ANNUAL REPORT
FOR 1996

STATUS OF IMPLEMENTATION OF SENATE BILL 90-126 THE AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION ACT

Colorado Department of Agriculture
Colorado State University Cooperative Extension
Colorado Department of Public Health and Environment

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In the report dated December 31, 1995, several goals for 1996 were identified by the cooperating agencies. The progress made toward each of the goals is detailed in the following pages.

Memoranda of Understanding

Memoranda of Understanding as provided in Section 25-8-205.5 (3)(f) and (g) of the Act have been signed for fiscal year 1996/97 between the Colorado Department of Agriculture and: 1) Colorado State University Cooperative Extension, 2) the Colorado Department of Public Health and Environment. The objectives for 1996 for this program are stated on pages 9 and 10.

Education and Communication

Communication is a vital component of the program. Numerous methods are used to provide information to individuals and organizations affected by the program as well as the general public. Fact sheets are prepared to provide information on the program and are being distributed at meetings, conferences and trade shows. Also, a display board is being utilized at conferences and trade shows to provide information on the program. A short video entitled Protecting Colorado's Groundwater is available to inform the general public on groundwater quality, agricultural chemicals and the Act. This video may be borrowed from the Department of Agriculture or

copies may be purchased from the CSU bulletin room. Information on the program is continually being presented to the public through radio shows, mass media, press releases and at presentations at meetings throughout the state.

Development pressures in once rural outlying areas have heightened public awareness of the potential for impacts to water quality. The program has responded to these concerns by offering technical assistance to water conservancy districts, groundwater management districts, and other local entities interested in evaluating water quality in their area. Presentations of how the program works, past and present water quality projects, and plans for future projects with request for local input are made at every opportunity. We consider this type of outreach an important part of the customer service component of the program.

The initiation of the National Certified Crop Advisor program in Colorado has dovetailed into this program to provide a mechanism for training and education regarding the correct use of agricultural chemicals. Over 150 crop consultants and advisors have passed the national and state exam and proven sufficient experience to be certified as crop advisors in Colorado. These individuals and others to be certified in the future are required to obtain continuing education units to maintain their certification. This affords an ideal opportunity to provide information concerning pesticides and fertilizers and groundwater protection to those making recommendations to farmers.

Best Management Practices

Best Management Practices (BMPs) are being developed at the user level through extensive local input. A general BMP notebook for Colorado Agriculture has been completed and consists of eight subject specific BMP chapters and one booklet providing an overview of the BMP process. The notebook has been provided to producers, pesticide and fertilizer dealers, CSU Cooperative Extension offices, and all USDA Natural Resources Conservation Service offices.

In 1996, an economic analysis of the BMPs was performed to determine the cost of implementing the BMPs that required purchasing a service or product to adopt the practice. This information is being condensed into fact sheets that agricultural chemical users can easily utilize. All of the BMP chapters are available through the CSU Bulletin Room.

The statewide notebook is being utilized to guide local work groups through the BMP development process for regionally specific BMPs. Localized BMP development is continuing in the San Luis Valley, the South Platte River Basin from Denver to the Nebraska state line, and the Uncompahgre Valley of the western slope.

In the San Luis Valley, a booklet entitled Best Management Practices for Nutrient and Irrigation Management in the San Luis Valley was completed in 1994 and published in cooperation with the San Luis Valley Water Quality Demonstration Project. The group then began developing pesticide management BMPs for specific crops in the San Luis Valley. In the past year they have published their findings in two booklets entitled: Best Management Practices for Potato Pest Management in the San Luis Valley and Best Management Practices for Small Grain Pest Management in the San Luis Valley (Appendix I).

A local group centered in the Montrose area of the Uncompahgre Valley, headed by the Shavano Soil Conservation District, developed and published practices appropriate to this area on the western slope entitled: Best Management Practices for the Uncompahgre Valley (Appendix I).

Localized BMPs for the Front Range/South Platte Basin have also been completed. A document entitled Best Management Practices for Irrigated Agriculture was published from this group's efforts. Based on groundwater monitoring results through 1994, it was determined that additional resources also needed to be focused on the South Platte Basin. A request to the legislature was made for one additional FTE to focus on water quality educational activities in this area. The request was approved and a water quality specialist was hired in July to work exclusively in the South Platte Basin. This will greatly enhance the programs ability to provide information and work with farmers in this area. In addition, development of BMPs specifically for irrigated barley production has began.

In an effort to provide increased access to the BMPs as well as articulate the need for farmers to adopt water quality protection practices, a 20 minute instructional video was produced entitled: "Best Management Practices for Colorado Agriculture". The video show farmers speaking to why they have adopted practices and the need for continued diligence on their part to protect water quality. The video is available from the CSU Bulletin Room.

The use of pesticides and commercial fertilizers in urban areas also has the possibility to impact groundwater resources. Four fact sheets describing BMPs for urban pesticide and fertilizer have been developed and distributed. This project was completed in conjunction with the City of Colorado Springs which had identified a need to do pesticide use and disposal education to protect their wastewater treatment plant. The four fact sheets are entitled: Homeowner's Guide to Protecting Water Quality and the Environment, Homeowner's Guide to Pesticide Use Around the Home and Garden, Alternative Pest Management for the Lawn and Garden, and a Homeowner's Guide to Fertilizing your Lawn and Garden (Appendix I). These fact sheets are available from the CSU Bulletin Room or the Colorado Department of Agriculture.

Demonstration Sites and Field Days

Field demonstrations continue to be an integral part of the program to demonstrate BMPs to farmers. A new technology known as in-season nitrate testing was highlighted for demonstration. This tool may help farmers improve nitrogen recommendation accuracy and minimize the use of "insurance" fertilizer. Demonstration plots and field days will be utilized in the South Platte River Basin and the San Luis Valley in 1997. In the future, locations for these plots will be expanded to other regions of the state. (Appendix II).

Groundwater Monitoring

In 1996, the groundwater monitoring program sampled and analyzed groundwater in two areas of the state. The first was in the urbanized area of the front range. This is part of the regional surveys that are being conducted throughout the state to determine a baseline of impact by pesticides and fertilizers to groundwater. However this one differed from past surveys in that it was looking at urban uses of agricultural chemicals and not production agriculture. The second area was in the alluvial aquifer from Brighton to Greeley as a continuation of a long term monitoring effort in this area.

In the urban areas, 72 existing wells were sampled for nitrate and 46 pesticides. Most of the wells were privately owned domestic wells but nine monitoring wells located within the incorporated limits of communities in Weld County were also sampled. Nitrate analysis showed that 10% of all the wells exceeded the nitrate drinking water standard of 10 mg/L. However, if the monitoring wells sampled in Weld County are eliminated the nitrate exceedence drops to only half that or 5%. Pesticide data revealed the following three pesticides present in a portion of the well samples: atrazine, bromacil, and

prometon. The breakdown product of atrazine, deethyl atrazine was also present in those samples in which atrazine was detected. No pesticide detection exceeded a water quality standard. (Appendix III)

As part of the long term monitoring effort initiated in 1995, 87 wells in Weld County between Brighton and Greeley were sampled in June and July. Of the 87 wells used, 19 were monitoring wells and 68 were irrigation wells. All wells were analyzed for nitrate. The 19 monitoring wells were analyzed for the complete suite of 46 pesticides. The pesticide analysis for the irrigation wells was a immuno assay screen for the triazine herbicides. Nitrate analysis showed that 74% of the monitoring wells and 78% of the irrigation wells exceeded the nitrate drinking water standard of 10 mg/L. The pesticide analysis detected five pesticides: atrazine, bromacil, DCPA, metolachlor, and prometon. Three pesticide breakdown products were also detected: deethyl atrazine, aldicarb sulfoxide, and aldicarb sulfone. Atrazine was present in 53% of the wells, deethyl atrazine in 68% of the wells, metolachlor in 21% and prometon in 37%. Bromacil and DCPA were detected in only one well each. The level of metolachlor reached 30 µg/L (ppb) in one well. Detection levels for other pesticides averaged around one ppb. (Appendix III)

The triazine herbicide screen used on the irrigation wells detects any pesticide in this family, which includes atrazine, cyanazine, simazine, deethyl atrazine, and prometon. The results are calibrated in units of atrazine equivalent but may be actually composed of one or more of the components. In 1996, triazine herbicides were detected in 96% of the irrigation wells. Levels ranged from 0.05 µg/L to 1.28 µg/L (ppb). (Appendix III)

All of the groundwater sampling is closely coordinated with extension agents, water conservancy districts, other agencies, and local and county officials. Many of these agencies have groundwater monitoring projects analyzing for at least one agricultural chemical, usually nitrate.

One goal of the monitoring program as stated in the long range sampling plan (Appendix III) is to have a permanent state wide well monitoring network that can be used to gather long term data. The U.S. Geological Survey is continuing to drill monitoring wells throughout the state as part of the National Water Quality Assessment. These wells will form a substantial basis for the Agricultural Chemicals and Groundwater Protection program monitoring network. The USGS has indicated they would like the state groundwater protection program to take over ownership of some

of these wells that local agencies such as water conservancy districts have not claimed. The USGS will be forced to abandon the wells and plug them if they remain unclaimed. This is an excellent opportunity to establish a large part of the monitoring network. CDPHE is currently working out the details in taking over ownership of these wells.

Groundwater Vulnerability Determination

In the initial years of the program, vulnerability analysis was performed to prioritize groundwater monitoring and education efforts. To perform this analysis, current information was synthesized and priorities were developed; however, maps were not developed. The requirements of the proposed rule for State Management Plans for Pesticides being promulgated by EPA requires development of a sensitivity analysis/vulnerability assessment map of the state in a Geographic Information System (GIS) format by which to determine where to focus education and monitoring activities. Through grant funds from EPA, a sensitivity analysis pilot project was conducted to determine the sensitivity of groundwater to impact by pesticides for the northeastern part of the state. The process was received favorably by EPA. Additional grant funds were requested and have been received from EPA to complete the sensitivity analysis for the remainder of the state. This will be completed in 1997.

Groundwater Data Management System

The collection, evaluation and entering of existing groundwater quality data from all available sources is ongoing. The data that is currently available has been or is in the process of being entered into the groundwater quality database at the Department of Public Health and Environment. Other data has been generated, however it remains unavailable due to concerns about privacy and future use of the data (Appendix III).

Advisory Committee

The advisory committee continues to be an integral part of the implementation of this program by providing input from the many facets of the agricultural community and the general public that they represent (Appendix V). The committee met two times during 1996. All major program activities are discussed with the committee prior to implementation. The committee has been essential in providing input on program strategy by helping to determine which issues to address first, where geographically to focus efforts, critiquing drafted documents, providing ideas about the most effective means of

distributing materials, and giving comments on how the information will be received, in addition to many other items.

Coordination

Coordination with other projects and programs relating to agricultural chemicals and groundwater is an essential part of the implementation of the program. All three agencies work continually to keep abreast of other programs both governmental and private so information can be incorporated into the implementation of the Act as well this programs information passed on to other agencies and organizations. Input is sought in all phases of the implementation of this program to avoid duplication of efforts, costs, conflict or duplication of regulation and to insure decisions are made with the most complete knowledge available.

Storage Regulations

The rules and regulations as required in section 25-8-205.5 (3) (b) became effective September 30, 1994 (Appendix IV). As in 1995, 1996 was spent educating and providing information about the requirements of the rules and the time line for implementation. As required by law, owners of pesticide facilities must have their operations in compliance by September 30, 1997 and fertilizer facilities by September 30, 1999. Numerous facilities throughout the State have already been completed and others are diligently working toward compliance. As stated in last year's report, generic design plans for small to medium sized facilities have been developed and made available.

The Colorado Department of Agriculture requested the General Assembly for authority to hire one FTE to perform the facility inspections. Prior to beginning the inspections, an enforcement program will have to be developed as well as a database to track facility inspections and the results.

State Management Plan for Pesticides

EPA is developing a program which would require states to produce management plans for pesticides thought to be a significant groundwater hazard. If a state wants to allow continued use of any of the pesticides identified, it must produce an EPA-approved management plan specific to that pesticide. In June 1996, EPA published the proposed State Management Plan rule. In order to make pesticide users aware of the regulation and to gather comments to submit to EPA on the rule, the department held several meeting

around the state. Based on the input from these meetings, formal comments were developed and submitted. The comments were submitted under the joint signature of the directors of the three agencies involved in the agricultural chemicals and groundwater protection program. Copies of the comments submitted are available from the Colorado Department of Agriculture. (Appendix IV)

The program is developing a generic State Management Plan that can be adapted to different pesticides once EPA formally identifies these compounds. A draft of this plan has been submitted to EPA for review.

One requirement of the State Management Plan is to have county level pesticide use data. This data has never been developed for Colorado. To meet this need, grant funds from EPA have been obtained and the Colorado Agricultural Statistics Service has been contracted to perform a pesticide use survey. The survey will take place during the fall and winter of 1997-98.

Major Issues

In last year's report, the State Management Plan (SMP) for pesticides and current funding levels for two components of the program were identified as major issues. As discussed earlier, the legislature approved a decision item to increase the funding levels for the two components: education and training and groundwater monitoring.

The SMP is still a major concern. In the comments developed regarding the proposed rule, the program expressed its many concerns. In addition, the Colorado Department of Agriculture worked with the National Association of State Departments of Agriculture and the Association of American Pesticide Control Officials to provide comments and input to EPA on the proposed rule.

Objectives for 1997 Determined

The following objectives for 1997 have been established:

- Continue the development and implementation of localized BMPs for irrigated crops in the South Platte River Basin;
- Continue demonstration plots in the South Platte River area for displaying improved nitrogen and water management to farmers;
- Coordinate an interagency field day to deal with water quality issues in the South Platte River Basin;
- Continue the implementation of localized BMPs in the San Luis Valley and complete development of the localized pesticide use BMPs for the major crops;
- Continue BMP demonstration work in the San Luis Valley;
- Begin BMP implementation and demonstration in the Uncompahgre Valley;
- Continue the distribution of the BMP video;
- Complete fact sheets on the economic analysis of the BMPs and begin distribution;
- Complete a survey on the number of producers who have implemented best management practices and which practices they are adopting;
- Continue developing educational resource materials for groundwater education;
- Continue distribution of urban BMPs to encourage improved agricultural chemical and water management in urban areas;
- Continue to hold in-service training for chemical applicators, agency personnel, etc.;
- Participate in the Certified Crop Advisor program;

- Continue to provide information and training on the containment rules and regulations;
- Obtain funding and hire an inspector to perform inspections on facilities requiring compliance with the containment regulations;
- Begin inspections of facilities that must comply with the containment regulations;
- Complete the report of the groundwater samples taken during 1994 and 1995 in the Arkansas River Basin;
- Collect and analyze groundwater samples in the Ogallala aquifer for pesticides and nitrate;
- Continue the long term monitoring program in Weld County by collecting and analyzing groundwater samples for pesticides and nitrate;
- Complete the sensitivity analysis of groundwater to impact by pesticides for all of Colorado;
- Begin a pesticide use survey for Colorado;
- Obtain concurrence from EPA on the generic State Management Plan for pesticides;
- Obtain and input results of other groundwater monitoring for agricultural chemicals into the Agricultural Chemicals and Groundwater database;
- Integrate results of other projects to achieve goals in the Act;
- Continue disseminating information on the Act and groundwater protection to special interest groups in Colorado;
- Continue publishing and distributing fact sheets;
- Continue using the display board to provide information on the program at trade shows and professional meetings.

