

## **Chapter 2**

# **Agriculture - Silviculture Nonpoint Source Management Program**

by

**Colorado Department of Public Health and Environment  
Water Quality Control Division**

**Prepared in cooperation with the  
Colorado Nonpoint Source Council  
Agriculture - Silviculture Committee**

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## **I. Introduction to the Agricultural - Silvicultural Nonpoint Source Management Program**

Colorado's original Nonpoint Source Management Program was approved in 1989, and revised in 1990. Other than small, case-by-case changes resulting from advancing technology, the program has not been altered.

This update addresses several needs and issues. The original program was largely completed, and it was necessary to provide clear direction on the priorities for protecting Colorado's water resources from nonpoint sources. In addition, the continuing advance of technology has refined, redefined, or even caused the obsolescence of many BMPs used in the original program. The best management practices as originally listed also did not provide the flexibility to deal with technological changes. This update provides BMPs in more general terms by identifying specific purposes for each BMP, but recognizes there are innumerable combinations of individual practices that can accomplish those purposes. This update also recognizes that while the overall purpose for each BMP is improving water quality, secondary purposes may provide the cumulative incentives necessary to achieve voluntary adoption, especially of new technology.

Another issue acknowledges the lessons learned from the last 10 years of nonpoint source activities. Demonstration projects, watershed remediation and educational efforts are beginning to "pay off," in terms of increased awareness, increasing technologic adoption, and water quality benefits. In addition, the targeted monitoring efforts of numerous entities are providing a better picture of the quality of Colorado water, especially as related to nonpoint impacts.

The third is the development and increasing reliance on targeting tools, which provide a means of evaluating proposed projects, as well as the opportunity to prioritize both funding and staff.

### **A. Accomplishments**

The original NPS management program had a number of milestones and targeted watersheds identified for action. Highlights include:

- Development by the Natural Resources Conservation Service (then the Soil Conservation Service) of new standards and specifications for nutrient and pest management;
- Revision of the soil stabilization on forest lands BMP to address eroding roads;
- Development of a Memorandum of Agreement between WQCD and the Bureau of Land Management on federal consistency with the Clean Water Act;

- Development by the USFS of the “Watershed Conservation Practices” for use in each updated forest plan;
- Activity has been at least initiated, and in some instances completed, in each of the 45 specific watersheds identified as priorities in 1990. Activities include further investigations to determine the scope and extent of the NPS problem; establishment of stakeholder groups; development and implementation of watershed restoration plans, utilizing funds from both the Nonpoint Source Program and USDA programs.
- A much greater quantification of the impact of agriculture on groundwater quality.

On-the-ground activities also have been significant. In several instances, Section 319 funds were used in conjunction with USDA Water Quality Initiative projects to enhance abilities of each program.

- In the Badger Creek Watershed, which is the longest-running Section 319-funded watershed project, land treatment and riparian management have narrowed and deepened the channel of Badger Creek; the trend analysis indicates a more favorable aquatic habitat is developing.
- In the Owl Mountain Partnership watershed project in the North Platte basin, wetlands were created for waterfowl on a Bureau of Land Management grazing allotment with cooperation of local ranchers, the permittee, Ducks Unlimited and Colorado Division of Wildlife. In addition, new water tanks were installed on BLM, USFS and private lands to provide water for cattle, which keeps the animals out of the riparian areas at critical periods and enhances restoration. Hundreds of willows were also planted in riparian areas.
- The Northern Colorado Water Conservancy District has used demonstrations within their Irrigation Management Service to encourage irrigated producers to improve both irrigation and nutrient management.
- In the Patterson Hollow Hydrologic Unit Area project, more than 35,000 acres have been treated with irrigation water management and nutrient and pest management. In addition, more than 10,000 acres have been treated with polyacrylamide, which greatly reduces the transport of sediment from irrigation fields. The HUA project led to USDA planning for a small watershed project, the Highline Breaks PL566 Watershed Project.
- In the lower Arkansas River Valley, another USDA small watershed project, Limestone - Graveyard Watershed Project, in its first years of contracting has obligated nearly \$1 million on 16,250 acres to reduce selenium and salinity loading to the Arkansas River system.

- In the San Luis Valley USDA Water Quality Demonstration Project, nearly 20,000 acres have implemented improved irrigation water management, and more than 15,000 acres are using improved nutrient management. In addition, eight chemical handling facilities were constructed, to reduce the risk of ground water contamination from potential spills at these sites.

- Another USDA project, the Trinidad Lake North project, implemented general land improvement practices on 35,000 acres, to reduce the sediment load to Trinidad Lake.

The actual measurement of water quality improvements as a result of these activities, though, have not yet occurred. In general, it takes at least 8 to 10 years after treatment to begin to see changes in monitoring data; programmatically, we are just now approaching the window where improvements may be noted. However, the experience from the Rural Clean Water Program also indicates "effects monitoring" to be a highly complex process, with a level of sophistication the Colorado program overall is just beginning to acquire.

## **II. Nonpoint Source Pollution and Agriculture and Silviculture**

### **A. Impacts to Surface Water**

Agriculture and silviculture, for the purposes of this management program, includes the cultivation of cropland (including grains, vegetables, and orchards), the raising of livestock and the harvesting of forest products. This broad definition includes activities such as irrigated and dryland farming, grazing, animal feeding operations, and timber harvesting and related road construction on public and private lands.

The *Colorado Nonpoint Assessment Report*, last updated in 1990, is superseded by the 1998 305(b) report "*Status of Water Quality in Colorado*" and the 1998 303(d) list of *Water Quality Limited Segments still requiring TMDLs*." The 305(b) report identifies a number of surface water segments that are potentially impacted by agricultural or silvicultural activities, but more information (data collection) is necessary to determine if those segments are fully supporting, partially supporting or not supporting the classified uses of the water.

The 303(d) lists 14 surface stream segments in the state where agriculture is a possible contributor to the pollutant load. The pollutants are typically sediment or selenium, although in a couple instances bacteria or nutrients are also included. Many of the segments originally listed in the *Nonpoint Assessment Report* need further evaluation and have been moved to the monitoring and evaluation list within the 303(d) list.

In Colorado the primary pollutants of concern from agriculture (in terms of surface stream miles impacted) are excessive sediment and excessive salinity (total dissolved solids). These pollutants often occur naturally due to the inherent erodibility of soils

and Colorado's arid and semi-arid climate. Human activities can greatly increase the rate of erosion and lead to siltation of stream beds, as well as lakes and reservoirs. Siltation may lead to loss of aquatic habitat in both streams and standing water bodies.

Nutrients such as phosphorus and the various forms of nitrogen used in agricultural activities also pose a threat to water quality. Over-application of fertilizers and animal waste to cropland may lead to increased nitrate levels in groundwater, and nutrient-enriched surface runoff may stimulate the growth of algae or nuisance weeds in lakes and reservoirs. High levels of nitrate (in excess of 10 mg/l nitrate nitrogen) are present in a few drinking water supplies, in particular several communities in the lower South Platte Basin that depend on alluvial ground water. Recreational activities in lakes and reservoirs may be restricted by over enrichment of standing waters.

### **B. Impacts to Groundwater**

As a result of the Agricultural Chemicals and Groundwater Protection Act (SB90-126), much more information on the quality of Colorado's groundwater is available now than 10 years ago. Studies of the alluvial South Platte River aquifer, the San Luis Valley, the alluvial Lower Arkansas River aquifer and the Ogalalla Aquifer have been completed, providing a good idea of existing "hot spots" in groundwater.

Groundwater monitoring is conducted by a number of other agencies and organizations, as well, including the North Front Range Water Quality Planning Association, the USGS, Colorado Division of Water Resources, and public water suppliers. Nonpoint source funding has been used to sample wells in many areas.

Examples of areas of high nitrate-N include the South Platte alluvial groundwater, where monitoring has found levels ranging from a trace to 37 parts per million, with a mean of 8.7 ppm and median of 6.7. The San Luis Valley groundwater samples ranged from trace to 37 ppm. The Lower Arkansas River nitrate-N ranges from a trace to 39 ppm, with a mean of 5.3 ppm and median of 4.0. Agriculture is suspected as one of the sources of excess nitrogen.

SB90-126 monitoring to date also indicates a few locations with pesticide detections in the groundwater, but no widespread contamination. For instance, in the South Platte alluvial aquifer, 19 of 96 wells had detections of atrazine, but only seven of those were above the practical quantification level. Those seven ranged from 0.51 to 1.38 ug/l of atrazine; the maximum contaminant level for atrazine is 3.0 ug/l. Alachlor was detected in one of 96 wells, at a level of 3.09 micrograms per liter (ug/l); the M.C.L. for alachlor is 2.0 ug/l. The well with alachlor also had a trace of atrazine, benefin, and EPTC.

