkholes, agriculture well heads, or other conduits to surface waters, or;
 - 1. As a setback alternative, the permitted CAFO may substitute the 100- foot setback with a 35-foot wide vegetated buffer where applications of manure or process wastewater are prohibited.
 - 2. As a setback alternative, the permitted CAFO may substitute the 100- foot setback with a 35-foot wide vegetated buffer where applications of manure or process wastewater are prohibited.

Reporting Requirements

Technical Standard 17 - Reporting and Recording Keeping Requirements

For each individual field that receives manure or process wastewater from the operation during the previous 12 months, the following items are required to be reported to the Ag Program:

- Actual crop planted.
- Calculated yield goal that was discussed in the operation's NMP.
- Actual crop yields.
- Actual nitrogen and phosphorus content of the manure, litter, and wastewater that was provided in the results of the most recent analysis conducted by the operation.
- Actual amounts of manure, litter, and process wastewater applied to each land application field during the previous 12 months.
- Nutrient applied from other sources (e.g. starter or commercial fertilizer).
- Total applied plant available nitrogen or phosphorus.
- Crop nutrient recommendations for nitrogen and phosphorus based on the calculated yield goal and applicable nutrient credits.
- Soil testing results for nitrogen and phosphorus taken during the preceding 12 months for each land application site receiving an application of manure or wastewater.
- Information showing the difference between total applied plant available nitrogen from all sources and the calculated nitrogen requirement.

References

The references below were used to develop this document:

Bauder, T.A., R.M. Waskom, and A. Andales 2011. Nitrogen and irrigation management. Fact Sheet No. 0.514. Colorado State University-Extension, Fort Collins, CO

Certified Manure Testing Labs. Minnesota Department of Agriculture, St. Paul, Minnesota.

<http://www2.mda.state.mn.us/webapp/lis/manurelabs.jsp>

Colorado Department of Public Health and Environment, Water Quality Control Commission, Colorado Discharge Permit System Regulations, 5 CCR 1002-61 (Regulation No. 61), Denver, CO

Colorado Department of Public Health and Environment, Environmental Agriculture Program, Colorado Discharge Permit System-General Permit-COA932000, Denver, CO

Colorado Department of Public Health and Environment, Environmental Agriculture Program CAFO, Nutrient Management Plan Template, Denver, CO

Colorado State University-Extension, Crop and Soil Sciences, Crop Recommendations. Fort Collins, CO.

<http://www.extsoilcrop.colostate.edu/Soils/cnmp/nutRecs.html>

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North American Proficiency Testing Program-Performance Assessment Program (NAPT- PAP). List of Accredited Labs. Soil Science Society of America. Madison, WI.

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From time to time this document for the Colorado Nutrient Management Technical Standards may need to be updated for content based on new information from the Ag Program, CSU-CE or USDA-NRCS. Anyone using this document is strongly encouraged to make sure that they are using the most up to date version. The most current version will always be available on the Ag Program's website.