APPENDICES

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Best Management Practices for Integrated Pest Management in the San Luis Valley

Potato

San Luis Valley

Demonstration Project

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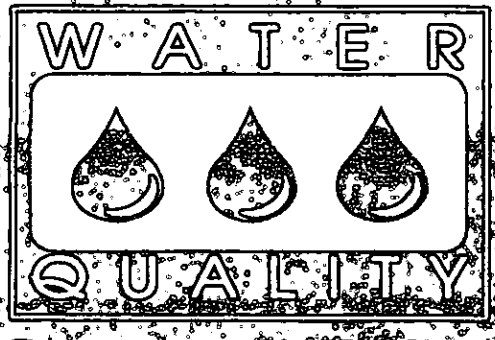
Best Management Practices for Integrated Pest Management in the San Luis Valley

Small Grains

San Luis Valley



Demonstration Project

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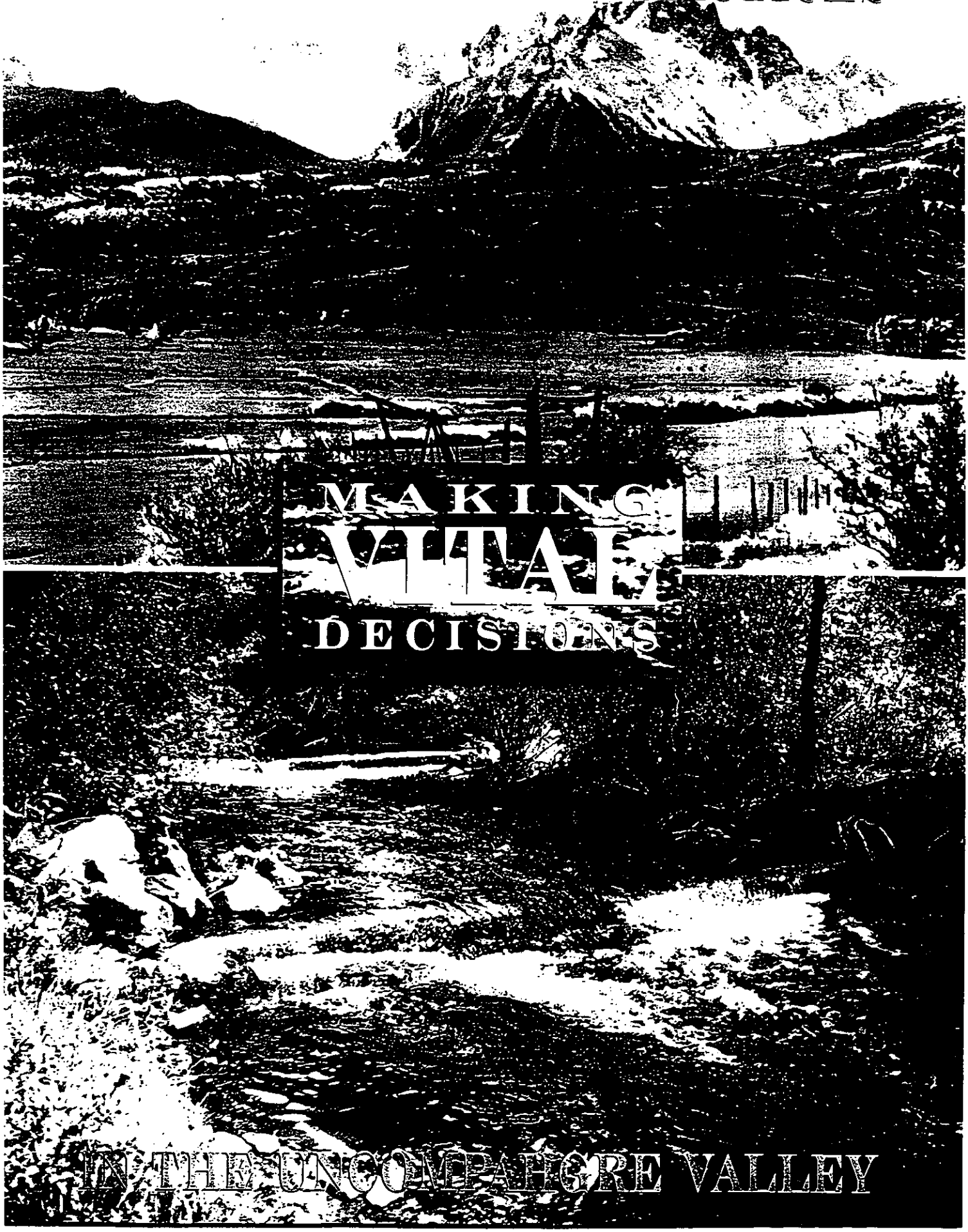
BEST MANAGEMENT PRACTICES

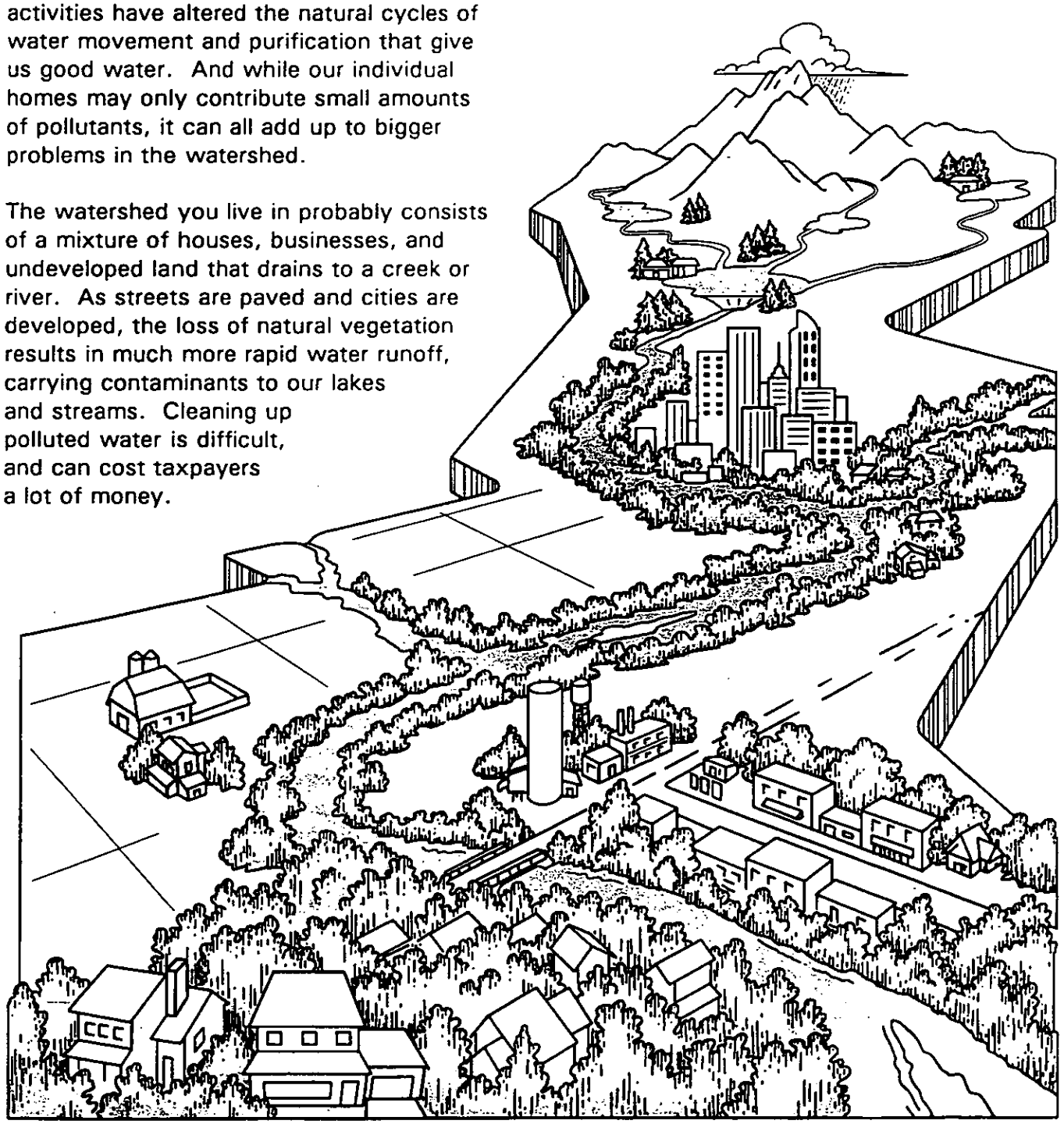


Homeowner's GUIDE

To Protecting Water Quality and the Environment

It's a fact of urban life - many of our activities have altered the natural cycles of water movement and purification that give us good water. And while our individual homes may only contribute small amounts of pollutants, it can all add up to bigger problems in the watershed.

The watershed you live in probably consists of a mixture of houses, businesses, and undeveloped land that drains to a creek or river. As streets are paved and cities are developed, the loss of natural vegetation results in much more rapid water runoff, carrying contaminants to our lakes and streams. Cleaning up polluted water is difficult, and can cost taxpayers a lot of money.



In the Home

The typical home has an amazing assortment of cleaning products, paints, solvents, oils, fertilizer, and pest control products stored in cabinets and garages. They seem to make our lives easier. And many of them fall within the Environmental Protection Agency's definition of a hazardous substance because they can catch fire, explode, corrode, or are toxic.

So no matter how beneficial they are, disposing of these products can cause some serious environmental problems if done incorrectly. For example, one of the worst ways to get rid of insecticide is to dump it down the drain. While the water from toilets and sinks goes to a municipal waste water treatment plant before returning to the watershed, some chemical wastes cannot be effectively treated there.

It doesn't take much to cause trouble; as little as one teaspoon of certain insecticides rinsed down a drain is enough to show up as a pollutant in local streams. This can cause a city's water treatment plant to fail federal guidelines designed to protect the watershed and our water quality.

In many cases there are non-hazardous or less hazardous products that will do the job just as well and won't pose a threat to community water. The best way to minimize the problem is to reduce the use of hazardous products. If you must use them, here are some other things you can do as well:

☛Buy only enough chemical for the immediate job.

☛Follow all label directions for use and disposal.

☛Store leftover products in their original containers.

☛Share unused products with neighbors.

☛Hire a professional service to apply chemicals.

☛Never dump leftover chemicals in your backyard, trash, down the drain or in storm sewers.

If you are unsure how to dispose of a chemical, contact your city or county health department or wastewater treatment plant.

	Signal word	Meaning
Most dangerous	Poison	highly toxic
↕	Danger	extremely flammable, corrosive, or highly toxic
↕	Warning	moderate hazard
↕	Caution	low/moderate hazard
Safest	No signal word	not hazardous

Hazardous Household Chemicals:

Automotive products: oil, battery acid, brake fluid, antifreeze, gasoline
Fertilizers and pesticides: herbicides, fungicides, insecticides, no-pest strips, flea collars, and pet shampoo
Household cleaners: spot removers, furniture polishes, deodorizers, drain cleaners, oven cleaners, disinfectants, moth repellants, ammonia
Maintenance supplies: paint, varnish, lacquer, turpentine, wood stains, wood preservatives, asphalt, asbestos, roofing tar, swimming pool chemicals

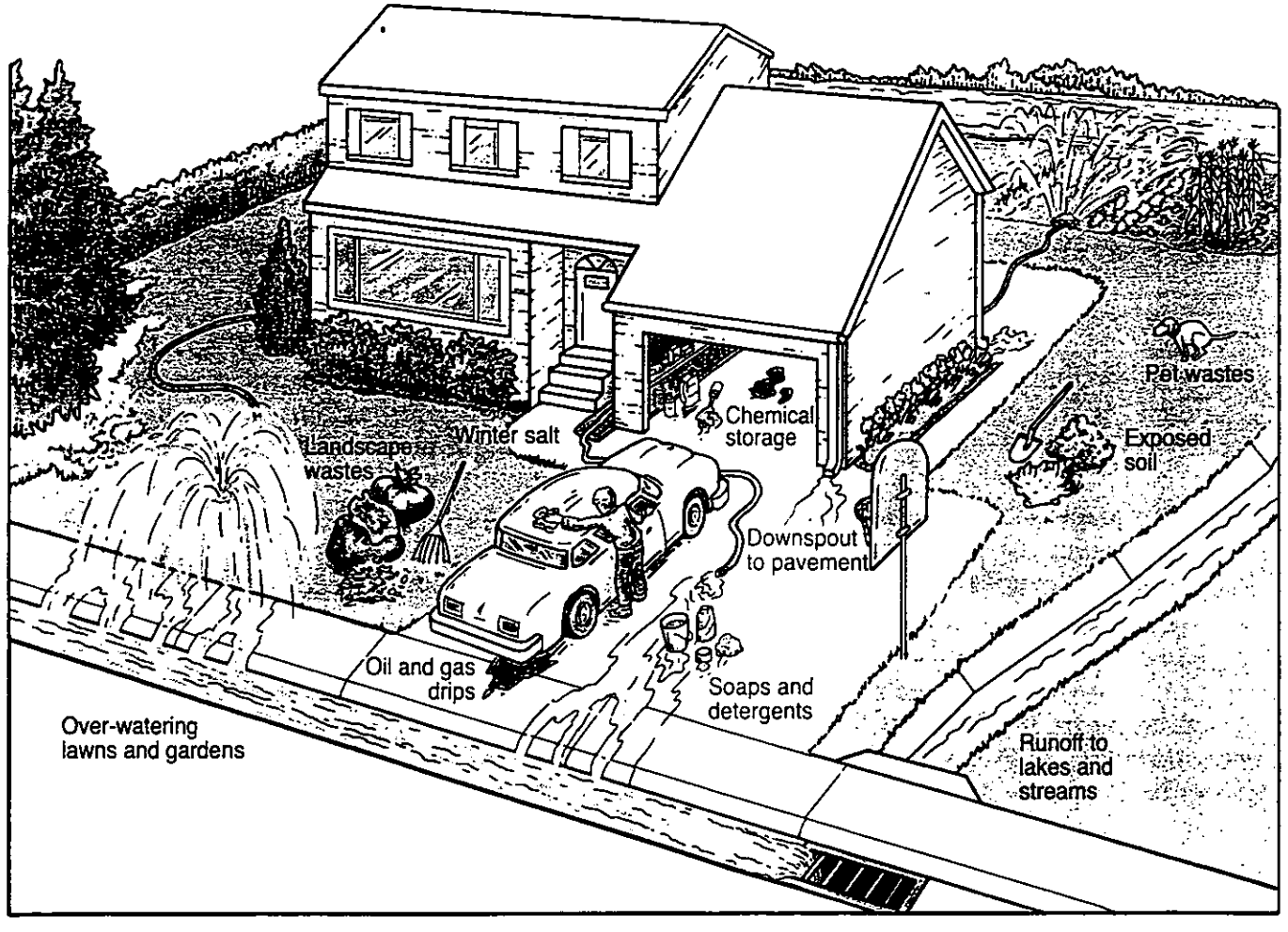
Outside Your Home

Your landscape can help to prevent water quality problems or it can contribute to them. For example, rain or irrigation water can wash misapplied lawn fertilizer and pesticide into lakes and streams via a storm drain.

On the other hand, careful landscaping and sound lawn care practices can reduce the need for chemicals and watering, and so reduce the chances of harming community water supplies.

Just 4 quarts of oil from your car's engine can form an 8-acre oil slick if spilled or dumped down a storm sewer.

Similarly, a garage, driveway, or sidewalk can be a source of water pollution. Anything that drips from your car - oil, gas, antifreeze - can wash into storm sewers and end up in our reservoirs. Pet wastes, de-icing salts, pet flea shampoos, water softener chemicals, even car washing detergents can be harmful to aquatic life. Dumping waste oil or other such products into the storm sewer is no different than pouring it directly into the nearest stream.



Some beneficial practices to consider:

☛Reduce the amount of area in high maintenance turf or concrete surfaces.

☛Compost leaves and other yard wastes.

☛Select native and xeriscape landscape plants which require less water, fertilizer and pesticide.

☛Replace grass in inappropriate areas (dense shade, steep slopes, hard-to-water areas), with a hardy groundcover, mulch or porous paving material.

☛Establish a groundcover or mulch on all bare soil areas.

☛Install water efficient sprinkler systems which are directed away from paved surfaces.

☛Incorporate a chemical-free buffer strip of dense vegetation next to any watercourse, stream, or lake that borders your property.

☛Use mulches in flower beds to reduce weeds and conserve water.

☛Wash your car at a commercial car wash rather than in your driveway.

☛Build gravel trenches on the down slope side of large paved areas to catch runoff.

Chemicals can be an asset to homeowners in some situations. But fertilizing when the lawn doesn't really need it, using weed killers at the wrong time of year, spraying insecticides "just to be safe," even watering a little bit every day ... are unnecessary and can contaminate our water supplies.

Sometimes, just changing the method of watering may take care of pest problems. In other cases, beneficial insects may destroy garden pests better than any insecticide.

Some beneficial lawn care practices include:

☛Use only the amount of fertilizer that is recommended: more is not better.

☛Use slow release forms of fertilizer.

☛Use pesticides (herbicides, insecticides, and fungicides) only as a last resort.

Some home gardeners use on average more fertilizer and pesticide per square foot than farmers do in their fields.

☛Calibrate spray equipment for accurate delivery, and follow all label instructions.

☛Dispose of pesticide containers, rinse water, and leftovers safely and without dumping anything down the drain or storm sewer.

☛Keep a record of pest problems and what worked to control them.

☛Water the lawn when it is dry rather than on a calendar schedule. Don't water the pavement!