In the Arkansas River basin, atrazine was detected at trace levels in the alluvial groundwater in 12 of 139 wells. One well registered a trace of metolachlor and one well had a trace of 2,4-D.

In the San Luis Valley, three pesticides were detected in the groundwater, one in each of three separate wells. The 2,4-D and hexazinone herbicides were below the practical quantification level. Lindane was found in one well at 0.29 ug/l; the M.C.L. for lindane is 0.20 ug/l.

It is also worth noting that the US Geological Survey National Water Quality Assessment (NAWQA) of the South Platte River has found a number of pesticide detections in Cherry Creek, within the Denver metropolitan area. Some, such as lindane and EPTC, were detected only during storm events. Others, including simazine and prometon, were detected nearly every month.

A groundwater study group was formed by the Nonpoint Source Task Force in 1990 to determine how to consistently approach groundwater data needs. This group was comprised of federal, state, and local governmental agencies involved in groundwater activities, and other interested public interest groups. Some of the major accomplishments were developing a statewide computerized groundwater database (QUALDAT) and establishing groundwater monitoring protocols.

### **C. Generic Groundwater Pesticide Management Plan**

The State of Colorado, Department of Agriculture is developing a "Groundwater Pesticides Management Plan," to prevent pesticide contamination of all groundwater sources of the state through effective management policies and appropriate regulations, and to protect all groundwater as drinking water, including surface water hydrologically connected to groundwater. The plan will include information on groundwater sensitivity and vulnerability, best management practices and program evaluation for effectiveness.

A statewide sensitivity analysis was completed in 1998; it considered four primary factors:

- conductivity of exposed aquifers;
- depth to water table;
- permeability of materials overlaying aquifers; and
- availability of recharge for the transport of contaminants.

This information will be combined with land use data, management practices and pesticide use data to generate groundwater vulnerability rankings. This ranking can then be used to prioritize monitoring efforts, based on the degree of vulnerability.

An extensive discussion of the interaction between the nonpoint source program and the generic pesticide plan may be found in Chapter 1.

## **III. The Approach to NPS Management for Agriculture and Silviculture**

### **A. Establishment of Ag/Silv NPS Water Quality Priorities and Geographic Targeting**



There are several tools available to identify priorities for the Agriculture/Silviculture Program. The most highly targeted tool is the *303(d) List of Waters Still Needing TMDLs*. The 3/98 list identifies segments in each major river basin impacted by nonpoint sources such as sediment and selenium. Based on the goals for the program, projects which identify specific aspects of the listed segments would be considered high priority efforts.

The Unified Watershed Assessment also provides the second, significant targeting tool for the use of Section 319 grants. Guidance established by the Environmental Protection Agency regarding 319 grants stipulates that any additional funds appropriated by Congress over the normal annual appropriation of \$100 million may be used by states only to address watershed restoration priorities. In Colorado the Unified Watershed Assessment identified watersheds needing restoration where additional financial resources can be utilized to enhance the process of developing and implementing the requirements of a TMDL or enhance on-going efforts sponsored by other agencies.

The third targeting tool involves the pollution prevention aspect of the nonpoint source program and incorporates the priority issues identified in the Agriculture - Silviculture White Paper (7/94). It is commonly held that prevention is less expensive than remediation; this is recognized in the second part of the NPS program goal, to prevent future impairments of Colorado's water resources. In addition to the priority issues of the white paper, the rapid suburban or semi-rural development occurring in many Colorado watersheds is a concern for local government agencies and citizen organizations. Increasing population increases the pressure on many of the state's highest quality water and land resources. Locally initiated, voluntary, citizen supported activities to protect high quality water resources are encouraged. The White Paper is included in the Appendix of this chapter.

## **B. Goals and Objectives**

The goal of this program is two-fold: to restore to full use those waters, both surface and ground water, impaired by agricultural and silvicultural nonpoint sources; and to prevent future impairments of Colorado's waters.

The goal will be accomplished primarily through a voluntary approach utilizing cost-share incentives for best management practice implementation, demonstration projects, or educational and training efforts, on either a statewide or watershed basis, as appropriate.

## **C. Objectives and Actions**

1. Reduce the sediment load to surface waters from streambank, riparian, and/or upland instability.

Action 1.1: Promote remediation projects in high priority category 1 watersheds which were identified as impaired or threatened due to the impact of sediment.

By: On-going, the WQCD Watershed Coordinators will contact local stakeholders or other local officials to offer assistance in addressing issues, and encourage locally-led efforts to initiate project actions on a watershed basis.

Action 1.2: Using the “White paper” and other targeting tools, identify high quality waters and watersheds where prevention actions are needed to prevent impairment resulting from sediment.

By: 6/30/2000 develop a process for watershed stakeholders to use in determining level of “threat” to high quality waters and watersheds from nonpoint sources.

2. Support selenium targeting efforts in the Gunnison and Arkansas watersheds.

Action 2.1: Establish a local stakeholder group in the Gunnison watershed.

By: 1/1/99

Action 2.2: Identify current selenium loads to Gunnison surface waters through a locally led targeting effort.

By: 12/31/2002 complete Phase 1 and 2 targeting in the basin.

Action 2.3: Allocate selenium loads, using TMDL model.

By: 6/30/2004

Action 2.4: Encourage establishment of a local stakeholder group in the Arkansas watershed to coordinate selenium targeting efforts.

By: 6/30/2004

Action 2.5: Identify current selenium loads to Arkansas surface waters through a locally led targeting effort.

By: 6/30/2006

Action 2.6: Allocate selenium loads, using TMDL model.

By: 6/30/2008

3. Reduce nutrient and pesticide loading to Colorado waters.

Action 3.1: Cooperating with the SB90-126 Advisory Committee, establish an incentive program to encourage irrigated land users to adopt proper management.

By: 12/31/2000 develop the framework for implementing an incentive program.

By: 12/31/2001 establish a pilot incentive program in a high priority targeted area to improve irrigation and nutrient management.

By: 12/31/2003 utilize the results of the pilot program to establish the incentive program in identified priority areas throughout the state.

Action 3.2: Establish a marketing initiative to promote comprehensive nutrient management, utilizing principles in the national Animal Feeding Operation Strategy.

By: 12/31/99 cooperate with NRCS to quantify need for Comprehensive Nutrient Management Plans (CNMPs) in Colorado, and develop draft strategy.

By: 12/31/2000, assuming need has been quantified, finalize strategy for developing the CNMPs.

By 12/31/2000 begin implementation of state strategy for CNMPs.

Action 3.3: Develop a “surge irrigation technology compendium” where projects in Colorado that have demonstrated surge technology for water quality improvement share the results of their projects, to establish the full range of possibilities for surge in reducing pollutant loading.

By: 6/1/2000 survey surge demonstration proponents to determine need for holding a workshop.

By: 9/30/2001, if need is indicated from survey, hold the workshop to share results.

By: 12/31/2001, create a surge educational package, based on lessons learned in the demonstrations, as presented in the workshop.

4. Assure federal land management agency consistency with state water quality goals, as related to agricultural and silvicultural activities, and support other federal agency efforts to improve and protect water quality in Colorado by developing a productive partnership with the public land management agencies and users of public lands, in a mutually beneficial framework.

Action 4.1: Establish a liaison/interagency personnel agreement with the U.S. Forest Service which will provide a USFS staff person to the Division to help the Division coordinate federal lands issues, including monitoring, TMDL development, and best management practice audits.

By: 2/1/2000

Action 4.2: Annually seek cooperation of appropriate federal land management agencies in monitoring activities in stream segments identified in the 1998 303(d) list and Monitoring and Evaluation (M&E) list, and future 303(d) and M&E lists.

By: Annually

Action 4.3: Establish a five-year, rotating, best management practice (BMP) audit schedule among the U.S. forests and BLM resources areas, and perform scheduled audits by 9/30 of each year, beginning with 9/30/2000.

By: By 6/30/2000 establish schedule

Action 4.4: Evaluate the BMP audit process by using it in the 2000 field audits. By 3/1/2001 modify the audit process, if necessary, to reflect current on-the-ground and programmatic needs.

By: 3/1/2000 modify process as necessary

Action 4.5: Assure nonpoint source program participation in the USDA State Technical Committee, and promote water quality considerations in prioritizing Environmental Quality Incentive Program priority areas and resource issues.

By: Annually, attend meetings as scheduled by the State Conservationist, and identify opportunities for cooperation between programs.

Action 4.6: Encourage the use of PL566 Small Watershed Program to deal with NPS issues on a watershed basis.

By: 12/31/99 and annually thereafter, each WQCD watershed coordinator will consult with NRCS on the use of PL566 funds for individual projects.

Action 4.7: Use other existing forums to coordinate activities that may impact water quality.