♧♧♧

Much of our pesticide and fertilizer use is due to a desire for "perfect," pest-free lawns and gardens. These products also kill

beneficial insects that naturally help to control unwanted ones. Learn to accept a few weeds or insects in your yard as part of the natural balance. If you think that chemical pest control is necessary, consider using the services of a licenced applicator.

In the Community

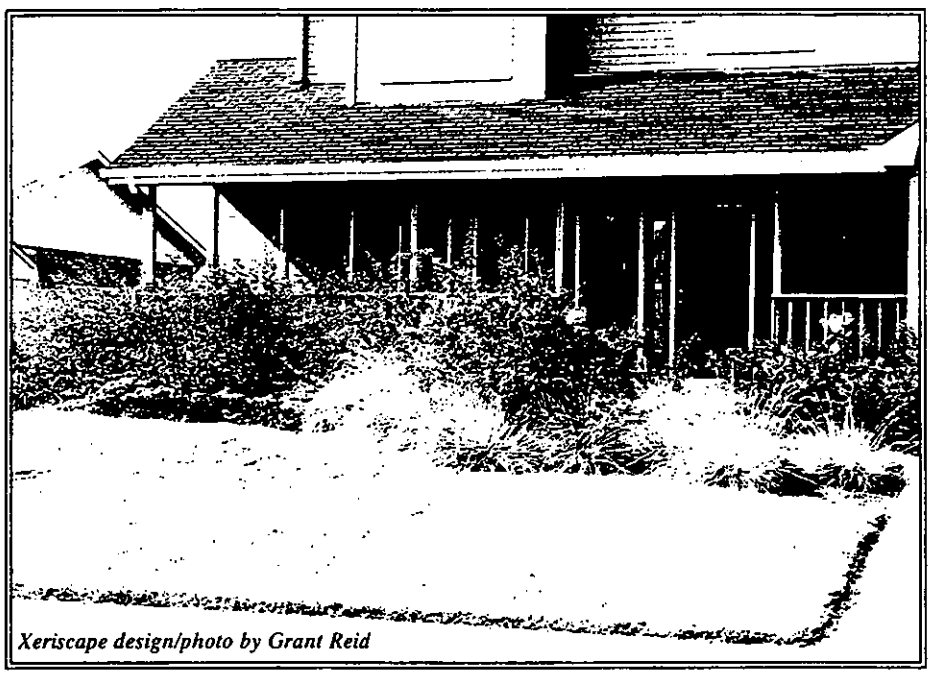
Public awareness about water quality needs to start at home, in our own neighborhood.

☛Act on your interest in cleaning up and safeguarding local waters. Learn about your watershed. Tell public officials that a healthy ecosystem is important now *and* later.

☛Support the preservation of greenbelts and natural areas that filter runoff water and buffer the effects of urban life.

☛Participate in projects and events that promote conservation and cleanup of our water resources.

More information on proper lawn and garden management techniques is available at your local Cooperative Extension office. The local Master Gardeners program can also help you determine how to fertilize properly and how to control pests.



Xeriscape design/photo by Grant Reid

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Simple Things You Can Do To Protect Water Quality

√ Redirect downspouts from paved areas to vegetated areas and away from foundations.

√ Select landscape plants that are well adapted and have low maintenance chemical and water requirements.

√ Maintain a healthy lawn and garden so that pest problems are minimized.

√ Mow your grass up to 3 inches high, and do so often so that clippings and their nutrients can be recycled.

√ Apply only enough irrigation water to satisfy plant needs. Never over-water after pesticide or fertilizer applications.

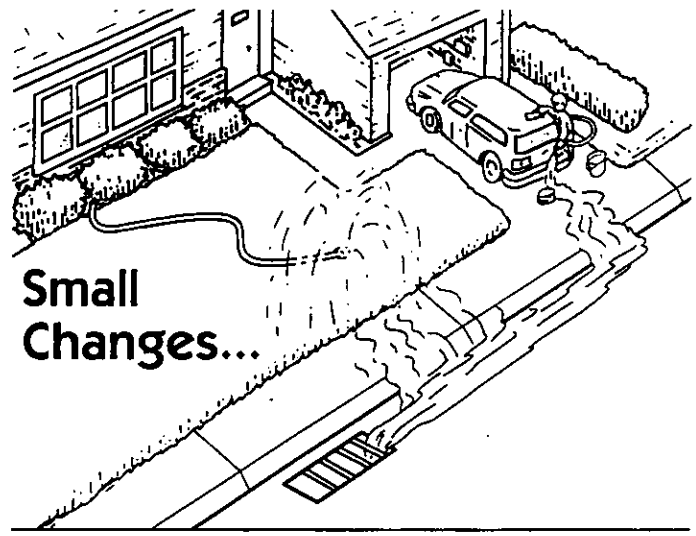
√ Adjust sprinklers to avoid watering paved areas.

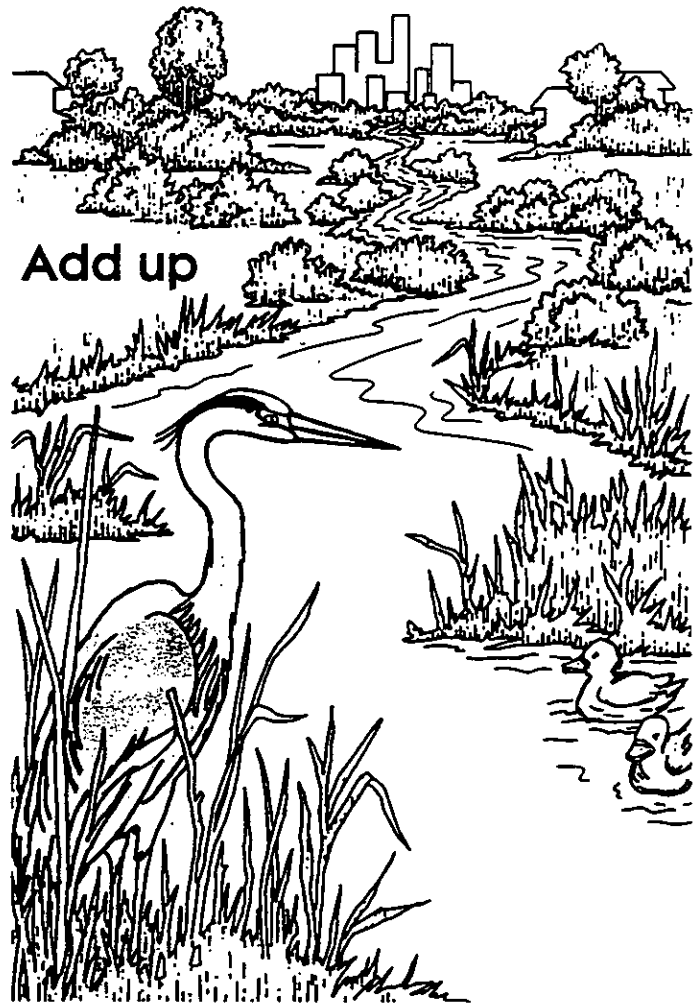
√ Keep fertilizers and pesticides off sidewalks and driveways.

√ Select alternative pest control measures first. If a pesticide is needed, apply it at the correct time and rate. Consider using a professional landscape or pest control service.

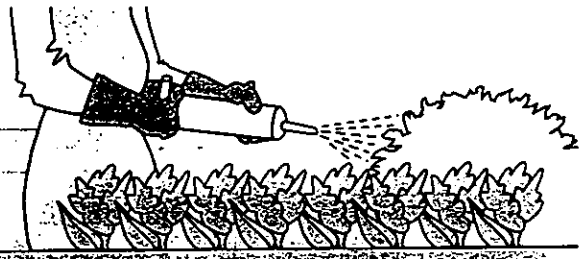
√ Store all pesticides and fertilizers in a safe, dry place with the labels intact.

√ Check with your local health department or wastewater treatment plant about safe disposal of lawn care chemicals, paints, solvents, or hazardous household wastes.





Homeowner's GUIDE



To Pesticide Use Around the Home and Garden

Pesticides can serve a useful purpose around the home and garden, reducing some of the problems we face from pests. But they can harm our drinking water supplies if handled improperly.

Pesticides include insect killers (insecticides), weed killers (herbicides), and fungus killers (fungicides). The ingredients that make these chemicals toxic to pests also can be harmful to people and animals, and in some cases, they also can contaminate water supplies.

This can happen even when pesticides are used according to the label. Water contamination is costly to remedy, and homeowners who use pesticides need to follow some common sense guidelines to avoid these unintended consequences.

Before You Buy a Pesticide

Pest-free homes and gardens are expensive, impractical, and environmentally unsound. The urge for a chemical "quick fix" for every problem around the home should be reevaluated. Instead, maintaining weeds or garden insects at non-damaging levels is a more realistic goal. Allowing low levels of pests to survive will actually help maintain a population of natural pest enemies.

There are a number of strategies homeowners can use to manage pests without chemicals. Evaluate all your options - non-toxic sprays, biological controls, changes in cultural practices, even doing

nothing - before you purchase a chemical. In some cases, a pesticide may be the best option. Consider calling a licensed, professional applicator in these instances.

Before even purchasing a pesticide, be sure you know:

- **What is the problem?** Correct diagnosis is essential to successful control.

- **What are the control options?** Evaluate your options and the need for treatment. In some cases doing nothing may be the best choice.

- **Which pesticide is appropriate for the problem?** No single pesticide can take care of all of your pest problems and some can even make the problem worse.

- **What is the target area?** This helps to determine exactly how much pesticide is needed and just where it needs to be applied. Avoid sidewalks, driveways and other hard surfaces where runoff could occur. In some cases, only a small portion of the yard or garden needs to be treated.

- **When should the pesticide be applied?** Pesticides should be applied at a time when they will be most effective against the pest. In many cases, pests under dormant or inactive conditions may not be susceptible to pesticide treatments.

Ask for help from a local pest control professional or Cooperative Extension office if you are unsure how to answer any of these questions.

Buying Home and Garden Pesticides

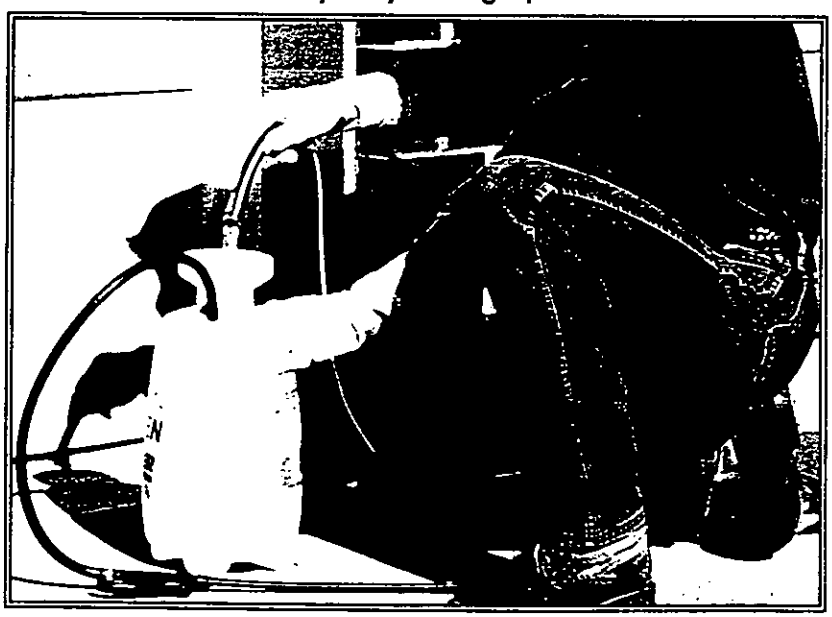
Once you're sure that a pesticide is required, you must determine how much chemical is needed. Know the size of the area you want to treat before buying the chemical. Usually, only a small amount of pesticide is necessary. Many chemicals can now be purchased in ready-to-use spray bottles, eliminating the need for mixing, large containers, and specifically calibrated equipment.

When you go to the store to buy any pesticide:

- **Read the label** at the store and look for information on health and environmental hazards associated with the product.

- **Look for *selective* or *pest specific* pesticides** rather than *broad spectrum* pesticides, which may end up harming non-target species.

- **Buy only enough pesticide** for the



job to avoid having to store or dispose of leftover chemical.

Mixing Pesticides

Before you actually mix a pesticide for application, test your sprayer with water to make sure it is working properly and is not leaking. Read the label again to determine the amount of chemical you need to mix. Be sure to do any needed calculations before you begin. Then select an area on the lawn or open ground to mix the pesticide.

As little as one teaspoon of certain pesticides rinsed down a drain is enough to show up as a pollutant in local streams.

☛**Put on rubber gloves** and a long sleeve shirt before opening the package.

☛**Do not mix pesticide on a hard surface** or concrete; a grassy area where children do not play is usually best.

☛**Never mix pesticide with anything besides water**, unless specifically directed to do so by the label.

☛**Fill the sprayer with 2/3 of the amount of water needed**. Add the correct amount of pesticide. Rinse the measuring spoon into the sprayer and finish filling the sprayer as directed.

☛**Measure the proper amount** of product as specified on the label. More is not better!

☛**Mix only the amount needed** for the current job and spray it all out to avoid disposal problems.

Applying Pesticides

Before spraying, clear all people, pets, toys, pet dishes and other items out of the area to be treated. Keep everyone away until the spray has dried or for as long as the label directs.

It's best to spray in the early morning or late evenings - this will help protect honey bees and other pollinators. If a wind comes up while you are spraying, stop and finish the job later so that other areas are not affected by pesticide drift.

Nationwide, about 11% of pollution problems in our rivers come from storm sewers and urban runoff.

☛Apply pesticide only on the target areas. Do not apply on driveways, sidewalks, or other hard surfaces where water runoff is a danger.

☛Clean up any spilled chemical right away. Cat litter and "floor dry" work well to clean up spilled liquid concentrate.

☛If the label states that the product must be watered in, apply only enough water to completely wet the treated area. Stop watering before it puddles or begins to run off.

Cleaning Up and Disposing of Waste

If you have any pesticide mix left over after the job, spray it out on an appropriate area of your lawn or garden. Rinse off all equipment and gloves on the grass, rather than rinsing into a storm sewer or other drain. Don't forget to flush out the hoses and nozzles.

And before you drink, eat, or smoke, wash with soap and water. The clothes worn during spraying should be laundered separately from the family's regular wash.

To dispose of empty pesticide containers:

1. Fill the empty container half full with water and shake to rinse.
2. Empty the rinse water into the sprayer. Repeat and rinse two more times.
3. Use the rinse water to make up your last batch of spray. Do not pour it down the drain or storm sewer.
4. Puncture the bottom of the container if it is plastic or metal, then wrap it in newspaper and throw it in the trash. Do not burn or recycle pesticide containers.

Storing and Disposing of Pesticides

One of the most compelling reasons not to apply lawn and garden chemicals yourself is the problem of storing or disposing of unwanted pesticide. Improper disposal of pesticides causes some of the greatest water quality and environmental concerns.

Sloppy storage practices are dangerous. Children or pets that get into your stored pesticides can be seriously harmed, or worse.

To store pesticide properly:

☛Keep pesticide in a locked, weather-

proof cabinet away from the living area. Keep gloves and measuring utensils locked up also to prevent their use for other purposes.

☛Keep all chemicals tightly sealed in their original containers.

☛Do not allow powder or granular products to get wet or liquid products to freeze. This may ruin the products and lead to disposal problems.

The best way to get rid of a pesticide is to use it as intended. If you have extra, try giving it to a neighbor or friend who needs it. Legally disposing of concentrated pesticides can be difficult. Watch your paper for information on hazardous waste collection programs or call your local Cooperative Extension office, city or county health department, or wastewater treatment plant for details on pesticide recovery/disposal programs.

In spite of the difficulty of getting rid of these products, do not resort to dumping them down the drain, in the garbage, or down the storm sewer.

Important Phone Numbers

Colorado Department of Agriculture;
Pesticide Section
(303) 239-4140
Colorado Department of Health/ Environment;
Household Hazardous Waste Division
(303) 692-3320
Colorado State University Cooperative Extension.
(970) 491-6281
EPA Region VIII Pesticide Office
(303) 312-6429
Rocky Mountain Poison Control Center
(800) 332-3072

PESTICIDE SIGNAL WORDS

most dangerous	Signal Word	Meaning
↕	Poison	highly toxic
↕	Danger	extremely flammable, corrosive, or highly toxic
↕	Warning	moderate hazard
safest	Caution	low/moderate hazard
	No signal word	not considered hazardous

This publication was prepared by Colorado State University Cooperative Extension with support from the Colorado Department of Agriculture and the Agricultural Chemicals and Groundwater Protection Program. Principal author - Reagan Waskom, Extension Water Quality Specialist; technical assistance, editing, and layout - Caroline van Schaik; graphics - Greg Nelson, CSU Office of Instructional Services. April/1996

Simple Things You Can Do to Protect Water Quality

√ Question the need for pesticide. There may be a better choice.