By: 9/30/2000, and annually thereafter, participate in the Riparian Coordination Team (RIPCORDER).

5. Build partnerships with existing associations to communicate program goals and needs.

Action 5.1: Identify audiences/constituents currently not represented on the Nonpoint Source Council and Agriculture/Silviculture Committee.

By: 3/1/2000 and annually thereafter

Action 5.2: Pro-actively present those audiences with information on the Nonpoint Source Program, especially as it relates to agriculture and silviculture in Colorado.

By: 7/1/2000 and annually thereafter, each organization identified in that year will be contacted and given information on the NPS program.

By: 7/1/2000 and annually thereafter, each organization identified in that year will be added to the state NPS newsletter mailing list.

#### **IV. Authorities for Managing Agricultural/Silvicultural Nonpoint Sources**

##### **A. Colorado Department of Public Health and Environment (CDPHE)**

Primary responsibility for water quality control in Colorado is invested in the Water Quality Control Division and the Water Quality Control Commission, both located within CDPHE. Their roles are fully described in Chapter 1, Overview of the NPS Program.

##### **B. Colorado Department of Agriculture (CDA)**

The CDA is the lead state agency for pesticides. The Pesticide Section of CDA regulates pesticides, pest control devices, pesticide application, pesticide applicators and is the lead agency for the protection of groundwater quality from contamination by agricultural chemicals. Its services include: ensuring proper labeling, packaging, display, formulation, and effectiveness of pesticide products; handling special local needs' pesticide registrations and emergency exemption requests for pesticides; ensuring competency of commercial pesticide applicators, and under certain circumstances, limited commercial and public applicators; and to ensure the protection of groundwater and the environment from impairment or degradation due to the improper use of agricultural chemicals while allowing for their proper and correct use. CDA is also developing the State Management Plan for Pesticides. (It should be noted that private pesticide applicators in Colorado are registered by the Environmental Protection Agency and must pass a certification exam which allows them to purchase and apply restricted use pesticides for personal, not commercial, use.)

In addition CDA is also authorized to developed BMPs relating to the use of agricultural chemicals. The Commissioner of Agriculture can also designate agricultural management areas to prevent or mitigate the impact of specific agricultural chemicals on ground water, if monitoring finds the voluntary practices do not work.

CDA's legal authorities to carry out these functions are contained in the Pesticide Act (35-9 C.R.S.) and associated rules and regulations, the Pesticide Applicator's Act (35-10 C.R.S.) and associated rules and regulations, the Agricultural Chemicals and Groundwater Protection Act (25-8-205.5 C.R.S.) and associated rules and regulations.

### **C. Federal Land Management Agency Responsibilities**

The Federal Land Policy and Management Act, National Forest Management Act and Resource Planning Act require that significant land holding federal agencies, such as the Bureau of Land Management and U.S. Forest Service, maintain an ongoing land planning process which evaluates, among other things, environmental impacts of various uses of federal lands. Since these plans guide the general activities on federal lands, they are important in assessing water quality impacts from proposed activities. The federal consistency language of the Clean Water Act addresses the need for federal agencies to be consistent with state water quality goals and standards.

### **D. U.S. Department of Agriculture**

The USDA mission is to enhance the quality of life for the American people by supporting production of agriculture, including caring for agricultural, forest, and range lands and supporting sound development of rural communities. A number of USDA agencies have a mission or legislative directive to address nonpoint source issues, either directly or indirectly.

**Natural Resources Conservation Service (NRCS)** works hand-in-hand with the American people to conserve, improve, and sustain natural resources on private lands. This includes standards for conservation systems that address such areas as erosion control, animal waste management, irrigation water management, wetlands conservation and restoration, and flood control and streambank stabilization and computer "models" for predicting soil erosion by wind and water, agricultural nonpoint-source pollution of water

**Agricultural Research Service (ARS)** provides access to agricultural information and develops new knowledge and technology needed to solve technical agricultural problems of broad scope and high national priority. The goal is to ensure an adequate supply of high quality, safe food and other agricultural products to meet the nutritional needs of consumers, sustain a competitive food and agricultural economy, to enhance quality of life and economic opportunity for rural citizens and society as a whole, and to maintain a quality environment and natural resource base.

**Cooperative State Research, Education, and Extension Service (CSREES)** works with partners and customers to advance research, extension and higher education in the food and agricultural sciences and related environmental and human sciences to benefit people, communities and the Nation. It also focuses on the practical education Americans can use in dealing with the critical issues that affect their daily lives and the Nation's future, such as water quality and sustainable agriculture.

**Farm Service Agency (FSA)** helps stabilize farm income, aids farmers in conserving land and water resources, provides credit to new or disadvantaged farmers and ranchers, and helps farm operations recover from the effects of disaster.

**E. State Soil Conservation Board**

The legislative mandate for the Board is to provide the State of Colorado with a program of soil and water conservation to control wind and water erosion, prevent floods and preserve adequate underground water reserves. The Board represents the local soil conservation districts in the state in a number of government processes. The Board and districts are involved in a number of projects which address nonpoint source issues and are beneficial to water quality.

Additional entities with responsibilities in the nonpoint source program are identified in Section V of Chapter 1.

## V. Implementation

### A. Technical Resources: Who to Contact for Assistance in Planning and Implementation

*The following table is not all-inclusive, but lists some of the entities available to provide nonpoint source planning and implementation assistance. They are listed in no particular order.*

<b>Grazing Lands and Riparian Management</b>	<b>Cropland, Irrigation, Nutrient, Pest and other Agronomic Management</b>	<b>Forest Land Management</b>	<b>Animal Waste Management</b>
Colorado Cattlemen's Association	Certified Crop Consultants	Colorado State Forest Service	Colorado Livestock Association
Colorado Division of Wildlife	Colorado Dept. of Agriculture	Colorado Timber Industry Association	Colorado Department of Public Health and Environment
Colorado Grazing Land Initiative	Colorado Division of Water Resources/ State Engineer's Office	Forestry Consultants	Colorado Corn Growers and Administrative Committee
Colorado Riparian Association	Colorado State Forest Service	Soil Conservation Districts	Colorado Dept. of Agriculture
Colorado State Forest Service	Colorado Water Conservation Board	State Soil Conservation Board	Colorado Pork Producers Council
CSU Cooperative Extension	Colorado Weed Management Assn.	U.S. Forest Service	CSU Cooperative Extension
Society for Range Management	CSU Cooperative Extension	USDA Natural Resources Conservation Service	County Health Departments
Soil Conservation Districts	Soil Conservation Districts		Private engineers and consultants
State Soil Conservation Board	U.S. Bureau of Reclamation		Soil Conservation Districts
The Nature Conservancy	USDA Natural Resources Conservation Service		USDA Natural Resources Conservation Service
U.S. Fish and Wildlife Service	Water Conservancy Districts		
U.S. Forest Service	Water Conservation Districts		
USDA Natural Resources Conservation Service	Ground Water Management Districts		
USDI Bureau of Land Management	Colorado Corn Growers and Administrative Committee		

### How do I find these agencies and associations?



Phone numbers are provided for the state headquarters for some of the agencies. These entities should be able to provide a contact at the local level. Keep in mind, with government reinvention many agencies have undergone significant personnel changes, updating of equipment and relocations. Consequently, there is no assurance that a phone number included here will be valid beyond the moment it is printed.

Government agencies are listed in the phone book a number of different ways, depending on the phone company. Larger directories may have separate sections for government listings; others will be located in the white pages under "U.S. Government" or "State Government" or "Colorado State Government." Also, state and federal agencies are often listed with their department, not simply alphabetically. Likewise, local agencies may be listed individually or with a particular county or city listing. It may require some perseverance on the part of the user to find a number -- but at least the likelihood is quite high the number will be correct.

Internet addresses are also included for some of the entities. While the same risk of obsolescence exists for these addresses as well, an old Internet address often will provide a forwarding link to the new address.

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U.S. Department of Agriculture  
<http://www.usda.gov>  
Stream Corridor Restoration  
[http://www.usda.gov/stream\\_restoration/](http://www.usda.gov/stream_restoration/)

U.S. Department of Interior  
<http://www.doi.gov>

USDA Natural Resources Conservation Service  
<http://www.nrcs.usda.gov>  
303-236-2886

USDI Bureau of Land Management  
<http://www.blm.gov>  
303-239-3600

U.S. Forest Service  
<http://www.fs.fed.us>  
303-275-5350

CSU Cooperative Extension  
<http://www.colostate.edu/Depts/CoopExt>  
970-491-6281

U.S. Fish and Wildlife Service  
<http://www.fws.gov>  
303-236-7904

Colorado State Forest Service  
<http://www.colostate.edu/Depts/CSFS>  
970-491-6303

U.S. Geological Survey  
<http://www.usgs.gov>  
Colorado District  
<http://webserver.cr.usgs.gov>  
303-236-4882

Colorado Division of Wildlife  
<http://wildlife.state.co.us>  
303-297-1192

Colorado Division of Water Resources/State Engineer's Office  
<http://water.state.co.us>  
303-866-3581

Colorado Water Conservation Board  
<http://water.state.co.us>  
303-866-3441

Colorado Department of Public Health and Environment  
<http://www.cdphe.state.co.us>  
303-692-3500

Colorado Department of Agriculture  
<http://www.ag.state.co.us>  
303-239-4100

Northern Colorado Water Conservancy District  
<http://www.ncwcd.org/ncwc>  
970-667-2437

Colorado Department of Natural Resources  
<http://www.dnr.state.co.us>  
303-866-3311

Colorado River Water Conservation District  
<http://www.crwcd.gov/crwcd>  
970-945-8522

Colorado State Soil Conservation Board  
303-866-3351

Southwest Water Conservation District  
<http://web.frontier.net/SCAN/wip/wiphome.html>  
970-247-1302

Society for Range Management  
<http://cnrit.tamu.edu/srm>  
303-355-7070

Water Information Program  
<http://www.waterinfo.org>

Bureau of Reclamation  
<http://www.usbr.gov>  
303-236-8098

Colorado Water Knowledge  
<http://www.cnr.colostate.edu/CWK>

Environmental Protection Agency  
<http://www.epa.gov>  
<http://www.epa.gov/region08>  
303-312-6312

The Nature Conservancy  
<http://www.tnc.org>  
303-444-2950

Trout Unlimited  
<http://www.tu.org/trout>  
303-220-7766

Conservation Technology Information Center  
<http://www.ctic.purdue.edu>

USDA-ARS Conservation and Production  
Research Laboratory  
<http://www.cpri.ars.usda.gov>

## **B. Financial Resources: How can NPS projects be funded?**

There are a number of funding sources that could be used for nonpoint source purposes.

### **319 grants**

Section 319(h) provides the authorization for the Environmental Protection Agency to make grants to states for the purpose of carrying out the nonpoint source management plan. EPA grants the funds to the states, based on an approved work plan, which usually consists of project implementation plans from individual projects. Projects may be sponsored by nearly any entity that can legally enter into a contract. The state contracts with each sponsor to complete the work proposed within each project. The funds are provided on a 60 - 40 basis: 60% grant funds, 40% state or local match.

### **EQIP (USDA)**

The Environmental Quality Incentive Program was created in the 1996 Farm Bill. It is intended to focus USDA's financial assistance funds in priority areas, proposed by local conservation working groups to the State Conservationist and State Technical Committee. Proposed priority areas are evaluated on a number of factors; the intent is to provide enough assistance over the project life to make a measurable impact on the resources identified in the priority area. In Colorado, approximately half of the funded

priority areas deal with water quality issues. In addition to the priority areas, there are several “priority issues” identified in Colorado. Producers who are not within a priority area are eligible for financial assistance from EQIP if it relates to one of the issues. Water quality is the highest priority issue.

#### **Conservation Reserve Program (USDA)**

The Conservation Reserve Program, which has been successfully used since 1986, “rents” farm land from farmers, who in turn return the crop land to permanent vegetation for at least 10 years. There are a number of variations within the program, including riparian buffer areas. Farmers “bid” their land into the program; a complex formula combining several factors is used to determine what land will be offered rental contracts. The four primary goals of CRP are to reduce erosion, improve water quality, enhance wildlife, and improve air quality.

#### **Wetland Reserve Program (USDA)**

The Wetland Reserve Program is a voluntary program designed to restore and protect wetlands on private property. Landowners who participate in WRP may sell a permanent or 30-year conservation easement, or may enter into a cost-share restoration agreement of a minimum of 10 years with USDA to restore and protect wetland.

#### **Wildlife Habitat Incentive Program (USDA)**

WHIP is a voluntary program that helps landowners develop habitat for upland wildlife, wetland wildlife, threatened and endangered species, fish and other types of wildlife.

#### **Watershed Protection and Flood Prevention (PL 86-566) (USDA)**

The Small Watershed Program provides broad authority for USDA agencies and other federal and state agencies to cooperate in watershed planning, surveys, and investigations. With assistance from NRCS, rural and urban communities can solve their land and water quality problems by using the watershed approach. One purpose of the program is to improve water quality in both surface and ground water. Within an approved project, the program can provide significant cost-share resources for structural BMPs. Management practices are not eligible for cost share assistance.

#### **Forestry Incentives Program (USDA)**

The FIP is designed to benefit the environment while meeting future demands for wood products through tree planting, timber stand improvement, site preparation for natural regeneration, and other related activities. It is a cost-share program that supports good forest management practices on privately owned, non-industrial forest lands.

#### **Natural Resources Conservation Matching Grants**

This relatively new funding source is managed by the State Soil Conservation Board in the Department of Natural Resources. It provides funds to assist soil conservation districts in addressing issues identified at the local level. The funds are used to

implement enduring conservation practices for preservation and protection of Colorado's natural resources in a public/private partnership.

### **Colorado Water Conservation Board Construction Fund Loans**

The Water Conservation Board provides low interest loans for water resource projects. Loans are available for raw water projects involving construction of new dams or rehabilitation and enlargement of existing dams; rehabilitation or construction of agricultural water supply systems, including diversion dams, ditches, headgates; and rehabilitation or construction of municipal raw water supply system, including diversion structures, pipelines and well. Loans are available for up to 75 percent of the total engineering and construction costs of a project.

### **State Revolving Loan Funds**

Colorado is developing its SRF for use in more traditional BMP-focused nonpoint source projects. No loans have been made as yet, as several institutional hurdles must still be overcome. However, its use is anticipated in the mid-term of the NPS program.

**U.S. Forest Service Landowner Assistance Programs** help private landowners protect, improve, restore, and sustain forests.

- ◆ The Forest Legacy Program protects private forest lands from being converted to nonforest uses.
- ◆ The Forest Stewardship Program helps private forest landowners develop plans for the sustainable management of their forests.
- ◆ The Stewardship Incentives Program provides financial assistance to private landowners to carry out their stewardship plans.

### **C. Information and Education**

Considerable progress has been made in addressing the statewide educational needs. For instance, irrigation water management, nutrient and pest management demonstrations for water quality improvement have been funded in nearly every major river basin in the state. In addition, the need for a statewide newsletter has been assumed by the "Colorado Conservator." Several videos and informative pamphlets and brochures have also been developed and distributed to the rural communities to describe how to implement nonpoint source technologies.

Future education needs for agriculture and silviculture include fact sheets on completed projects and a "surge irrigation technology compilation." The NPS Information and Education Coordinator will consider additional agriculture and silviculture needs in developing the I&E workplan, based on the I&E NPS Program.

### **D. Technology Transfer**

Each project completed to date provides some information that may benefit others with similar conditions. Project sponsors are generally required to provide some means of

transferring the lessons learned to the public. The Division is currently developing a template to facilitate technology transfer. In addition, the NPS Information and Education Coordinator is available to provide assistance to project proponents in developing a total outreach package.

### **E. Monitoring and Evaluation**

There are two aspects to monitoring and evaluation. First is programmatic evaluation, to determine the progress being made in actually accomplishing the goal of reducing impairments and improving water quality in the state. This can be evaluated a number of ways. Progress will be measured through the milestones developed for this program. Progress will also be measured, over a long period of time, through the state's synoptic sampling program and other monitoring efforts.

The second aspect of monitoring and evaluation (M&E) is at the project level, and determines if and how well an individual project accomplished its stated goals. Each project is required to have a specific monitoring and evaluation plan. The plan considers the actual goal of the project, for instance, whether to reduce pollutant loading to the system, measurably improve aquatic habitat, or educate a certain audience.

M&E efforts funded with Section 319 grant funds must comply with the state's EPA approved Quality Assurance Project Plan. Deviations from the QAPP, in the form of site specific amendments, will be approved by EPA prior to implementation, on case-by-case basis. The Division is currently in the process of developing a Division-wide QAPP, rather than the separate, program-specific QAPPs that have been developed over time.

Part of compliance with the QAPP also requires that projects develop sampling and analysis plans, which will address a number of specific items including how projects will handle any data collected, what protocols are used for data collection, and identify any training needs that may exist.

### **F. Partnerships**

While the statutory authority for water quality rests with the Colorado Department of Public Health and Environment, the actual implementation of the agricultural - silvicultural program relies on the partnerships that have developed over the years. Table 4 in Chapter 1, Overview of the NPS Program, contains a detailed description of the contributions of many NPS partners.

### **G. Updates to Ag/Silv Management Program**

It is the commitment of the Agriculture - Silviculture Committee of the Nonpoint Source Council to annual review progress of this management program, to bi-annually review the best management practices, and propose changes as necessary to the Nonpoint Source Council and the Water Quality Control Division.