√ Consider using a licensed, professional applicator instead of applying chemicals yourself.

√ Follow all label directions for storing and mixing of pesticides and for disposing of empty containers.

√ Use only the amount of chemical specified by the label - more is not better!

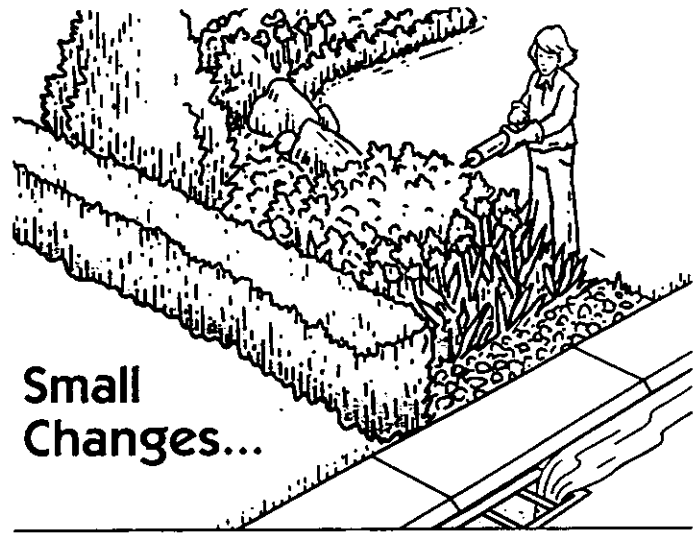
√ Mix only the amount of pesticide that will be used for the current job.

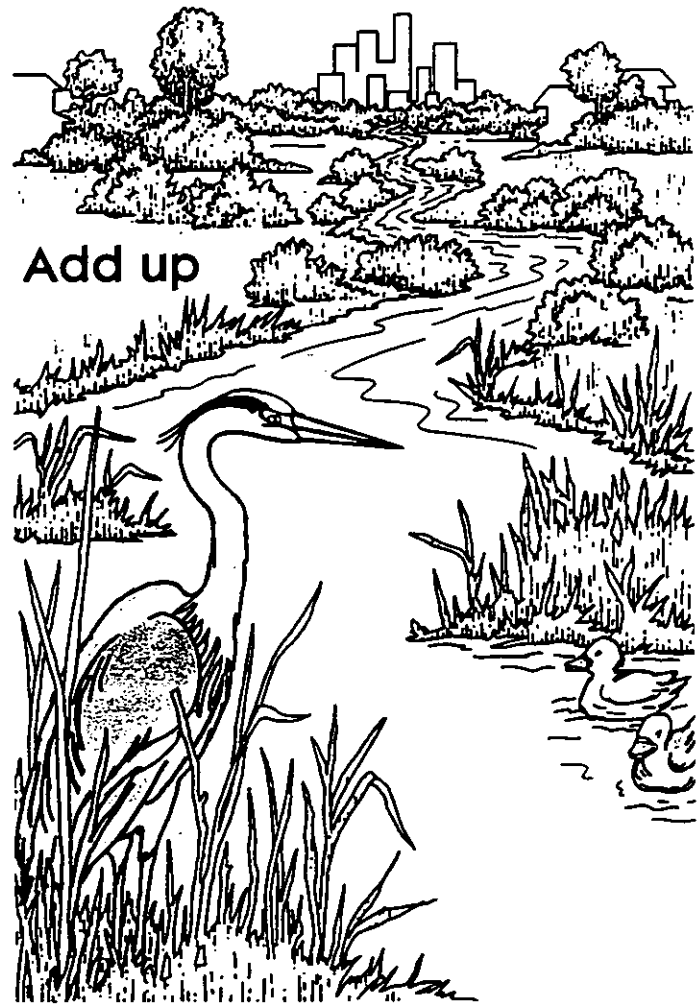
√ Take the time and care not to get any pesticide on sidewalks, driveways, or other hard surfaces.

√ Store pesticides in their original containers with labels intact, visible and legible.

√ Never pour leftover spray mix or pesticide down the drain or storm sewer.

Pesticide labels often include a telephone number where expert information on the product is available. If someone is poisoned, take the pesticide label to the attending physician.





Homeowner's GUIDE

To Fertilizing Your Lawn and Garden

We all want a home landscape that is attractive - but did you know that some of our common landscape management practices can cause pollution? The improper use of lawn fertilizers has the potential to harm our water supplies.

Have you ever noticed a pond that was overgrown with weeds or algae? Chances are, it had received an excess of nutrients - perhaps from urban runoff via lawn and garden water. Drinking supplies can become contaminated in the same way when nitrogen in fertilizer becomes nitrate and causes a health problem in extreme cases.

Your yard can have a positive effect on water quality by slowing down and filtering runoff water, or it can contribute to water quality problems. It all depends on how you manage water, chemicals, and the landscape around your home. Fertilizer carelessly applied on one lawn may seem insignificant - just a waste of your money. On hundreds or even thousands of lawns it can add up to polluted streams, lakes, and even groundwater.

What Can You Do To Protect Water Quality?

- Fertilize your lawn and garden properly.
- Water wisely.
- Use low maintenance landscaping.
- Maintain a healthy lawn.

Fertilizing Your Lawn for Healthy Plants and Clean Water

An effective lawn fertilization program actually starts in early fall, not in the spring. Spring applications alone may promote excessive top growth, leaving shallow root systems that poorly sustain lawns during hot dry spells or harsh winters. Fall fertilizer applications on established grass promote healthy root systems and hardy lawns.

One way to know how much fertilizer to apply is to take a soil test. If an analysis is not feasible, Table A shows the proper timing and amounts for various lawn types common in Colorado. The table assumes that all lawn clippings are left on the lawn to be recycled naturally. Keep in mind that over-fertilizing and poor timing are the primary reasons for thatch buildup - not grass clippings.

Selecting a Fertilizer

The label on all fertilizer bags contains three numbers that describe the amount of nitrogen (N), phosphate (P_2O_5), and potash (K_2O). For example, a 40 lb. bag of 20-10-5 fertilizer contains 20% (8 lbs.) nitrogen, 10% (4 lbs) phosphate, and 5% (2 lbs.) potash. The remainder of the ingredients

are likely to be inert carriers such as sand or ground limestone, and sometimes micro-nutrients or an herbicide.

Plants do not distinguish between nutrients supplied by granular, liquid, or organic fertilizers. Select a lawn fertilizer based on nutrient analysis, nutrient form, and price. Slow release fertilizers contain nutrients in a form that become available to plants throughout the growing season. This is advantageous because fewer applications are required and leaching losses are less likely. Avoid fertilizers that contain post-emergence herbicides for broadleaf weed control. Instead, spot spray or pull weeds in trouble spots.

Most Colorado lawns will get adequate phosphorus (P) and potassium (K) with routine application of commercial fertilizers. There is little reason to be concerned about other nutrients besides N, P, and K unless a soil test indicates a deficiency.

Table A. Recommended fertilizer applications by lawn type and season

FERTILIZER APPLICATION SCHEDULE FOR ESTABLISHED COLORADO LAWNS					
GRASS TYPE	mid-March to April*	May to mid-June	July to early August	mid-August to mid-September	early Oct. to early Nov. (when grass is still green)
	(pounds of nitrogen per 1000 square feet of lawn) -- assumes grass clippings are recycled --				
Bluegrass/Ryegrass	½-1	1		1	1
Turf-Type Tall Fescue.	½	½-1		1	1
Fine Fescue	½	½-1		½-1	
Buffalograss/Blue Grama/Bermudagrass	Apply no N	½ - 1	½ - 1	Apply no N	Apply no N

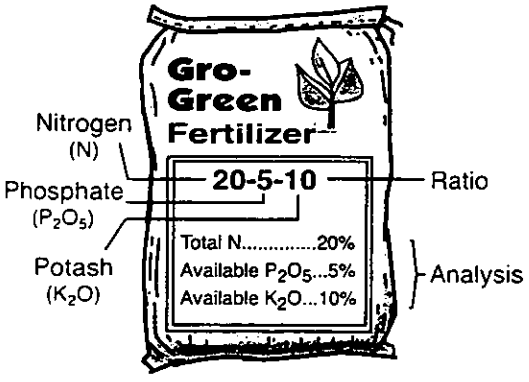
*The March-April nitrogen application may not be necessary if you fertilized late the previous year (Sept. to Nov.). If spring green-up and growth is satisfactory, delay fertilizing until May or June. Adapted from CSU Cooperative Extension SIA 7.202.

Determining How Much to Buy

Determine how much fertilizer you need before you make a purchase to avoid having to store leftover materials. Measure the area of your lawn to get an idea how many square feet you have to fertilize. Most urban lawns are about 4,000 - 6,000 sq ft. Read the fertilizer bag to determine how much nitrogen is in the bag.

For example, if you want 1 lb. of nitrogen per 1,000 sq ft. from a 10-10-5

product, you need to apply 50 lbs. of fertilizer on a 5,000 sq ft. lawn. (1 lb. N/1,000 sq ft x 10% x 5,000 sq ft lawn) Fertilizer applied above the recommended rate is wasted money and potentially harmful to drinking water supplies.



Applying Lawn Fertilizer

Most garden stores have spreaders that are calibrated for their products. The directions on the fertilizer bag usually tell where to set the applicaor as well.

If you do are not sure where to set the spreader, put it on a "low" setting to avoid over-fertilizing. Go back over the lawn at another angle if you did not get enough on the first pass. This will insure a more uniform application. Be sure to sweep up sidewalks and driveways afterwards.

Fertilizing Landscape and Garden Plants

Nutrient requirements for garden plants can vary considerably. In general, nitrogen promotes leafy top growth; phosphorous is needed for good root development; and potassium is necessary for winter hardiness, disease resistance, and general plant health.

Always improve the soil prior to planting with a good organic soil amendment such as aged manure or

compost to develop a rich, well-drained soil. If plants show yellowing leaves, consult your local Cooperative Extension agent for nutrient recommendations. Iron deficiency, not a lack of nitrogen, is a common reason for yellow landscape plants in Colorado.

Most established trees and shrubs planted in well-drained, fertile soils do not need annual fertilizer applications. However, if plants are growing poorly and you cannot identify a specific pest or weather related reason, they may need to be fertilized.

The easiest and most economical method of fertilizing is to sprinkle a balanced liquid or granular fertilizer material under the plant and water it in. Mulching will help conserve moisture, protect roots, and prevent the loss of soil and nutrients.

Vegetable gardens are a great place to incorporate composted materials from your kitchen and garden. Aged or composted animal manures are also a good way to improve garden soils.

Some vegetables, such as corn or tomatoes, may benefit from the addition of a low analysis, complete mineral fertilizer (such as 5-10-5) added at the rate of approximately 10 to 20 lbs of material per 1,000 sq ft of garden.

Commercial Tree and Lawn Care Companies

If all of this sounds too complicated, you may want to consider using the service of a professional company to maintain your landscape. A reputable service offers licenced applicators who are trained how to handle and apply chemicals properly.

Some areas of consumer caution should be noted, however:

☛**Do you really need the "perfect lawn"** provided in a "full service" lawn care package? A low maintenance program might be more suitable.

☛**Are routine insecticide applications desirable?** Most of the insects found in Colorado lawns are actually beneficial; lawn insecticides are rarely needed under our conditions.

☛**Are routine herbicide applications needed?** Weeds are not the cause of an unhealthy lawn; they are the result. In many cases, an attractive lawn can be maintained with sound watering, fertilizing, mowing, and aeration.

☛**Are all of those fertilizer nutrients necessary?** Most commercial fertilizers contain phosphorous (a potential water pollutant) even though in many cases it is already adequately supplied in your soil.

♧♧♧

In short, a "one size fits all" lawn program may not be best for you or the environment. Question the blanket use of chemicals in favor of a more tailored program.

Watering Your Yard

Poor watering practices are probably responsible for more landscape problems in Colorado than any other single factor - except maybe our weather. Over-watering causes the loss of nutrients to the environment and is not particularly good for most landscape plants. Still, different plant needs and soil types make it difficult to make precise watering recommendations.

In general, a sandy soil should receive ½ to 1 inch of water at each application,

and a clay soil should receive a very gradual application of 1 to 1½ inches of water. A dense stand of Kentucky bluegrass may need up to 2.25 inches of water per week during the hottest part of the summer, but other grasses such as tall fescue can thrive on less if they have developed deep roots. Over-watering is wasteful and can transport contaminants via runoff from the soil surface or percolation below the rootzone.

Low Maintenance Landscapes

You can make a positive environmental impact by designing your landscape with plants that require less water and fertilizer, and have fewer pest problems.

Alternatives to Kentucky bluegrass, such as buffalograss, blue grama grass, and tall fescue can provide a beautiful lawn that requires less resources. Often, we plant grass in areas that are too shady, or that have steep slopes or poor soils where grass just doesn't grow well. More fertilizer and water are not the answers in these cases - it's usually best to replace this grass with hardy ground covers, mulch, or a porous paving material such as gravel.

Native landscape plants are often less dependent on fertilizer and water inputs. Additionally, they help attract song birds, butterflies, and beneficial insects. Check with your local Cooperative Extension office to get more information on xeriscapes and low input landscapes.

Finally, landscapes designed to hold rain and snow melt are environmentally friendly because they result in less water runoff. Keeping any part of your property that borders surface water in a dense natural vegetation can help filter out chemicals that might be carried in runoff water.

Maintaining a Healthy Lawn

When grass is dense and vigorous, it competes effectively against most pests. A sound watering and fertilization program is basic for a healthy lawn.

Other things you can do include:

- Maintain a mowing height at 2½ to 3 inches. This encourages deeper rooting and heat resistance.

- Mow often enough so that you can mulch grass clippings on the lawn. This will recycle nutrients; it does not cause thatch.

- Core aerate your lawn once or twice a year to encourage good rooting and water penetration.

- Keep your mower blade sharpened to avoid ragged cutting that then increases moisture loss and stress.

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Simple Things You Can Do To Protect Water Quality

√ Redirect downspouts to vegetated areas.

√ Select landscape plants that are well adapted and have low water requirements.

√ Mow your grass high and often so that clippings and their nutrients can be recycled.

√ Water your lawn on an "as needed" basis, rather than on a calendar schedule.

√ Adjust sprinklers to avoid watering paved areas.

√ Use slow release forms of fertilizer.

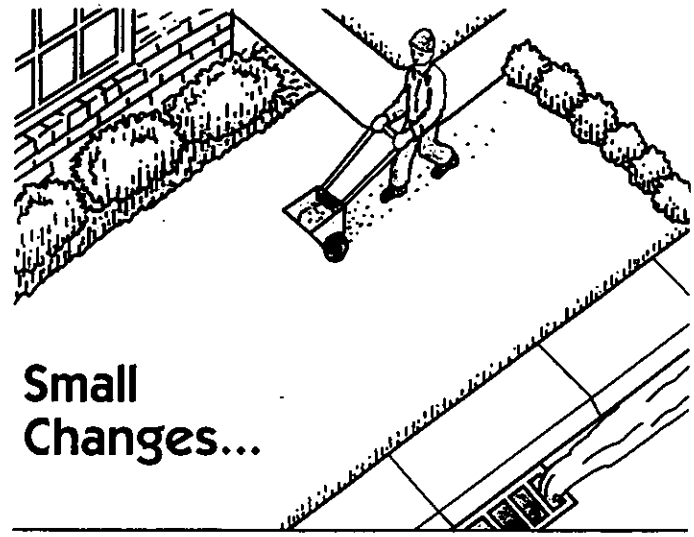
√ Treat specific weedy areas rather than resorting to general 'weed and feed' mixtures.