## VI. Best Management Practices

Best Management Practices (BMPs) for this management program are defined as:

*A practice or combination of practices, as determined by a responsible group after examination of alternative practices and appropriate public participation, to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water/stream quality goals.*

*They include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures.*

A two tier system of BMPs is recommended in this management program. The first tier is the list of recommended statewide BMPs included in this document. These serve as a general reference for accepted practices to improve water quality impacted by the various subcategories of agricultural and silvicultural nonpoint pollution, and are a composite of practices which have been implemented by a number of agencies. The second tier refers to the on-the-ground application of the recommended statewide practices to an affected site by customizing the statewide practices to fit site-specific watershed conditions.

The recommendation of BMPs is a complex issue, due to the interaction between various natural resources. A watershed as a whole must be considered, to determine true cause and effect for a nonpoint source concern and identify the most appropriate BMP for the situation. Off-site impacts of BMP implementation must also be considered.

In addition, the selection of specific BMPs will require the involvement and coordination of many parties and interests. Prior to selecting BMPs, a decision must be made on the level of land management to be continued after treatment. Complex systems with high maintenance requirements, although they may be effective initially, will be useless if they are not maintained in the long term.

Selected BMPs may not control all nonpoint loading, but will be installed as necessary to reduce nonpoint loading to the desired level. Reasonableness of implementation costs must be considered with each proposed application of BMPs but cost will not be used as a sole determining factor to preclude BMPs in a particular location.

The coordination needed to develop specific BMPs is best illustrated in the process used around the state to develop localized adaptations of the "BMPs for Colorado Agriculture" from the SB90-126 Agricultural Chemicals and Ground Water Protection program. Local producers working with technical advisors adapted the state-wide BMPs for use in specific regions such as the South Platte, San Luis Valley, and

Uncompahgre Valley. Local adaptation increases adoptability of practices that include new, different or innovative technologies.

The Water Quality Control Division is responsible for the maintenance and updating of the statewide list of recommended BMPs as part of this management program. Education and personal commitment are necessary to insure that the BMPs are understood by the public and other users. Monitoring of the BMPs by project sponsors and others is a continuing process to insure that the practices are serving their original intent. Modifications and improvements of recommended BMPs will be the result of this process.

*The list of statewide BMPs is not all- inclusive; deletions or additions may be made as needed, based on an annual project progress reports, field inspections, emerging technologies, and requests for special practices.*

### **Agriculture/Silviculture Best Management Practices**

The BMPs in this management program are a compilation of the recommended practices available at this time. Implementation of BMPs to correct nonpoint source water quality problems, where such BMPs are identified solely as part of the state Section 319 program, is voluntary in Colorado. Thus, in the absence of independent statutory or regulatory authority, reference in other state and federal enactments to Colorado's Section 319 program, including BMPs developed thereunder, shall not establish an enforceable requirement that BMPs be implemented other than voluntarily.

Each agriculture/silviculture BMP that follows contains five parts:

*Definition* describes, in broad terms, how the BMP may be used.

*Purposes* are the broad goals or objectives for each practice. It should be noted that most BMPs have other purposes in addition to improving water quality. It may be possible for a primary purpose to be something other than water quality, that, when used in concert with other BMPs, has the overall effect of improving water quality. The inclusion of secondary purposes also improves the marketability of a practices, and improves the likelihood they will be adopted.

*Planning and Implementation Tools* are the technical references and guides that provide guidance in site-specific planning, design, implementation or construction, operation and maintenance of a practice or components of a practice.

*Who to Contact ...* is a separate reference that lists some of the entities available to provide assistance in planning and implementation of the BMPs. It is not all-inclusive.

*Examples of What Might be Included* are common components of each BMP, which may be used in combination to create site-specific BMPs. Again, these examples are not intended to be an all-inclusive list, but are provided to show project sponsors the intent of the BMP.



This management program also changes how the BMP technical references are maintained for nonpoint source program use. Rather than maintaining library copies at a variety of locations throughout Colorado -- and risk rapid obsolescence of the material -- project sponsors or others interested in a particular BMP should contact the publishing entity or author for the most recent version of the reference. A complete index and description of the references mentioned in these BMPs is included, and will be updated as necessary.

*It will be noted there is significant redundancy within these BMPs. The intention was for each topic to stand alone and be used independently, if necessary, as an informational tool.*

## **SOIL STABILIZATION ON GRAZING LANDS**

### **Definition**

Minimizing erosion by using vegetation, structures, or temporary artificial soil covers.

Used on all public and private rangeland, native pasture, grazeable forest land, and grazed wildlife land.

### **Purposes**

1. Improve water quality by preventing excessive soil and water loss
2. Produce optimum vegetation (i.e., plant species appropriate for the ecological site and land use) for grazing and browsing animals on grazing land or land converted to grazing land from other uses
3. Improve the visual quality of grazing land

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

USDA Natural Resources Conservation Service Field Office Technical Guide  
U.S. Forest Service Watershed Conservation Practices Handbook and other technical references  
USDI Bureau of Land Management Technical References

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

grazing management techniques and strategies such as rotational grazing, deferred grazing, proper grazing use; critical area treatment; sediment basin; diversions; grade stabilization structures

## **GRAZING MANAGEMENT**

### **Definition**

Grazing at a proper rate of timing and intensity that will maintain sufficient cover to protect the soil and maintain or improve the quantity and quality of desirable vegetation.

Used on all public and private rangeland, native pasture, grazed wildlife land, grazeable forest land, and riparian areas.

### **Purposes**

1. Increase the vigor and reproduction of key plant communities
2. Accumulate litter and mulch necessary to reduce erosion and sedimentation and improve water quality
3. Improve or maintain the condition of vegetation and increase production
4. Maintain natural beauty
5. Maintain or improve soil fertility and soil quality

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

Natural Resources Conservation Service Field Office Technical Guide

NRCS National Range Handbook

Bureau of Land Management Technical References

U.S. Forest Service Watershed Conservation Practices Handbook and other technical references

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

grazing management techniques and strategies such as rotational grazing, deferred grazing, proper grazing use; facilitative components such as fencing and water development; brush management

## **SOIL STABILIZATION IN RIPARIAN AREAS**

### **Definition**

Using vegetation and/or structures in-stream, on banks, and on immediately adjacent areas of streams or constructed channels to stabilize and protect against scour and erosion.

Used on public and private riparian areas in all land uses.

### **Purposes**

1. Reduce sediment loads which cause downstream or in-stream damage
2. Improve or restore a stream for recreation or as a habitat for fish and/or wildlife
3. Control channel meander that may adversely affect onsite and downstream facilities
4. Prevent the loss of land or damage to utilities, roads, buildings, or other facilities adjacent to the channel banks
5. Minimize impacts of human activities within riparian, sensitive and wet areas

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

USDA Natural Resources Conservation Service Field Office Technical Guide  
U.S. Forest Service Watershed Conservation Practices Handbook and other technical references  
USDI Bureau of Land Management Technical References  
Colorado State University Cooperative Extension

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

streambank protection and stream channel stabilization; stabilization of critically eroding areas; buffer strips; wildlife habitat management strategies; livestock grazing management

## **IRRIGATION WATER MANAGEMENT**

### **Definition**

Determining and controlling the rate, amount, and timing of irrigation water in a planned and efficient manner.

Used on all irrigated agricultural lands.

### **Purposes**

1. Manage and control the moisture environment of crops to promote the desired crop response
2. Minimize soil erosion and loss of plant nutrients and agri-chemicals
3. Control undesirable water loss either through runoff or leaching
4. Reduce degradation of water resource due to salinity

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

USDA Natural Resources Conservation Service Field Office Technical Guide  
Colorado Irrigation Guide  
Colorado State University Cooperative Extension  
Best Management Practices for Colorado Agriculture

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

irrigation structural improvements, including but not limited to pipelines, ditch and canal lining; irrigation water management, timing and application; subsurface moisture monitoring; land leveling, surge valves, cablegation, conversion to sprinklers

## **SOIL STABILIZATION IN CROPLANDS**

### **Definition**

Utilizing existing plant residues, temporary or permanent vegetative cover and/or structures to reduce erosion and minimize sediment transport.

Used on all agricultural lands with the potential for wind and water erosion.

### **Purposes**

1. Prevent sediment and soil-borne pollutants from entering surface water
2. Improve or maintain good physical, chemical and biological conditions of the soil
3. Improve water use efficiency
4. Improve wildlife habitat
5. Break reproduction cycles of plant pests

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

USDA Natural Resources Conservation Service Field Office Technical Guide  
Colorado State University Cooperative Extension  
Best Management Practices for Colorado Agriculture

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

crop residue management techniques, for instance conservation tillage  
conservation cropping sequences or rotations  
terraces, strip cropping, contour farming  
buffer strips, green manure crops

## NUTRIENT MANAGEMENT

### **Definition**

Application of nutrients based on crop needs, and accounting for all sources of nutrients (commercial fertilizer, manure or sludge, irrigation water, atmospheric sources, composted products, etc.).

Used on all lands where nutrients are applied.

### **Purposes**

1. Minimize availability of nutrients for transport by eliminating over-application
2. Reduce nutrient loading to surface and ground water

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

USDA Natural Resources Conservation Service Field Office Technical Guide  
Colorado State University Cooperative Extension  
Best Management Practices for Colorado Agriculture

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

nutrient budgeting  
legumes in rotation  
green manure crops  
animal waste utilization  
fall-planted scavenger crops  
precision application of agri-chemicals

## **INTEGRATED PEST MANAGEMENT**

### **Definition**

Utilizing integrated pest management strategies, evaluating all options to determine the appropriate treatment to deal with target pests. When pesticides are used, some considerations include: selecting the appropriate chemical, using the minimum effective rate, and timing the application for the targeted pest.

Used on all lands where pests are managed.

### **Purposes**

1. Reduce reliance upon chemicals by integrating all pest management options, considering biological, cultural, and mechanical means as appropriate
2. Minimize pesticide loss to surface and ground water by eliminating over-application

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

USDA Natural Resources Conservation Service Field Office Technical Guide  
Colorado State University Cooperative Extension  
Best Management Practices for Colorado Agriculture

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

pest scouting; precision application of agri-chemicals  
trap cropping and crop rotations  
chemical mixing centers  
mowing or grazing  
biologic and cultural alternatives



## **FOREST MANAGEMENT**

### **Definition**

Managing multiple uses on forest lands in a manner that will maintain or improve the quality and quantity of desirable forest vegetation.

Used on any public or private forest land managed for any purpose.

### **Purposes**

1. Maintain sufficient vegetation to reduce erosion and sedimentation
2. Maintain litter and mulch necessary to reduce erosion and sedimentation
3. Maintain natural beauty and visual quality
4. Maintain and protect existing uses
5. Minimize hazard of dangerous wildfires
6. Maintain or improve habitat conditions for fish and wildlife

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

Colorado Timber Industry Association Silviculture BMPs

Colorado State Forest Service Technical References

USDA Natural Resources Conservation Service Field Office Technical Guide

U.S. Forest Service Watershed Conservation Practices Handbook and other technical references

USDI Bureau of Land Management Technical References

Colorado State University Cooperative Extension Technical References

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

proper timber harvesting that minimize erosion; woodland thinning or pruning for tree health; road construction and management techniques that minimize erosion and controls runoff; drainage control measures; grazing management strategies; recreation area management strategies

## **SOIL STABILIZATION ON FOREST LANDS**

### **Definition**

Using vegetation and/or structures to reduce erosion and minimize sediment transport.

Used on any public or private forest land where there is, or is likely to be, an accelerated level of erosion and/or sedimentation due to the activity of man, and in or near any area within forest lands considered to contain sensitive and important values that require a higher than normal level of management attention and protection.

### **Purposes**

1. Minimize soil loss, and maintain or improve soil quality
2. Minimize or eliminate degradation of water quality
3. Rehabilitate areas where an unacceptable level of erosion and/or stream/lake sedimentation is already occurring
4. Restore and maintain fisheries that have been damaged or destroyed by sedimentation
5. Maintain or improve the quality and integrity of sensitive areas such as, but not limited to, research, natural, scenic, and unstable geologic areas.

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

Colorado Timber Industry Association Silviculture BMPs

Colorado State Forest Service Technical References

USDA Natural Resources Conservation Service Field Office Technical Guide

U.S. Forest Service Watershed Conservation Practices Handbook and other technical references

USDI Bureau of Land Management Technical References

Colorado State University Cooperative Extension Technical References

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

stabilization of critically eroding areas; proper road construction, rehabilitation or closure; grade stabilization structures; revegetation; buffer strips; sediment basins

## **ANIMAL WASTE MANAGEMENT**

### **Definition**

Handling animal waste in a manner that minimizes impacts or potential impacts to surface or ground water, including issues such as collection, storage and land application.

Used on small to medium size confined animal feeding operations that fall outside the point source category.

### **Purposes**

1. Prevent ground and surface water contamination
2. Properly apply animal waste to cropland

### **Planning and Implementation Tools**

The following references and guides provide the specific information necessary for planning, installing, operating and maintaining the appropriate components to this best management practice.

USDA Natural Resources Conservation Service Field Office Technical Guide  
Agricultural Waste Management Field Handbook  
Colorado State University Cooperative Extension  
Best Management Practices for Colorado Agriculture  
Colorado Cattle Feeders Association MEAT Program

### **Who to Contact for Assistance in Planning and Implementation**

The best source of assistance for planning and implementing any best management practice will be in the locality where the BMPs are used. Local offices of the various natural resource management agencies, whether local, state, or federal, can develop site-specific recommendations or designs that account for the local climate, soils, hydrology, etc., as well as any social or cultural considerations. In addition, topic-related professional organizations may also have the resources to provide assistance.

### **Examples of What Might be Included in this BMP**

Storage lagoons, manure testing, composting, nutrient budgets, runoff diversions, filter strips, buffer areas, constructed wetlands, alternative feeding strategies

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## **VIII. Summary of Projects, through 12/31/98**

### **Section 319 Grants, FY 1998**

Dry Creek Basin Continuation: grazing management on rangeland, with mixed ownership, intended to reduce sediment and improve riparian habitats. Original project funded in FY 1995. Sponsored by the San Miguel Basin Soil Conservation District for the local Coordinated Resource Management Committee.

Ag BMP Effectiveness Assessment: determine the current mass balance of nitrates in the ground water beneath the San Luis Valley, to establish a baseline against which to compare future BMP implementation efforts for effectiveness. Sponsored by the Center Soil Conservation District for the local coordinating committee.

Ogallala Water/Nutrient Management Demonstration: demonstrates and educates on the BMPs that can be used to protect the Ogallala Aquifer. Sponsored by and located on the Irrigation Research Foundation farm.

### **FY 1997**

Demonstration of BMPs for Irrigated Agriculture: Field demonstrations in the north Front Range area. Sponsored by the Northern Colorado Water Conservancy District. Continuation funding.

Silviculture BMPs: Development of a silvicultural BMP guidebook and establishment of two demonstration sites in timber harvest areas. Sponsored by Colorado State Forest Service.

Owl Mountain Watershed: Continuation of a project originally funded in FY 95, intended to reduce sediment and restore riparian habitat in east and southeast Jackson County. Sponsored by the Colorado Wildlife Heritage Foundation for the Owl Mountain Partnership.

Animal Waste Education Project: A three phase project sponsored by the Colorado Cattle Feeders Association which held a satellite conference on animal waste issues, developed a traveling workshop to information producers on the issues on their sites, and conduct field demonstrations of low cost BMPs for managing animal waste. Continuation funding.

### **FY 1996**

Demonstration of BMPs for Irrigated Agriculture: first year of project described in FY 1997.

Animal Waste Education Project: first year of project described in FY 1997.

Lower Gunnison BMPs: Develop a local BMP guidebook for agriculture and hold workshops to inform land users. Sponsored by Shavano Soil Conservation District.

Lower South Platte BMP Demonstration: Field demonstrations of BMPs for irrigated agriculture in three counties; essentially the last area where demonstrations were needed, especially related to surface irrigation. Sponsored by Cooperative Extension.  
**FY 1995**

Dry Creek Basin Watershed Project: first year of project described in FY 1998.

Owl Mountain: first year of project described in FY 1997.

San Luis Valley Demonstration Project: Provide additional cost share assistance in the USDA Water Quality Demonstration Project area, to address BMP implementation needs not covered by the USDA portion of the project. Sponsored by the San Luis Valley Resource Conservation and Development Council.

#### **FY 1994**

Agricultural Chemical Recovery Program: Pilot program to provide farmers and ranchers with a safe alternative to dispose of expired, illegal and overstocked agricultural chemicals. Sponsored by Cooperative Extension.

Bent-Prowers BMP Demonstration Project: Field demonstrations of BMPs for irrigated agriculture in Bent and Prowers County. Sponsored by the Prowers Soil Conservation District.

Farmers Independent Ditch: Project was to develop nutrient management plans for producers along the Farmers Independent Ditch, and assist with implementation. Sponsored by Central Colorado Water Conservancy District.

#### **FY 1993**

Irrigation and Nutrient Management Demonstration: Similar to those described above; sponsored by Northern Colorado Water Conservancy District.