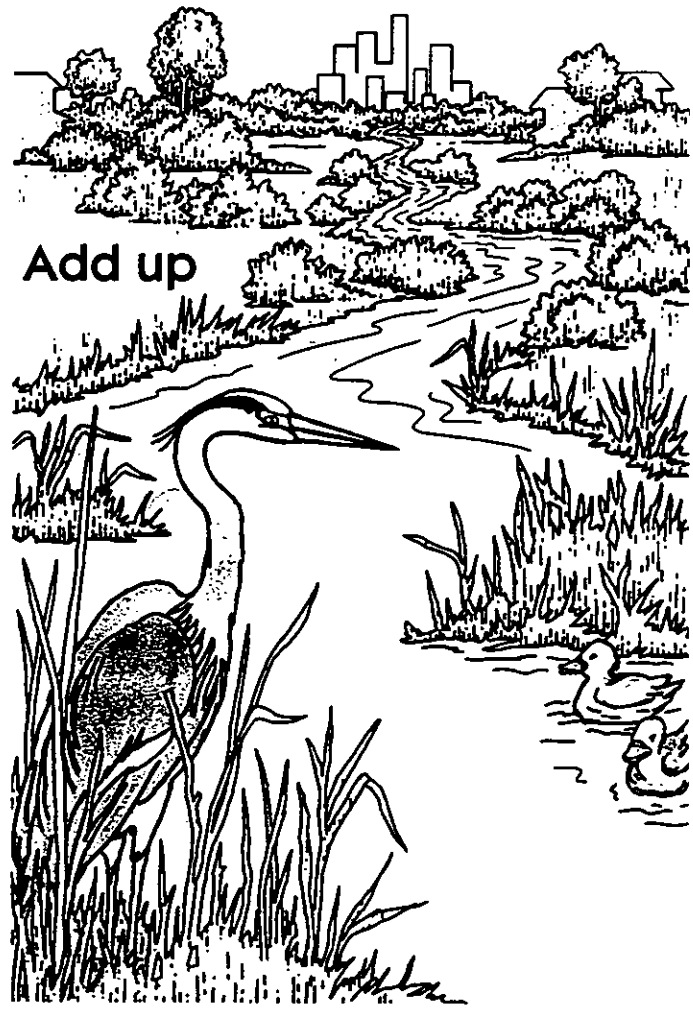
√ Use only the amount of fertilizer that is recommended: more is not better.

√ Keep fertilizers and pesticides off sidewalks and driveways.

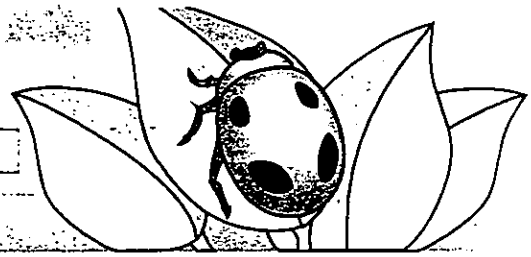
√ Wash off fertilizer application equipment on the lawn, not on the sidewalk or driveway.

√ Maintain natural buffer areas where no chemicals are applied between your property and any stream or lake.





Homeowner's GUIDE



Alternative Pest Management for the Lawn and Garden

A pest-free lawn and garden may sound ideal, but is it really? Maintaining the perfect urban landscape often results in a reliance on pesticides that can lead to environmental and human health problems such as groundwater contamination. In fact, the amount of pesticide sold for urban use now exceeds agricultural use in some areas of the country.

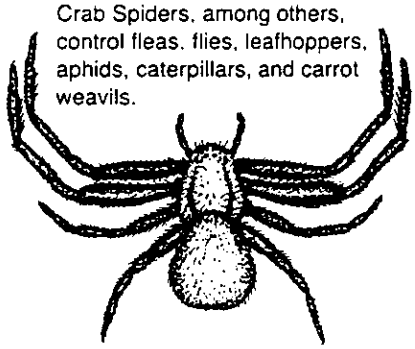
Many homeowners are turning to pesticide alternatives as they re-evaluate the consequences of their not-so-ideal landscaping.

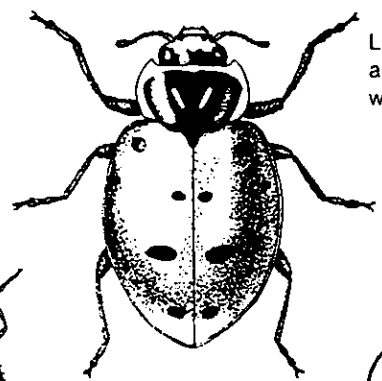
Fortunately, there are many biological processes that work to keep pests in a natural balance. The 'ideal' garden is one with vigorous plants and protected natural enemies of certain annoying pests. The traditional approach - of applying pesticides routinely, or at the first sign of any pest - is replaced with a lower input emphasis on nature at it's best.

It is not the answer to all problems every time. But when it works, it is an ideal way to address pest problems while helping protect our water supplies.

Beneficial Insects and the Pests They Control

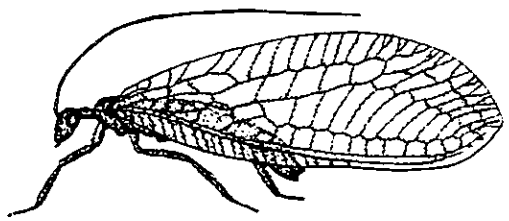
Crab Spiders, among others, control fleas, flies, leafhoppers, aphids, caterpillars, and carrot weavils.



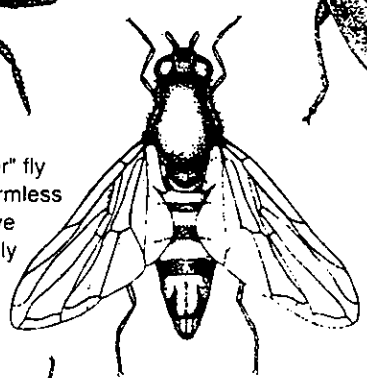


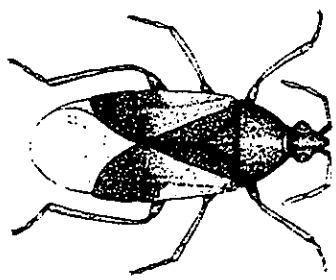
Lady Beetles, or "Ladybugs", control aphids, aphid larvae, rootworms, spider mites, and weavils.

Green lacewings, especially the larvae, are voracious consumers of aphids, caterpillars, beetles, and white flies.

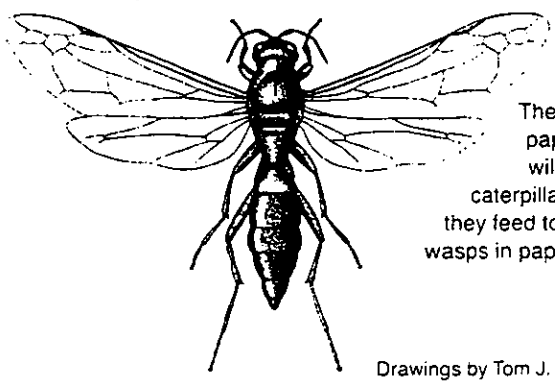


The Flower fly or "Hover" fly (Syrphidae family) is harmless to humans but is effective against aphids, especially early in the season.





Minute pirate bugs are tiny (less than 1/8 inch) but feed on thrips, spider mites, and insect eggs.



The Polistes paper wasp will hunt for caterpillars which they feed to imature wasps in paper nests.

Drawings by Tom J. Weissling

The principles of this alternative approach include:

- Learning more about plants and their pests
- Selecting landscape and garden plant varieties that are resistant to pests
- Rotating annual garden plants to reduce the buildup of soil-borne pests
- Inspecting plants frequently for the presence both of pests and beneficial organisms
- Determining if control measures are really necessary before taking action
- Selecting methods that are least disruptive to natural controls and least hazardous to the environment

Xeriscape design/photo by Grant Reid

As you experiment with pesticide alternatives, it's a good idea to keep a record of your observations and the results of your treatments for future reference.

Cultural Pest Control Methods

Cultural pest control methods seek to create the optimum growing conditions for plants and natural predators, and unfavorable conditions for pests.

Some things to remember in managing a garden this way:

- Select well-adapted, disease resistant plant varieties. Often, these are native species.
- Plant the right plants for the location and the soil condition.
- Buy transplants that look healthy and pest-free.
- Avoid under- or over-watering, since both make plants vulnerable to insects and disease.
- Maintain a soil appropriate for the plants being grown. A soil analysis is the best way to evaluate soil type and fertility.
- Correct nutrient deficiencies to keep plants healthy.
- Change the location of annual plants from year to year to disrupt the life cycle of pests.
- Remove infested plant residue from your garden in the fall so that pests do not over-winter there.
- Incorporate a wide variety of plants to disperse potential pest problems and to provide diverse habitat for beneficial insects.
- Keep your vegetable garden clean of rocks, wood, and debris that provide hiding places for slugs and other damaging insects.

In managing your lawn:

☛Plant hardy strains of fescue, blue gramma, wheatgrass, or buffalograss instead of high-maintenance Kentucky bluegrass.

☛Maintain a healthy lawn with good watering practices: water as needed, and turn off automatic sprinkler systems after a rain or during cloudy weather.

☛Fertilize your lawn only as needed to promote a vigorously growing turf that will compete well with weeds. A soil test is one way to know what nutrients your lawn needs.

☛Maintain a mowing height no less than 2½ to 3 inches, and leave the clippings on the lawn so that their nutrients are recycled.

☛Core aerate the lawn once or twice a year.

☛Use groundcovers, mulch, or beds in difficult areas such as sloped ground or shady spots.

Mechanical Pest Control Methods

Mechanical pest management options rely on physical methods of destroying pests and includes:

⇨Hand weeding

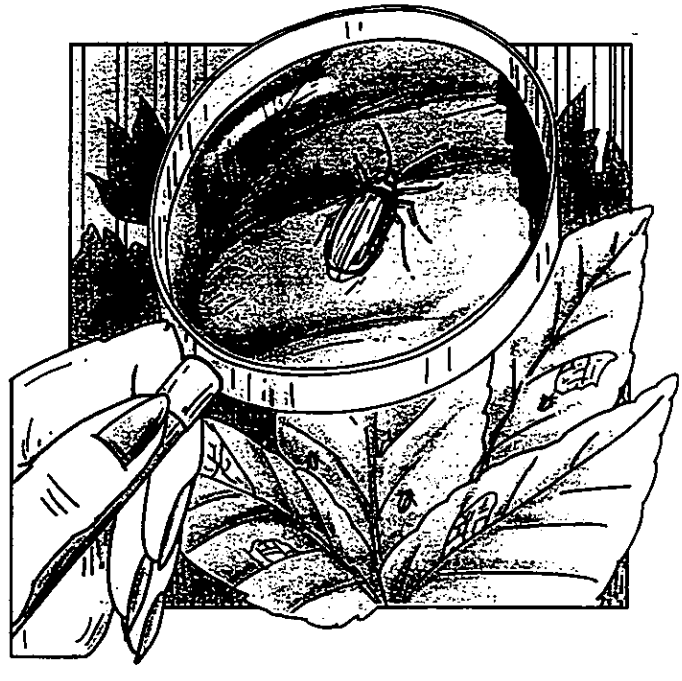
⇨Using a hoe or tiller rather than a herbicide

⇨Hand-picking insects off plants

⇨Hosing down plants to dislodge insects

⇨Pruning diseased or insect-infested woody plants

⇨Using mulches to reduce erosion and weeds and to conserve moisture



Biological Pest Control Methods

Beneficial organisms such as certain insects or fungi can help control pests when broad spectrum pesticides are avoided. These organisms may occur naturally or may be purposely introduced.

The main categories of these "beneficials" include:

Predators - such as lady beetles, spiders, green lacewings, syrphid flies, damsel bugs, minute pirate bugs, ground beetles, and predatory mites. Larger animals such as birds, frogs, and garden snakes also prey on pest insects.

Parasites - like the tachinid fly and braconid wasp. They lay eggs on or inside insect pests.

Pathogens - such as fungi, bacteria, and viruses that infect pests much in the same

way they infect people or other animals.

Some garden stores and catalogs carry beneficials such as lady beetles. Conserving beneficials already in your garden is probably more cost-effective, and frequently is more successful. Pesticides often kill these natural garden friends.

To encourage beneficials in your yard:

- ☛Plant a diverse landscape that provides a variety of habitats and food sources.
- ☛Learn to distinguish beneficial insects from pests.
- ☛Minimize pesticide applications.

These natural controls often work more slowly than pesticides and they require a food supply that could be the very pest you'd prefer to be gone. However, they are nature's way of handling high populations of pests, they don't contaminate our water supplies, and they can lend beauty to a garden.

Chemical Pest Control Methods

There are some naturally occurring chemicals that are classified as pesticides but nevertheless can be used in the context of "organic gardening". In general, these compounds tend to be less harmful to beneficial insects and they often break down more rapidly than synthetic pesticides.

Among the less toxic chemical controls are microbial insecticides, botanical pesticides, mineral-based pesticides, and synthetic organic compounds (oils, soaps and detergents) produced from petroleum distillates. They are available in some garden stores, but may have to be asked for specifically. Some of these products are listed in Table A.

Please note that these products are still classified as pesticides and should not be used indiscriminantly. They are best incorporated into a management program that uses all available cultural, mechanical, and biological control methods.

Finally, it is a mistake to assume that naturally occurring chemicals are non-toxic. As with all chemicals, always read the label instructions prior to using these alternatives. Under certain conditions, some of these chemicals can cause injury to plants and animals.

What to Plant to Attract Beneficial Insects

Herbs belonging to the mint family: lemon balm, pennyroyal, thyme, spearmint.

Plants belonging to the carrot family: dill and parsley.

Vegetables belonging to the cabbage family: radishes, mustard, and brocolli.

Queen Anne's lace, also known as wild carrot, will serve as a nectar plant for parasitic wasps.

Poppies, black medick, ivy, and red campion attract butterflies and bees.

Information on alternative pest management techniques is available at your local Cooperative Extension office. The local Master Gardeners program can also help you determine how to properly care for your yard and landscape.

Table A. Alternative Pesticides for Lawn and Garden Use

Microbial insecticides	*Controls*	*Notes*
Bacillus thuringiensis (BT, Dipel)	caterpillars	non-toxic to mammals
Avermectin-B (Avid)	mites, leafminers, psyllids	
Botanical pesticides		
Sabadilla (Red devil)	leaf hopper, caterpillars, squash bugs, et al.	low toxicity short residual may irritate
Rotenone (Rotacide)	aphids, beetles, caterpillars, thrips, potato beetles, et al.	very toxic to fish
Pyrethrum (Pyrenone)	most insects	low toxicity to mammals fast "knock down"
Neem (Margosan-O)	leaf miners, loopers, mealy bugs, thrips, whitefly, etc. some fungicidal activity	slow kill
Mineral based pesticides		
Sulfur	fungicidal activity on powdery mildew, rust, some blights insecticidal activity on psyllids, mites, thrips	plant injury possible
Lime sulfur	dormant spray for diseases such as blight, anthranchose, powdery mildew	bad smelling may irritate
Bordeaux mixture	acts as a fungicide, controls bacterial leaf spot repels many insects	some cannot be used on certified "organic" produce
Synthetic organic compounds		
Insecticidal soap (Safer's soap)	aphids, certain scales, mealy bugs, psyllids, mites, thrips, white fly	non-toxic to mammals plant injury possible
Dormant oils	aphids, mites, and certain scales that overwinter on woody plants	non-toxic to mammals possible plant injury
Summer oils	aphids, mites, scales, thrips and their eggs	plant injury possible

This publication was prepared by Colorado State University Cooperative Extension with support from the Colorado Department of Agriculture and the Agricultural Chemicals and Groundwater Protection program. Principal author - Reagan Waskom, Extension Water Quality Specialist; technical assistance, editing, and layout - Caroline van Schaik; graphics - Greg Nelson, CSU Office of Instructional Services. April/1996