Coordinated Resource Management: Held workshops across the state to train local watershed leaders in establishing local coordinated resource management committees. Sponsored by the Colorado Association of Soil Conservation Districts.

#### **FY 1992**

Groundwater Protection Project: First year of project in the San Luis Valley cooperating with the USDA Demo Project.

#### **FY 1991**

North Fork of the Republican: Watershed project to reduce sediment, restore riparian vegetation and improve aquatic habitat along the North Fork of the Republican. Sponsored by the Yuma County SCD.

Small Lot Grazing Project: Education project in Boulder County to inform small acreage owners of BMP opportunities. Sponsored by Boulder Valley SCD.

Longmont Composting Project: An extension of the Boulder Valley project; demonstrate composting of animal waste from a medium-size confined animal feeding operation. Sponsored by the Longmont Soil Conservation District.

**FY 1990**

Badger Creek: Watershed project to implement BMPs to reduce sediment and restore brown trout spawning areas of the Arkansas River. Sponsored by the Sangre de Cristo Resource Conservation and Development Council for the local coordinating committee.

**Section 201 (g)(1)(b) Governor's Discretionary Funds**

**FY 1992**

Irrigation Management: Sponsored by the Northern Colorado Water Conservancy District. Funded each year from FY 89 through 92.

Boulder Creek Riparian Restoration: installation of various BMPs to restore the riparian habitat of the Boulder Creek, and restore designated uses. Sponsored by the City of Boulder. Funded each year from FY 89 through 92.

Patterson Hollow: complementary project to the USDA Hydrologic Unit Project in Otero and Pueblo Counties; facilitate the implementation of BMPs and assess effectiveness. Sponsored by the West Otero Soil Conservation District.

**FY 1990**

Badger Creek: see above, 319 funding, FY 1990.

**FY 1989**

Milk/Alkali Creeks: BMPs installed to reduce streambank erosion. Sponsored by Eagle County.

### Best Management Practices used in each project

Project	SOIL STABILIZATION ON GRAZING LANDS	GRAZING MANAGEMENT	SOIL STABILIZATION IN RIPARIAN AREAS	IRRIGATION WATER MANAGEMENT	SOIL STABILIZATION IN CROPLANDS	NUTRIENT MANAGEMENT	INTEGRATED PEST MANAGEMENT	FOREST MANAGEMENT	SOIL STABILIZATION ON FOREST LANDS	ANIMAL WASTE MANAGEMENT	EDUCATION EFFORT ONLY, NO FIELD DEMO
Ag BMP Effectiveness Assessment											x
Agricultural Chemical Recovery Program											x
Animal Waste Education Project										x	
Badger Creek	x	x	x						x		
Bent-Prowers BMP Demonstration				x	x	x					
Boulder Creek Riparian Restoration			x								
Coordinated Resource Management											x
Demonstration of BMPs for Irrigated Agriculture				x		x					
Dry Creek Basin Coordinated Resource Management	x	x	x								
Longmont Composting Project										x	
Lower South Platte BMP Demonstration				x		x					
Lower Gunnison BMPs											x
Milk/Alkali Creeks			x								
Ogallala Water & Nutrient Management Demonstration				x		x					



Project	SOIL STABILIZATION ON GRAZING LANDS	GRAZING MANAGEMENT	SOIL STABILIZATION IN RIPARIAN AREAS	IRRIGATION WATER MANAGEMENT	SOIL STABILIZATION IN CROPLANDS	NUTRIENT MANAGEMENT	INTEGRATED PEST MANAGEMENT	FOREST MANAGEMENT	SOIL STABILIZATION ON FOREST LANDS	ANIMAL WASTE MANAGEMENT	EDUCATION EFFORT ONLY, NO FIELD DEMO
Owl Mountain	X	X	X								
San Luis Valley Demonstration Project				X	X	X	X				
Silviculture BMPs								X	X		
Small Lot Grazing Project		X								X	

# Appendix

Colorado Nonpoint Source Task Force

Agriculture/Silviculture Subcommittee

White Paper

**PRIORITIES, CONCERNS AND  
CHARACTERIZATIONS**

July 1994

updated May 1997

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## INTRODUCTION

Section 319 of the 1987 Federal Water Pollution Control Act provides a framework for determining nonpoint source water quality concerns and developing the programs for addressing those concerns. The Colorado Nonpoint Assessment Report, which identified the water resources impacted by nonpoint sources, was first approved in 1989 and is updated every two years through the 305(b) "Status of Water Quality" report of the Water Quality Control Division. The Colorado Nonpoint Source Management Program, approved in October 1990, described how the impacted waters would be improved. As the needs of priority watersheds identified in the management program were addressed by local efforts, it became necessary to develop another mechanism to assign priorities for future nonpoint source efforts.

This white paper for agriculture and silviculture was developed to assist the Colorado Nonpoint Source Task Force and the Agriculture/Silviculture Subcommittee determine program direction for nonpoint source control efforts. The intended outcome of the paper is to prioritize the nonpoint source issues which are most relevant within each river basin in Colorado by considering both the agriculture and silviculture production activities and the identified water quality concerns in those basins. This paper will guide the efforts of the Task Force in soliciting and encouraging water quality improvement projects, and in determining priorities for funding.

The Agriculture and Silviculture Nonpoint Source Management Plan, which is a chapter of the 1990 program, was revised in May 1997, primarily to address the needs of advancing technology, but also to recognize the "lessons learned" from the first few years of the nonpoint source program. This white paper should be used in conjunction with the Ag/Silv Management Program.

The white paper is a proactive planning tool to assist project sponsors in preparing project proposals. Information and education, pollution prevention, demonstration, and watershed project proposals submitted for funding will be compared to the priorities in this white paper. Projects which address priorities in this paper will rank higher than other projects.

This white paper will be refined from time to time, as new agricultural production information, water quality data, and the results of water quality improvement efforts become available.

## NONPOINT SOURCE CONCERNS AND AGRICULTURAL CHARACTERIZATION OF COLORADO, BY RIVER BASIN

	GREEN RIVER	UPPER COLORADO RIVER	LOWER COLORADO RIVER
Miles of stream impacted by Nonpoint Sources (unless otherwise noted, all related to agriculture)	343.5	153 - agriculture 28 - silviculture	181
Priority NPS issues	Riparian management and restoration Grazing Recreational activities	Riparian management and restoration Grazing Recreational activities	Riparian management and restoration Grazing Irrigated agriculture Salinity management
Average annual discharge, in acre-feet [data years in ( )]	Yampa River: 1,623,000 (1983 - 1993) at Deer Lodge Pk. White River: 595,100 (1983 - 1993) at Rangely	2,478,000 (1967 - 1993) below Glenwood Springs	4,491,000 (1951 - 1993) near the State line
Precipitation range, in inches	8 - 60+	12 - 60+	8 - 40+
Geographic boundaries	Utah and Wyoming state line on the west and north; Continental Divide on the east; Flat Tops, White River and Roan Plateaus on the south	Flat Tops on the northwest; Continental Divide on the north and east; Elk Mountains on the west and south; breaking at Glenwood Springs	White River and Roan Plateaus and Flat Tops on the north; Glenwood Springs on the east; Grand Mesa on the south; state line on the west
Major land resource areas (Natural Resources Conservation Service)	D34A Central Desertic Basins D34B Central Desertic Mountains and Foothills D34C Central Cold Desertic Plateaus E47 Wasatch and Uinta Mountains E48A southern Rocky Mountains	D34B Central Desertic Mountains and Foothills E48A Southern Rocky Mountains E48B Southern Rocky Mountain Parks	D34B Central Desertic Mountains and Foothills D35 Colorado and Green River Plateaus E48A Southern Rocky Mountains
Ecoregions (Environmental Protection Agency)	18 Wyoming Basin: 1-Semiarid to Arid Shrublands 20 Colorado Plateaus: 1-Desert Shrublands 2-Salt deserts 3-Wooded Uplands	20 Colorado Plateaus: 1-Desert Shrublands 21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevation Semi-Desert Shrublands	20 Colorado Plateaus: 1-Desert Shrublands 2-Salt deserts 3-Wooded Uplands 21 Southern Rockies 1-High Elevations Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevations Semi-Desert Shrublands