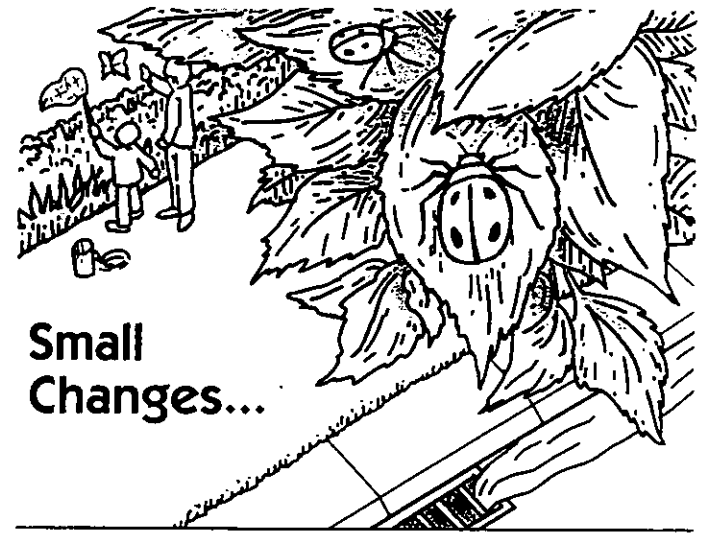
Alternative Pest Management Methods

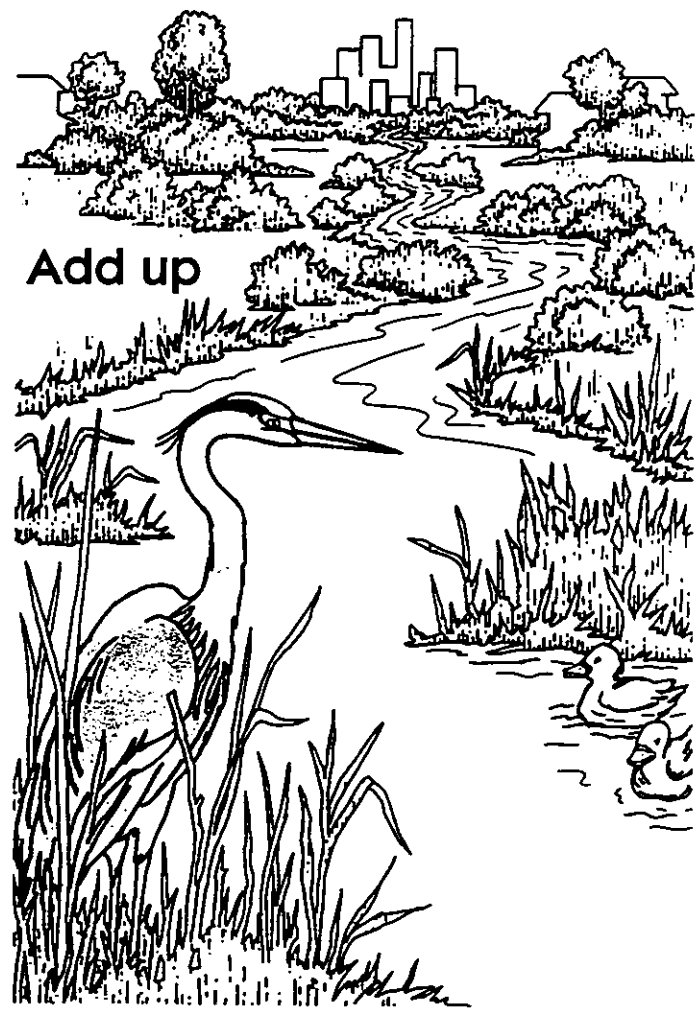
Insects:
√ Keep your garden free of infested plant residue and other debris.
√ Prune out insect-infested parts of plants. Hand-pick bugs off garden plants.
√ Encourage biological controls by planting flowers that provide nectar, pollen, and habitat for friendly predators.
√ Avoid broad spectrum insecticides.
√ Use insecticidal soaps, oils, and botanicals as appropriate.
√ Dislodge unwanted insects from woody plants using a stream of water.

Slugs:
√ Put beer in shallow containers to attract and drown slugs.
√ Place an overturned clay pot near plants where slugs feed and check frequently for collected slugs.

Weeds:
√ Crowd out weeds with a healthy lawn.
√ Use mulches and landscape fabric.
√ Hand pull, mow, or hoe weeds.
√ Accept some weeds in your lawn as part of a natural landscape.

Diseases:
√ Look for healthy transplants of well adapted, disease resistant varieties.
√ Rotate your annuals each year.
√ Prune and dispose of diseased branches.
√ Avoid over- or under-watering.





APPENDIX II

1996 Annual Report
Colorado State University Cooperative Extension

Accomplishments:

1. Conducted educational programs throughout Colorado on SB 90-126 and issues related to agricultural chemicals and groundwater quality. Groups addressed include commercial applicators, chemical dealers, weed districts, crop consultants, crop and livestock producers, agency personnel, and urban chemical users.

2. Conducted training related to the Colorado Best Management Practice Manual. Distributed booklets to Colorado citizens covering nutrient, pesticide, irrigation, manure, and water well management.

3. Hired a water quality specialist to work on education and demonstration projects in the South Platte River Basin.

4. Worked with three local groups in Colorado to develop and disseminate localized BMP guidelines for groundwater protection. The local group in the San Luis Valley published their findings in two booklets entitled: "Best Management Practices for Potato Pest Management in the San Luis Valley" and "Best Management Practices for Small Grain Pest Management in the San Luis Valley. The local group in the Montrose area headed by the Shavano Soil Conservation District developed and published practices appropriate for the West Slope in a booklet entitled: "Best Management Practices for the Lower Gunnison Basin".

5. Published a series of four factsheets to educate Colorado homeowners on BMPs for urban pesticide and fertilizer use. These factsheets are entitled:
   - Homeowner's Guide to protecting water quality and the environment
   - Homeowner's Guide to pesticide use around the home and garden.
   - Alternative pest management for the lawn and garden.
   - Homeowner's Guide to fertilizing your lawn and garden.

6. Began development of BMPs specifically for irrigated barley production in Colorado.

7. Cooperated with county Extension agents on nutrient management demonstrations on farmer fields and conducted manure management field days in eastern Colorado to discuss proper nitrogen, manure, and water management practices.

8. Produced newsletter articles, press releases, fact sheets, technical papers, radio and other mass media articles on groundwater protection in Colorado.

9. Produced a 20 minute instructional video entitled "Best Management Practices for Colorado Agriculture".

10. Worked to coordinate efforts of the Agricultural Chemicals and Groundwater Protection program with other state and federal programs in Colorado.

11. Assisted the Colorado Department of Agriculture in the implementation of the Bulk Storage Regulations and the development of the generic State Management Plan. Contracted with a private consultant to prepare a protocol for developing a Colorado groundwater sensitivity map.

BMP Development

Colorado State University Cooperative Extension is working with the Colorado Department of Agriculture to develop Best Management Practices for Colorado farmers, land owners, and commercial agricultural chemical applicators. The BMPs adopted for use at the local level must ultimately be determined by the chemical user because of the site specific nature of groundwater protection. The local perspective is also needed to evaluate the feasibility and economic impact of these practices. The SB 90-126 Advisory Committee has recommended that a significant level of input be received at the local level prior to adoption of recommended BMPs.

Colorado State University Cooperative Extension has compiled a broad set of BMPs encompassing nutrient, pest, and water management which will be used as a template for local committees. These documents were published in a notebook form in 1995 that will be updated as needed and expanded to include additional guidelines.

Cooperative Extension has piloted the local BMP development process in the San Luis Valley and in the front range area of the South Platte Basin. The local working committees consist of a small group of producers, consultants, and chemical applicators. The San Luis Valley group has produced a set of BMPs appropriate for their area which are being publicized and will be implemented by cooperating farmers in field scale demonstrations. The South Platte group is working towards consensus in a very complex farming region. Both of these groups have produced BMPs for nutrient and irrigation management - the most serious problem in their respective areas. They are now working on pest and pesticide management BMPs for specific crops. A local BMP group was formed in 1995 in the Montrose/Delta area. The Shavano SCD worked with local Extension agents and producers to develop a set of practices appropriate for the West Slope entitled "Best Management Practices for the Lower Gunnison Basin". During 1996, a forth local BMP work group was initiated in the lower South Platte basin.

Field Demonstrations

Colorado State University Cooperative Extension has worked with the USDA Agricultural Research Service and farmers on field research and educational plots to demonstrate improved nitrogen, manure, and irrigation management techniques. New production tools are being evaluated and demonstrated to farmers which may improve producer profitability and help protect groundwater.

Field trials are held on farm fields in Colorado to demonstrate BMPs. Educational field days are held at these sites to acquaint other producers and interested parties with the need for groundwater protection.

A new technology known as in-season nitrate testing was demonstrated to farmers on strip trials on their farms. This tool may help farmers improve N recommendation accuracy and minimize the use of "insurance" N fertilizer. By complementing preplant soil testing with in-season testing, it may be possible to improve N fertilizer requirement prediction accuracy, resulting in reduced

leaching of nitrate to groundwater. Quick soil test kits for nitrate have been developed that allow "field testing," thereby alleviating the problem of slow turn-around time in commercial soil testing laboratories. The development of these quick test kits has made the in-season nitrate test a viable soil testing procedure for assessing the N fertility status of crops at any growth stage. It is expected that this will result in the joint use of preplant deep soil nitrate testing and in-season testing which will increase the accuracy of N fertilizer recommendations. The total application of N fertilizer can be decreased without negatively affecting crop yields as farmers adopt this improved technology.

Other production tools being evaluated and demonstrated to farmers include the portable chlorophyll meter to access N status of growing plants and surge irrigation valves to help decrease irrigation water runoff and leaching. Additionally, research is being conducted on the usefulness of the NLEAP computer model in selecting and evaluating BMPs for nitrogen leaching.

Project sponsors include Colorado State University Cooperative Extension and Department of Soil & Crop Sciences, USDA Agricultural Research Service, Northern Colorado Water Conservancy District, and the Natural Resources Conservation Service.

APPENDIX III

COLORADO DEPARTMENT OF HEALTH
Water Quality Control Division
Ag Chemicals Program

Executive Summary

The Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) has responsibility under the Agricultural Chemicals and Ground Water Protection Program (SB 90-126) to conduct monitoring for the presence of commercial fertilizers and pesticides in ground water. This data assists the Commissioner of Agriculture in determining whether agricultural operations are impacting ground water quality. This past year the program monitored groundwater quality along the urbanized portion of the Colorado Front Range.

This was the first time the program attempted to determine the possible impacts to ground water from urban uses of agricultural chemicals. This urban use would include homeowners applications to yards and gardens, and municipal and private applications to parks, and golf courses.

Seventy two wells were sampled for nitrate and 46 pesticides. In all cases existing wells were used. Most of these wells were privately owned and permitted as domestic wells. Nine monitoring wells located within the incorporated limits of communities in Weld County were also sampled.

Nitrate analysis showed that 10 % of all the wells exceeded the nitrate drinking water standard of 10 mg/L. If the monitoring wells sampled in Weld County are eliminated though, the nitrate exceedence drops to only half that or 5 %. Pesticide data revealed three pesticides, Atrazine, Bromacil, and Prometon present in the well samples. The breakdown product of Atrazine, Deethyl Atrazine was also present in those samples with Atrazine. No pesticide concentration exceeded a water quality standard.

In addition to monitoring ground water for the presence of agricultural chemicals, the Ag Chemicals Program is required to determine the likelihood that an agricultural chemical will enter the ground water. This type of determination has been described as a vulnerability analysis. The Program is working jointly with a researcher at Colorado State University to develop a statewide vulnerability analysis for Colorado. A pilot project covering the northeastern portion of the state has been completed and the results were evaluated by CDPHE, CDA, CSU, and USEPA and approved for expansion throughout the state. The sources, format, and availability of the data needed for the statewide evaluation are currently being compiled. The finished mapping project will provide a standard method to determine vulnerability statewide. This effort will become a key element of the State Management Plan for pesticides implemented under the Federal Insecticide, Fungicide, and Rodenticide Act.

Introduction

The Water Quality Control Division (WQCD) of the Colorado Department of Public Health and Environment (CDPHE) has responsibility under the Agricultural Chemicals and Ground Water Protection Program (SB 90-126) to conduct monitoring for the presence of commercial fertilizers and pesticides in ground water. The Agricultural Chemicals Program has been established to provide current, scientifically valid, ground water quality data to the Commissioner of Agriculture. Prior to passage of SB 90-126, a lack of data had prevented an accurate assessment of impacts to groundwater quality from agricultural operations. This program will assist the Commissioner of Agriculture in determining to what extent agricultural operations are impacting ground water quality. The program also assists the Commissioner in identifying those aquifers that are vulnerable to contamination. The philosophy adopted is to protect ground water and the environment from impairment or degradation due to the improper use of agricultural chemicals, while allowing for their proper and correct use.

This report has been prepared to provide a summary of the work completed in 1996. The monitoring program involves the collection and laboratory analysis of ground water samples. This monitoring program was planned to meet the objectives necessary for a preliminary determination of the existence of agricultural chemicals in the ground water in a safe, cost effective, and timely manner.

The ground water quality sampling program is intended to fulfill the following objectives:

1. Determine if agricultural chemicals are present in the ground water.
2. Provide data to assist the Commissioner of Agriculture in the identification of potential agricultural management areas.

The factors considered in selecting an area for monitoring are:

1. Agricultural chemicals are used in the area.
2. The ground water in the area is shallow in depth or vulnerable.
3. The majority of the agricultural chemical use is on irrigated land.
4. The soil types are conducive to leaching.
5. The alluvial and /or shallow bedrock aquifers are utilized for domestic water supplies.

Before an area is selected for monitoring, CDPHE will contact interested parties to inform them of the sampling program and SB 90-126, and how we envision its implementation. CDPHE will coordinate closely with federal agencies, county extension agents, conservancy districts, and local health officials in the project area.

Ground Water Monitoring Program

The 1996 monitoring program monitored groundwater quality along the urbanized portion of the Colorado Front Range. This year was different from years past in that all sampling was in an area were there was no production agriculture. This was the first time the program attempted to determine the possible impacts to ground water from urban uses of agricultural chemicals. This urban use would include homeowners applications to yards and gardens, and municipal and private applications to parks, and golf courses.

Seventy two wells were sampled for nitrate and 46 pesticides. In all cases existing wells were used. Most of these wells were privately owned and permitted as domestic wells. Nine monitoring wells located within the incorporated limits of communities in Weld County were also sampled. Locating sampling sites within the urbanized areas presented new challenges never before encountered. The majority of the area has no known existing wells and those that are still present and operating are primarily located in fringe areas that were incorporated into cities after primary development of the area. Thus, well coverage is not uniformly distributed or even representative in most of the area. The number of samples is also corresponding lower than the rural areas sampled before. Personnel problems at CDPHE halted field work for six weeks in September and October. Despite these problems two areas received adequate coverage, Fort Collins and Boulder.

Preliminary analysis of the nitrate and pesticide data indicates that ground water in the majority of the areas sampled does not show as high a level of impact as was found in the agricultural areas. The major inorganic contaminant of concern is nitrate. Nitrate analysis showed that 10 % of all the wells exceeded the nitrate drinking water standard of 10 mg/L. If the monitoring wells sampled in Weld County are eliminated though, the nitrate exceedence drops to only half that or 5 %. The drinking water standard is used as a benchmark for nitrate levels in all wells regardless of use. Pesticide data revealed three pesticides, Atrazine, Bromacil, and Prometon present in the well samples. The breakdown product of Atrazine, Deethyl Atrazine was also present in those samples with Atrazine. No pesticide concentration exceeded a water quality standard.

1996 was the second year of a long term monitoring effort initiated in the South Platte alluvial aquifer from Brighton to Greeley. From June through July, 1996, 87 wells located in Weld County were sampled. Two types of existing wells were used, 19 monitoring wells operated by the Central Conservancy District and 68 irrigation wells sampled in 1989, 1990, 1991, 1994, and 1995. All wells were analyzed for nitrate and the 19 monitoring wells were analyzed for the complete suite of 46 pesticides. The pesticide analysis for the irrigation wells was a immuno assay screen for the triazine herbicides. Nitrate analysis showed that 74% of the monitoring wells and 78% of the irrigation wells exceeded the nitrate drinking water standard of 10 mg/L. In the monitoring wells, nitrate levels ranged from a low of 2.8 mg/L nitrate as nitrogen to a high of 78.3 mg/L. In the irrigation wells, nitrate levels ranged from below our detection level of 0.5 mg/L nitrate as nitrogen to a high of 40.0 mg/L. Pesticide data revealed five pesticides and three pesticide breakdown products, Atrazine, Bromacil, DCPA, Metolachlor, and Prometon present in the monitoring well samples. The breakdown product of Atrazine, Deethyl Atrazine and the breakdown products of Aldicarb, Aldicarb Sulfoxide and Aldicarb Sulfone were also detected.

Atrazine was present in 53% of the wells, Deethyl Atrazine in 68% of the wells, Metolachlor in 21% and Prometon in 37%. Bromacil and DCPA were detected in only one well each. The level of Metolachlor reached 30 ug/L (ppb) in one well. Detection levels for the other pesticides averaged around one ppb.

The triazine herbicide screen used on the irrigation wells detects any pesticide in this family, which includes Atrazine, Simazine, Cyanazine, Deethyl Atrazine, and Prometon. The results are calibrated in units of Atrazine equivalent but may be actually composed of one or more of the components. In 1996, triazine herbicides were detected in 96 % of the irrigation wells. Levels ranged from 0.05 ug/L to 1.28 ug/L (ppb).

The monitoring program included sample collection, laboratory analysis, and data analysis and storage. Due to the limited sample size, this survey does not fully establish a baseline for agricultural chemicals in ground water in this area. At some time in the future, additional data should be added to the study. Upon completion of more sampling and a full analysis, which should include integration with previous and current studies by other agencies, the resulting sampling program will provide the basis for determining a groundwater quality baseline for this region.