	<b>GUNNISON RIVER</b>	<b>DOLORES/SAN MIGUEL</b>	<b>SAN JUAN RIVER</b>
Miles of stream impacted by Nonpoint Sources (unless otherwise noted, all related to agriculture)	174.5	40.5	215
Priority NPS issues	Riparian management and restoration Grazing Irrigated agriculture Salinity management	Riparian management and restoration Grazing	Riparian management and restoration Grazing Road construction and maintenance, especially on public lands Irrigated agriculture, especially nonpoint source preventative measure Small acreage management
Average annual discharge, in acre-feet [data years in ( )]	1,873,000 (1897 - 1993) near Grand Junction	274,300 (1985 - 1993) downstream from W. Paradox Creek	1,733,000 (1978 - 1993) near NM/CO State line, downstream from Mancos River
Precipitation range, in inches	8 - 50+	8 - 50+	8 - 60 +
Geographic boundaries	Grand Mesa and Elk Mountains on the north and east; Continental Divide on the east and south; Uncompahgre Plateau on the south and west	Uncompahgre Plateau on the north and east; San Juan Mountains on the east and south; Utah state line on the west	San Juan Mountains and Continental Divide on the north and east; New Mexico and Utah state lines on the south and west
Major land resource areas (Natural Resources Conservation Service)	E34B Central Desertic Mountains and Foothills E35 Colorado and Green River Plateaus E48A Southern Rocky Mountains E48B Southern Rocky Mountain Parks	D34B Central Desertic Mountains and Foothills D35 Colorado and Green River Plateaus D39 Arizona and New Mexico Mountains E48A Southern Rocky Mountains	D35 Colorado and Green River Plateaus D37 San Juan River Valley Mesas and Plateaus D39 Arizona and New Mexico Mountains E48A Southern Rocky Mountains
Ecoregions (Environmental Protection Agency)	20 Colorado Plateaus: 1-Desert Shrublands 21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevations Semi-Desert Shrublands	20 Colorado Plateaus: 1-Desert Shrublands 21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevations Semi-Desert Shrublands	20 Colorado Plateaus: 1-Desert Shrublands 21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevations Semi-Desert Shrublands 22 Arizona/New Mexico Plateau: 1-Shrublands 2-Irrigated Flatlands 3-Saltdeserts

	<b>RIO GRANDE RIVER</b>	<b>UPPER ARKANSAS RIVER</b>	<b>LOWER ARKANSAS RIVER</b>
Miles of stream impacted by Nonpoint Sources (unless otherwise noted, all related to agriculture)	146	102	309
Priority NPS issues	Irrigated agriculture, especially as it related to ground water - pesticide and nutrient management Road construction and maintenance Riparian management and restoration Grazing	Riparian management and restoration Grazing Recreational activity	Irrigated agriculture - pesticide and nutrient management - salinity control Confined animal feeding operations
Average annual discharge, in acre-feet [data years in ( )]	325,000 (1931 - 1993) 5 miles north of State line	523,100 (1975 - 1993) 0.5 miles below Pueblo Dam	142,200 (1951 - 1993) 2 miles below State line
Precipitation range, in inches	7 - 50+	8 - 30+	8 - 16+
Geographic boundaries	Sangre de Cristo and Culebra Ranges on the north and east; New Mexico state line on the south; Continental Divide/San Juan and La Garita Mountains on the west and north	Mosquito Range on the north and east; approximately Interstate 25 on the east; Sangre de Cristo and Culebra Ranges on the south; Continental Divide on the west and north	Approximately Interstate 25 on the west; Palmer Divide and Smoky Hill Trail on the north; Kansas, Oklahoma and New Mexico state lines on the east and south
Major land resource areas (Natural Resources Conservation Service)	E48A Southern Rocky Mountains E51 High Intermountain Valleys	E48A Southern Rocky Mountains E48B Southern Rocky Mountain Parks E49A Southern Rocky Mountain Foothills (dry) E49B Southern Rocky Mountain Foothills	G67 Central High Plains G69A Upper Arkansas Valley Rolling Plains G69B Upper Arkansas Valley Rolling Plains, dry G70 Pecos-Canadian Plains and Valleys H77 Southern High Plains
Ecoregions (Environmental Protection Agency)	21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevation Semi-Desert Shrublands 22 Arizona/New Mexico Plateau 1-Shrublands 2-Irrigated Flatlands 3-Saltdeserts	21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevation Semi-Desert Shrublands	25 Western High Plains 1-Rolling Sand Plains 2-Moderate Relief Rangeland 3-Flat to Rolling Cropland 26 Southwestern Tablelands 1-Grasslands

	<b>NORTH PLATTE RIVER</b>	<b>UPPER SOUTH PLATTE RIVER</b>	<b>LOWER SOUTH PLATTE RIVER</b>
Miles of stream impacted by Nonpoint Sources (unless otherwise noted, all related to agriculture)	15 - silviculture	102	348.5
Priority NPS issues	Grazing Riparian management and restoration Road construction and maintenance	Riparian management and restoration Grazing Road Construction and maintenance Small acreage management Recreational activity	Irrigated agriculture - nutrient/pesticide management - salinity - sediment Confined animal feeding operations
Average annual discharge, in acre-feet [data years in ( )]	313,600 (1904 - 1993) 4.5 miles upstream of State line	400,800 (1976 - 1993) @ Henderson in Adams County	387,100 (1902 - 1993) 3 miles upstream CO/NE State line
Precipitation range, in inches	12 - 60+	16 - 40+	8 - 16
Geographic boundaries	Wyoming state line on the north; Medicine Bow Range on the east; Continental Divide on the south and west	Medicine Bow Range and Continental Divide on the west; Mosquito Range and Rampart Range on the west and south; Palmer Divide on the south; the divide between Cherry Creek and Running (Box Elder) Creek and approximately US Hwy 287 on the east; Wyoming state line	Approximately US Hwy 287 on the west; Wyoming and Nebraska state lines on the north and east; the divide between the South Platte and Republican Rivers on the south
Major land resource areas (Natural Resources Conservation Service)	E48A Southern Rocky Mountains E48B Southern Rocky Mountain Parks	E48A Southern Rocky Mountains E48B Southern Rocky Mountain Parks E49B Southern Rocky Mountain Foothills	E49B southern Rocky Mountain Foothills G67 Central High Plains H72 Central High Tableland
Ecoregions (Environmental Protection Agency)	18 Wyoming Basin: 1-Semiarid to Arid Shrublands 21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations	18 Wyoming Basin: 1-Semiarid to Arid Shrublands 21 Southern Rockies: 1-High Elevation Tundra 2-Cool and Moist Forests of the Middle to High Elevations 3-Warm and Dry Forests of the Middle to Low Elevations 4-Low to Middle Elevation Semi-Desert Shrublands 25 Western Relief Plains: 2-Moderate Relief Rangeland 3-Flat to Rolling Cropland	25 Western High Plains 1-Rolling Sand Plains 2-Moderate Relief Rangeland 3-Flat to Rolling Cropland



	<b>REPUBLICAN RIVER</b>
Miles of stream impacted by Nonpoint Sources (unless otherwise noted, all related to agriculture)	15
Priority NPS issues	Riparian management and restoration Grazing Road construction and maintenance, especially as related to snow removal Irrigation Ground water protection Confined animal feeding
Average annual discharge, in acre-feet [data years in ( )]	N. Fork: 33,080 (1935 - 1993) @CO/NE state line (only USGS data available; does not address entire basin)
Precipitation range, in inches	12 - 16
Geographic boundaries	Nebraska and Kansas state lines on the east; Smoky Hill Trail on the south; extreme east end of Palmer Divide on the west; South Platte River divide on the north
Major land resource areas (Natural Resources Conservation Service)	G67 Central High Plains H72 Central High Tableland
Ecoregions (Environmental Protection Agency)	25 Western High Plains 1-Rolling Sand Plains 2-Moderate Relief Rangeland 3-Flat to Rolling Cropland

## AGRICULTURAL TRENDS IN COLORADO

Depicting trends in agricultural production in Colorado can be a difficult task. Seasonal and yearly variations can be significant, depending on weather (both here and across the country), on what government programs are most popular (e.g. Conservation Reserve Program), and on the regulatory atmosphere. The observations made here should be viewed in light of the nature of the variability of the industry.

Most classes of livestock, using data from 1989 to 1996 are showing an upward trend. The exception are sheep; in 1994 the trend was slightly upward although inventory was dropping. In 1997, the trend is definitely downward. Cattle numbers are tending slightly higher, as are chickens. Hogs and pigs are trending significantly upward, despite a drop in total hog operations. A number of large hog operations have opened in the past few years.

When total principal crop production is assessed (using data from 1971 to 1995), planted acres have increased in each of the last three years, as have harvested acres. This is a move upward from the 1994 white paper, but still far below the 1984 and 1985 numbers, before the Conservation Reserve Program was enacted.

<b>STATEWIDE AVERAGES</b>	<b>1993</b>	<b>1996</b>
Number of farms	25,500	25,000
Land in Farms	32,800,000 acres	32,700,000 acres
Average farm size	1286 acres	1308 acres
Cropland acreage, approximate	11.0 million	10.9 million
Irrigated acreage, approximate	3.0 million	3.2 million
Total cattle operations, (includes feedlots)	14,000	13,000
Sheep operations	1800	1300
Hog operations	1600	1400