The monitoring wells in Weld County were sampled in cooperation with the Central Colorado Water Conservancy District in June 1996. Troy Bauder, of CSU Extension, sampled the irrigation wells in Weld County in July. All other sampling was performed by Brad Austin and John Colbert of CDPHE, July through November, 1996. Field sampling procedures followed the protocol developed by the ground water Quality Monitoring working group of the Colorado nonpoint task force.

The Colorado Department of Agriculture, Standards Laboratory performed all laboratory analysis. Well samples were analyzed for nitrate as nitrogen, and selected pesticides. A list of the pesticides analyzed for is presented in Table 1. Temperature, conductivity, total dissolved solids, pH, and dissolved oxygen were measured in the field.

The results from this sampling program have been entered into the CDPHE Groundwater Quality Data System maintained at CDPHE. A detailed report describing the area sampled, the protocol for sampling and analysis, and the results of the analysis will be provided to the Commissioner of Agriculture upon completion of the survey.

TABLE - 1

Colorado Department Agriculture
Standards Laboratory
Pesticide Methods and Detection Levels

Pesticide Trade Name	Pesticide Common Name	Pesticide Use	Chemical Type	EPA Method	MDL (ug/L)
Harness	Acetachlor	Herb	acetoalinide	525.1	0.1
Lasso	Alachlor	Herb	OrganoCL	525.1	0.1
AAtrex	Atrazine	Herb	Triazine	525.1	0.1
	Deethyl At			525.1	0.2
	Deisopropyl At			525.1	0.2
Balan	Benfluralin	Herb	OrganoFL	525.1	0.2
Hyvar	Bromacil	Herb	uracil	525.1	0.4
Captane	Captan	Fungi	carboximide	525.1	1.4
Bravo	Chlorothalonil	Fungi	Nitrile	525.1	0.1
Lorsban	Chlorpyrifos	Insect	OrganoPH	525.1	0.1
Bladex	Cyanazine	Herb	Triazine	525.1	0.2
Dacthal	DCPA	Herb	phthalic-acid	525.1	0.1
Diazinon	Diazinon	Insect	OrganoPH	525.1	0.2
Casoron	Dichlobenil	Herb	nitrile	525.1	0.1
Cygon	Dimethoate	Insect	OrganoPH	525.1	0.5
	p,p-DDT	Insect	OrganoCL	525.1	0.4
	Endrin	Insect	OrganoCL	525.1	0.3
	Heptachlor	Insect	OrganoCL	525.1	0.6
	Heptachlor epoxide	Insect	OrganoCL	525.1	0.8
Velpar	Hexazinone	Herb	Triazine	525.1	0.1
Gamma-mean	Lindane	Insect	OrganoCL	525.1	0.1
Malathion	Malathion	Insect	OrganoPH	525.1	0.1
Ridomil	Metalaxyl	Fungi	acylalanine	525.1	0.2
Marlate	Methoxychlor	Insect	OrganoCL	525.1	0.9
Dual	Metolachlor	Herb	acetamide	525.1	0.1
Sencor	Metribuzin	Herb	Triazine	525.1	0.5
Prowl	Pendimethalin	Herb	dinitroaniline	525.1	1.2
Prometon	Prometon	Herb	Triazine	525.1	0.1
Princep	Simazine	Herb	Triazine	525.1	0.2
Treflan	Trifluralin	Herb	OrganoFL	525.1	0.3
Weed B Gone	2,4-D	Herb	PhenoxyAcid	515.2	0.2
Banvel	Dicamba	Herb	Benzoic Acid	515.2	0.1
Kilprop	MCPP	Herb	PhenoxyAcid	515.2	2.0
Agritox	MCPA	Herb	PhenoxyAcid	515.2	2.0
Tordon	Picloram	Herb	PicolinicAcid	515.2	0.35

TABLE - 1 (continued)

Colorado Department Agriculture
Standards Laboratory
Pesticide Methods and Detection Levels

Pesticide Trade Name	Pesticide Common Name	Pesticide Use	Chemical Type	EPA Method	MDL (ug/L)
Temik	Aldicarb	Insect	Carbamate	531.1	1.0
	Aldicarb sulfone		Carbamate	531.1	1.0
	Aldicarb sulfoxide		Carbamate	531.1	1.0
Sevin	Carbaryl	Insect	Carbamate	531.1	1.0
Furadan	Carbofuran	Insect	Carbamate	531.1	1.0
	3-Hydroxycarbofuran		Carbamate	531.1	1.0
	Methiocarb	Insect	Carbamate	531.1	1.0
Lannate	Methomyl	Insect	Carbamate	531.1	1.0
	1-Naphthol		Carbamate	531.1	1.0
DPX	Oxamyl	Insect	Carbamate	531.1	1.0
Baygon	Propoxur	Insect	Carbamate	531.1	1.0

Aquifer Vulnerability Study Summary

In addition to monitoring ground water for the presence of agricultural chemicals, the Ag Chemicals Program is required to determine the likelihood that an agricultural chemical will enter the ground water. This determination is based upon the chemical properties of the chemical in question, the behavior of a particular chemical in the soil types of the region under study, the depth to ground water, the farming practices in use, and other factors. This type of determination has been described as a vulnerability analysis.

In the process of writing the generic State Management Plan for Pesticides (SMP), the staff at CDPHE, CDA, and CSU has studied various types of vulnerability analysis. The goal has been to satisfy the requirements of the SMP and SB 90-126, while remaining within the confines of existing staffing, organization and budget. In early 1996, a project was contracted to conduct a limited test of a aquifer sensitivity method in the northeastern section of the state. The results of this pilot project have been evaluated by CDPHE, CDA, CSU, and USEPA and approved for use throughout the state. The Program will expand this effort statewide in 1997 to produce a vulnerability analysis for Colorado. A contract for the expanded work will be negotiated in early 1997. The sources, format, and availability of the data needed for the statewide evaluation are currently being compiled. The finished mapping project will provide a standard method to determine aquifer sensitivity and agricultural chemical vulnerability statewide. Results will be evaluated and incorporated into a standard method to map those areas of the state were ground water is vulnerable to contamination from agricultural chemicals. The monitoring program can then target resources to those areas where attention is most needed. This effort will become a key element of the State Management Plan for pesticides implemented under the Federal Insecticide, Fungicide, and Rodenticide Act

Update on collecting existing Ground Water Quality Data

In the FY-97 Memorandum of Understanding, the Ag Chemicals Program agreed to pursue collecting, evaluating, and entering into a database all existing ground water quality data available. Ground water quality data from various regions of the state has been entered as it becomes available. Recently this includes, CDPHE data collected as part of Super Fund preliminary assessment studies by the Haz. Mat. Division, and recently published U. S. Geological Survey data. As the data from these studies is received, it is entered into a database specifically designed for this purpose. In addition, collection and entry of historical data from the U. S. Geological Survey and U. S. EPA is an ongoing process.

The U. S. Geological Survey (USGS) is now wrapping up monitoring in the South Platte and the San Luis Valley areas under the National Water Quality Assessment (NAWQA) program. The Upper Colorado Basin NAWQA is now underway with sampling planned for Federal FY97. As this data becomes available it will be incorporated into the final analysis for water quality in these areas. Several water conservancy districts are also actively engaged in collecting ground water quality data. Unfortunately, this data is not always readily available due to concerns about

privacy and future use of the data. The program hopes that as the monitoring effort continues and the agricultural community grows comfortable with our goals and intent, this valuable source of data will become available and enhance our understanding of the overall ground water quality of the state.

Other Activity

A long range sampling plan has been developed for the monitoring program. The plan covers three major types of ground water monitoring. The first type of monitoring is the initial screening surveys to be conducted on all major aquifers subject to contamination from agricultural chemicals. The screening surveys for the South Platte River alluvial aquifer, San Luis Valley unconfined aquifer, and the Arkansas River alluvial aquifer are complete. The second type of monitoring is a follow-up sampling program to resample, for confirmation, all wells in which any contaminant was detected at a level of concern. Surrounding wells may also be sampled, if available, to determine if the contamination is widespread or only a localized problem. Follow-up sampling was conducted in the South Platte in 1993 and in the Lower Arkansas in 1995. The third type of monitoring is the specialized sampling needed for evaluation of Best Management Practices or Agricultural Management Areas when established. This long term monitoring, utilizing special wells such as dedicated monitoring wells, was started in 1995 in the Brighton to Greeley reach of the South Platte. In 1996, we continued this long term monitoring project and began the initial statistical analysis of the data that has been gathered to date.

Recent development pressures, in once rural outlying areas, has heightened public awareness of the potential for impacts to water quality. The Program has responded to these concerns by offering technical assistance to water conservancy districts, ground water management districts, and other local entities interested in evaluating water quality in their area. Presentations of how the program works, past and present water quality projects, and plans for future projects with request for local input are made at every opportunity. In 1996, presentations were made at nine major meetings and several small local groups throughout the state. We consider this type of outreach an important part of the customer service component of the program.

Before an area is selected for monitoring, CDPHE will contact interested parties to inform them of the sampling program and SB 90-126, and how we envision its implementation. CDPHE will coordinate closely with federal agencies, county extension agents, conservancy districts, and local health officials in the project area.

Long Range Sampling Plan
Agricultural Chemicals Program

Short Term: (1-5 years)

Regional Baseline surveys

1) Major aquifers underlying an area of irrigated agriculture

South Platte Alluvial Aquifer system
Arkansas Alluvial Aquifer system
San Luis Valley unconfined aquifer
High Plains - Ogallala aquifer
Uncompahgre - Lower Colorado Alluvial Aquifer system

2) Major aquifers underlying urban areas

Denver Basin aquifer system
Fountain Creek
Cache la Poudre
Saint Charles Mesa

Mid Term: (3-7 years)

Begin follow-up surveys in those areas where baseline surveys suggest agricultural chemicals have impacted groundwater

1) Increase sampling density to better define area of impact
2) Establish trend if any
3) Incorporate other water quality data into analysis
4) Specific monitoring on BMP sites

Begin planning for permanent monitoring network

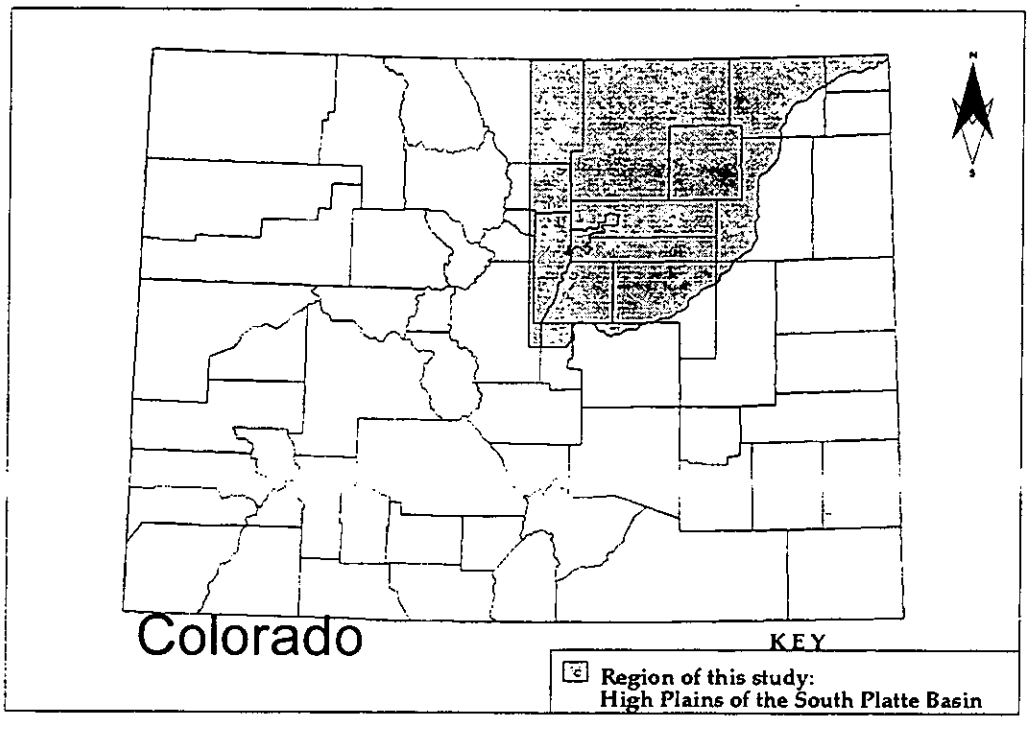
Long Term: (5 years +)

Installing a permanent monitoring network

1) Low density control wells around the state
2) Medium density monitoring wells in areas of concern
3) High density monitoring wells within any designated AMA

A Method for Assessing Sensitivity of Colorado Aquifers to Pesticide Contamination: A Pilot Evaluation of the Lower South Platte Basin

General Analysis Description



Prepared for: The Colorado Department of Agriculture

by Maurice D. Hall in cooperation with:
Colorado State University Cooperative Extension
Colorado Department of Agriculture
Colorado Department of Public Health and Environment
USDA, ARS - Great Plains Systems Research

April, 1996

APPENDIX IV

1996 Annual Report
Colorado Department of Agriculture

Rules and Regulations for Agricultural Chemical Bulk Storage Facilities and Mixing and Loading Areas

Section 25-8-205.5 (3)(b) of the Agricultural Chemicals and Groundwater Protection Act requires the Commissioner of Agriculture to develop regulations where pesticides and fertilizers are stored or handled in quantities that exceed the established thresholds. These regulations were adopted in July 1994 and became effective September 30, 1994. Efforts to provide information on the requirements of the regulations and the time line for compliance were initiated at that time. In 1996, numerous presentations were made to groups throughout the state. The presentations were given to organizations and associations which have a substantial number of their members subject to the regulations. In addition, numerous facilities were visited to provide information and answer specific questions. This educational process aids individuals in determining first, whether or not compliance with the regulations is required and second, what specifically must be accomplished to meet the requirements. The law mandated at least a three year phase-in period for the regulations. As a result of comments prior to and at the public hearings, a graduated phase-in schedule was adopted. Compliance is required by:

- **September 30, 1997** for liquid pesticide secondary containment and mixing and loading pads.
- **September 30, 1997** for liquid fertilizer tanks greater than 100,000 gallons, one of the three prescribed methods of leak detection must be utilized unless secondary containment is in place.
- **September 30, 1999** for liquid fertilizer secondary containment and mixing and loading pads.
- **September 30, 1999** for dry fertilizer storage and mixing and loading pads.
- **September 30, 2004** for secondary containment for fertilizer storage tanks with a capacity greater than 100,000 gallons.

One requirement of the regulations is that facility designs be signed and sealed by an engineer registered in the state of Colorado; or the design be from a source approved by the commissioner and available for public use. The second part of the requirement was added as a result of comments at the public hearings. It was asserted that some of the facilities may be very similar and that it would be a burden for small facilities to have an engineer sign and seal the plans. By adding this part, it allowed approved generic plans to be utilized without each facility needing to solicit an engineer.

Subsequently, the Colorado Department of Agriculture (CDA) in conjunction with Dr. Lloyd Walker, extension agricultural engineer with Colorado State University Cooperative Extension, produced a set of plans that meet the second criteria. The document is entitled, Agricultural Chemical Bulk Storage and Mix/Load Facility Plans for Small to Medium-Sized Facilities. The plans are available from Colorado State University or CDA free of charge.

Copies of the complete regulations and a summary sheet that contains a check list to allow individuals to determine if the regulations apply to their operation are also available from CSU or CDA.

State Management Plans for Pesticides

In October of 1991, the EPA released their Pesticides and Ground-Water Strategy. The document describes the policies, management programs, and regulatory approaches that the EPA will use to protect the nation's groundwater resources from risk of contamination by pesticides. It emphasizes prevention over remedial treatment. The centerpiece of the Strategy is the development and implementation of State Management Plans (SMPs) for pesticides that pose a significant risk to groundwater resources.

The EPA will require an SMP for a specific pesticide if: (1) the Agency concludes from the evidence of a chemical's contamination potential that the pesticide "may cause unreasonable adverse effects to human health or the environment in the absence of effective local management measures; and (2) the Agency determines that, although labeling and restricted use classification measures are insufficient to ensure adequate protection of groundwater resources, national cancellation would not be necessary if the State assumes the management of the pesticide in sensitive areas to address effectively the contamination risk. If the EPA invokes the SMP approach for a pesticide, its legal sale and use would be restricted to States with an EPA-approved Pesticide SMP.

EPA published the proposed rule for state management plans for pesticides on June 26, 1996. In order to develop comments for submission to EPA that reflected the views of the citizens of Colorado, four meetings were held around the state. These meetings were held during the summer in Henderson, Monte Vista, Delta and Greeley. In addition, several presentations about the proposed rule were given at various industry and agency meetings throughout the state. Through the input received at these meetings, comments were developed and submitted to EPA. The comments were submitted under the signature of the Commissioner of Agriculture, Director of Colorado State University Cooperative Extension and the Executive Director of the Colorado Department of Public Health and the Environment. Since these three state agencies have primary authority for protection of groundwater resources from pesticides and are the cooperating agencies for this program, it was felt the comments would carry more weight if they were jointly signed. The proposed rule stipulated a comment deadline of October 26, 1996; however, due to a large number of requests to have it extended, EPA changed the closing date to December 6, 1996. These comments follow the end of this report.

In addition, the Colorado Department of Agriculture worked with the Association of American Pesticide Control Officials and the National Association of State Departments of Agriculture, of which the Department is a member, in preparing comments submitted to EPA by these organizations.

In 1996, a complete draft of the generic state management plan was finished and provided it to EPA for their informal review. If Colorado can complete and receive concurrence from

EPA on a generic plan, it should be much easier for a pesticide specific plan to be approved once the proposed rule is finalized.

As discussed in last year's report, one of the more significant issues involves EPA's demand for a sensitivity analysis/vulnerability assessment map of the state in a Geographic Information System (GIS) format by which to determine where to focus education and monitoring activities. Funding has been unavailable to perform this analysis for even a portion of the state. In addition, significant amounts of data that is required for this analysis is not in electronic format to utilize with GIS. In late 1995, a small EPA grant was obtained to perform a sensitivity analysis pilot project for the northeastern part of the state. This work was completed in 1996 and provided to EPA. EPA reacted favorably to the project and has provided funding for a sensitivity analysis to be completed on the rest of the state. The work has begun and should be completed by October 1997.

Pesticide use data at the county level is another requirement of the SMP. In addition, with the passage of the Food Quality Protection Act by Congress, accurate pesticide use information has become more critical. To try and provide this data, CDA along with CSU Cooperative Extension is contracting with the Colorado Agricultural Statistics Service to perform a statewide pesticide use survey. Details of the survey are being discussed, and it is planned that the survey will take place in late fall and early winter of 1997. The majority of the funding is being provided by an EPA grant.

Waste Pesticide Disposal

In 1995, CSU Cooperative Extension operated a pilot waste pesticide collection program in Adams, Larimer, Boulder and Weld Counties. The purpose of this type of program is to provide pesticide users an opportunity to dispose of banned, canceled or unwanted pesticides in an economical and environmentally sound manner. Part of the funding for the program was provided by an EPA Nonpoint Source 319 grant. The program was successful and disposed of about 17,000 pounds of waste pesticides from 67 participants.

Based on the success of this pilot program, CDA was asked to continue a program that could collect and dispose of waste pesticides in other areas of the state. However, CDA currently has no statutory authority or funding to operate such a program. In light of this, two alternatives were discussed as a way for a waste pesticide collection program to continue. The first was for CDA to seek statutory authority and funding from the Legislature to operate a state run program. The second was to determine if a private program, operated by a hazardous waste handling company, was possible.

The possibility of continuing this type of program was made significantly easier by the passage of the Universal Waste Rule (UWR) by EPA and the Colorado Department of Public Health and Environment in late 1995. The UWR was developed to encourage disposal of products identified as universal wastes by relaxing the regulations in the Resource Conservation and Recovery Act (RCRA) and therefore making it easier to properly dispose of these products. Waste pesticides were defined in the rule as a universal waste.

CDA spoke to hazardous waste contractors to determine if they would be interested in attempting to collect and dispose of waste pesticides as a private program. One company stated they would be interested. Discussions were initiated with the company and it appeared it would be possible for the company to operate a private program at a reasonable cost to the participants. The company stated collection and disposal costs for participants would be between $2.25 and $2.75 a pound.

Based on this information, it was determined that the private program option would be pursued since the possibility of getting legislation passed was small. Furthermore, the time required for legislation to be passed would considerably delay the operation of a program.

After numerous issues were addressed, the private company targeted two areas of the state to initiate the program, the San Luis Valley and the six counties in northeastern Colorado. Registration for participants was set to begin in early 1997, with a scheduled collection of pesticides set for mid-March 1997. If this program is successful, it will be operated in other areas of the state.

STATE OF COLORADO

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December 5, 1996

Public Response and Program Resources Branch
Field Operations Division (7506C)
Office of Pesticide Programs
Environmental Protection Agency
401 M Street SW
Washington, DC 20460

Docket Control Number "OPP-36190"

To the Docket:

Thank you for the opportunity to comment on the Pesticides and Ground Water State Management Plan Regulation; Proposed Rule, 40 CFR Parts 152 and 156.

To formulate these comments, the Colorado Department of Agriculture (CDA) held four meetings around the state to present information on the proposed rule and seek comments from pesticide users, dealers and the general public. In addition, eight presentations were made at meetings of agricultural business associations and resource management districts throughout the state. Several articles were printed in newsletters, newspapers, and magazines to inform the public that the proposed rule was available for comment. Oral comments received at the meetings were noted and five organizations submitted written comments to CDA. Based upon these outreach efforts, we feel the following comments reflect the opinions of a broad range of Colorado citizens that would be affected by the proposed rule.

Our comments are divided into two parts. The first addresses the identification of pesticides for further restrictions; the second addresses the process outlined for development and approval of a State Management Plan (SMP).

Identifying Pesticides for Further Restriction

We support the concept of a graduated approach to regulatory restriction incorporated in the SMP process. This concept has been consistently presented as the EPA's preferred approach to ground water protection related to those pesticides which are

currently registered. In this proposed design the levels of regulation advance first from label requirements, then to risk mitigation measures\label changes, then to restricted use classification, then to pesticide SMPs and finally to cancellation.

Accordingly, we support restriction of these five pesticides, and any others for which an SMP will be required, by the conventional restricted use process. We therefore believe this rule apart from that process should not be used as the means by which these pesticides, or any others being considered for the SMP process, are categorized as restricted use.

On May 13, 1991 EPA published Criteria for Classifying Pesticides for Restricted Use Due to Ground Water Concerns; Proposed Rules 40 CFR Part 152. We recommend EPA finalize this proposed rule with criteria reflecting current scientific knowledge. EPA could then utilize these criteria to label the five identified pesticides (and any others that meet the proposed criteria) for restricted use due to ground water concerns. Restricting use of these pesticides in this manner, and then requiring an SMP if it is determined all other measures are not adequate, serves to reinforce the concept that an SMP is the final alternative before cancellation. By following this process, EPA would clearly demonstrate that the pesticides are selected for further restriction based on their own physical and chemical characteristics, uses and impact to the environment.

We further recommend that in finalizing the above mentioned rule, EPA consider restricted use pesticide (RUP) designation based on the threat to ground water from the various pesticides uses rather than selecting active ingredients. This will provide consistency with the way RUPs are currently designated. Also, minor uses that pose no threat to ground waters would not have to be included in an SMP. This approach will reduce the regulatory burden to states and protect public health and the environment.

In determining further restrictions, EPA should consider the metabolites of any pesticide it plans to designate for the SMP process. This step must be completed before identifying the pesticide for an SMP.

EPA has stated that all five of these pesticides meet the criteria proposed in this rule. Under the scenario that we have suggested, the five pesticides could be classified as restricted use faster than the 33 months (or longer) that it would take to receive approval of an SMP. Our proposal would allow adequate time to gather pesticide use information and to develop the SMP.

Our suggestion would allow the pesticides proposed for the SMP to be classified as restricted use, and therefore the proposed

changes to Part 156 would be unnecessary. A label design, or "box", (similar in nature to the Worker Protection Standard box) could be added to the label and entitled "Ground Water Protection Standard." The language which EPA has developed which reads:

> "For use only in accordance with an EPA-approved State Management Plan for ground water protection. Sale and use are prohibited in States that do not have an EPA-approved State Management Plan"

could be placed in the box.

We strongly believe Part 156 should not be revised to include an entire new Subpart G which among other things adds a new restricted use statement for SMP use. Establishment of a new class of restricted use pesticides, as put forth in the labeling requirements in proposed Part 156.137 (a)(2)(ii), would only create confusion and diminish the effectiveness of the restricted use process already in place. The restricted use classification and accompanying certification and training program is one of EPA's most successful programs. Changing this 20 year-old concept will require the complete re-education of applicators, dealers, regulators, pesticide educators, related industries, agencies and the public. It would undermine the entire program and cost millions of dollars to revise examinations, study guides, texts and related materials. Furthermore, this portion of the rule has the potential for expanding state enforcement programs beyond a level that makes environmental sense and beyond the means of our current fiscal resources. Such an unnecessary consequence could occur as a result of the way in which restricted use pesticides are defined in state statutes.

State Management Plan Process

There is strong support in Colorado for the concept outlined in the proposed rule by which states could take the lead in addressing the issues of ground water contamination from pesticides. Localized management is critical to address issues where the governing factors such as pesticide use patterns, geology, climate, etc., vary greatly within a state as well as between states. EPA should be commended for recognizing the value of state leadership in ground water protection and for incorporating it into the proposal. This approach will conform well to Colorado's localized management approach for protecting ground water from pesticide contamination.

Cost/Benefit Analysis

While the local management concept is largely supported across the state, a number of significant concerns were raised regarding the specifics of the proposed rule. EPA has stated that the cost/benefit analysis of a rule such as this is difficult to evaluate. However, an analysis of this nature is

critical in instances such as this where the financial implications are so great and where its effect will be so widespread. EPA states the impact to be well over $100 million annually. We are led to question how this analysis was conducted and the validity of the conclusions.

Funding

The proposed rule as it is currently written is an unfunded federal mandate. The proposed rule requires the state, as part of its SMP, to commit adequate resources to carry out the plan. EPA makes no commitment in the rule toward funding of the SMPs, yet the rule allows EPA to determine the adequacy of the state's resources and to withhold approval of the SMP until sufficient funds are committed. For this process to be acceptable, a commitment of new federal dollars to funding some portion of the SMPs will be necessary.

In addition, EPA grant funds identified as initiative monies and made available through cooperative agreements should be considered program monies. These monies would then be available to address any groundwater contamination concern from pesticides and not just pesticides designated as part of the SMP. This will provide flexibility for states to target the pesticides they have identified as a priority and address localized problems. Through the current changes being made to the grant process, this concept may have already been addressed, but if not, EPA should consider this approach.

Progress To Date

A prevailing concern in Colorado regarding the proposed SMP process is that it does not recognize activities that are already in place in the states. It provides no simple mechanism by which a state can show that the threat to ground water is minimal and that the state believes that the processes already in place are adequate to protect the resource. Progress made by states and registrants to address ground water concerns from pesticides is significant and should be recognized by EPA. The state may already be achieving the stated goal of the SMP program, which is "to prevent contamination of ground water resources that would cause unreasonable risk to human health and the environment resulting from the normal, registered use of pesticides by taking appropriate actions where such risk may occur."

SMP Components

The proposed rule would require a state to meet 12 "components." In our opinion, only four of the 12 are appropriate and would sufficiently demonstrate the state's activities and would provide adequate basis for EPA to make its determination. EPA's approval should be based only on the following four components: the basis for assessment and planning; monitoring; prevention actions; and response to detections. The detail and extent to which each of these four components is developed and explained should be commensurate with the risks associated with use and groundwater

vulnerability. This determination should be made by the state. The state has information regarding vulnerability of ground water, monitoring data, pesticide use, and a host of other items and is therefore in the best position to make the determination.

Such details as the source and methods used to generate ground water quality data should be left to the state. The states need the flexibility to utilize any data they determine credible to make decisions. In addition, we are adamantly opposed to EPA specifying trigger levels at a percentage of the ground water reference point which will dictate action. Such trigger levels may set a de facto water quality standard and would not be consistent with the state's regulatory system.

In-addition, the basis for ground water quality assessment and planning and monitoring components should be allowed to be phased in. Since these are the two most expensive components, a phased-in approach would decrease the overall financial burden of the proposed rule. The rule should direct EPA to accept an SMP that has initiated assessment and monitoring activities and which has an adequate plan to build upon these activities in the future.

The other eight components required by the proposed rule are matters properly determined by the states. The items addressed in these components, such as a state's philosophy, which agencies are necessary to be involved in the SMP process, how it coordinates ground water activities, the resources available, and the state's public participation process should not be subject to EPA approval. These items will vary greatly among states and generally are established through legislation, regulation or administrative procedures. These items should be included in the SMP to provide a framework for EPA to better understand how the state operates. This information should be for support purposes only and not subject to EPA approval. They should not be subject to EPA approval. In addition, the SMP should not be required to be submitted in electronic format, much less in a specified format likely to be obsolete within weeks.

Approval Of SMPS

Regarding approval of SMPs, EPA should be prepared to grant conditional approval of SMPs in cases where states are seeking changes to statutes or regulations. In some states the established process for these changes may take longer than the proposed 24 month development period. If conditional approval, the phased-in approach, and the scaled down requirements mentioned above are acceptable, then the 24 month time frame should be adequate.

We strongly suggest a process be developed to provide for relief in the event a state and EPA region cannot reach agreement on an SMP. An appeal process to headquarters or panel of regions would be acceptable. With ten different

regions approving SMPs, undoubtedly there will be differing views as to what constitutes am appropriate SMP. Just such differences have surfaced in the development of generic SMPs. Without an adequate means to handle these conflicts, success of the SMP process could be jeopardized.

Maximum flexibility is needed in developing SMPs because the factors that go into determining what needs to be addressed, and to what extent, will vary widely among the states. Our reasoning for proposing the ability to develop a scaled down SMP comes from several factors detailed below.

In the preamble to the proposed rule, EPA states its basis for choosing these five pesticides. Much of the reasoning is based on the fact that these products have been found in both surface and ground water in many areas and in significant concentrations.

In Colorado, ground water monitoring data has not found the same sort of impact, even in sensitive alluvial aquifers. While atrazine has been detected in some areas of the state, it has been at very low levels (well below the maximum concentration levels). Only one public water system has detected atrazine in one of it's five supply wells. This well was subsequently disconnected. Only a few other pesticides have been detected in Colorado public ground water supplies and these were at very low levels. No public water systems served by surface water supplies have detected atrazine.

Nevertheless, we are very concerned about preventing pesticide contamination of our precious water resources and having effective controls readily available to address problems if and when they arise. As mentioned earlier, Colorado has in place a solid program to address ground water protection from pesticides. It is not a judicious use of resources to develop extensive plans that may direct resources from what is already taking place.

Based on the extent of the requirements in the proposed rule in addition to previous information, it is apparent that developing and obtaining plan approval will not be a simple task. Without some assurance that a state can develop an appropriate plan which may be minimal in some cases as described above and without having to submit excessive data to prove the negative, Colorado cannot support the requirements of the proposed rule. By providing the state with the assurance of a flexible system, Colorado could direct its resources to the issues of greatest concern, and we could therefore accept the proposed rule. Resources have become difficult to obtain, and the trend will undoubtedly continue. Adoption of these recommendations would lessen the financial burden.

In the preamble, EPA asks many questions they would like addressed in the comments. We believe implementing the above

recommendations would address many of the concerns that generated the questions.

Default SMP

The one issue that deserves more explanation is the default or registrant SMP idea. If the specific requirements in the final rule are of a nature that assures the states they can develop and explain each component of an SMP in a manner that is commensurate with the risks associated with use and vulnerability (as determined by the state) this should lessen the level of concern. However, the idea should be explored through a separate rule making process and not incorporated in this rule without the states' ability to react to a specific proposal.

Conclusion

Colorado supports the general SMP concept. However, without incorporating the changes outlined above, the proposed SMP process will be unduly burdensome to Colorado. We have worked closely with the American Association of Pesticide Control Officials and the National Association of States Department of Agriculture to develop the joint comments from these groups. In general, we support the comments submitted by these groups. Their comments in addition to ours, if addressed, would help alleviate our concerns with the proposed SMP rule. We believe these changes will create a rule that will adequately address the protection of ground water resources in a more cost effective and efficient manner.

Sincerely,

Thomas A. Kourlis
Commissioner

Patti Shwayder
Executive Director
Colorado Department of Public Health and Environment

Milan Rewerts
Director
Colorado State University Cooperative Extension

APPENDIX V

AGRICULTURAL CHEMICALS AND GROUNDWATER PROTECTION ACT
ADVISORY COMMITTEE 1996

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