

Agricultural Crops, Nutrients and Pesticides: Management Ideas for Wellhead Protection Programs

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Production of agricultural crops in wellhead protection (WHP) areas may pose contamination risks to public drinking water sources. Principal sources of such risk include crop nutrients (commercial fertilizers and organic sources such as manure and legume carryover) and pesticides (insecticides, herbicides and fungicides). Nutrients and pesticides are generally applied to soils and crops over large areas of land. Environmental contamination from these inputs is typically the result of combined activities of many landowners within a WHP area. Such contamination is considered to be *nonpoint source contamination*, as opposed to “point” source contamination. Point source contamination comes from more readily identified and individually controlled sources such as wastewater discharge pipes, feedlots, waste lagoons, chemical storage tanks and chemical spills.

Most nonpoint source pollution from agricultural nutrients and pesticides results from over-application, improper timing of application, improper chemical selection or use, or specific tillage practices that result in losses to the environment.

Agricultural Best Management Practices and recommended fertilizer rates developed by the University of Minnesota Extension Service are designed to maximize crop use of nutrients (particularly nitrogen and phosphorus) and to minimize unnecessary pesticide use, thus saving crop producers money while reducing environmental contamination.

The following pages provide a list of educational, service and regulatory activities a public water supplier might choose to include in plans to manage agricultural activities in a WHP area. These activities are **not required** of public water suppliers, but provide a **menu of choices** – the methods chosen will depend on the local situation. It is also important to note that agricultural crop production is not always a problem in WHP areas nor are they the only problem to focus on. Many land uses can be sources of potential contamination in WHP areas.

Education:

Education Activities related to Crop Production in WHP Areas

Personal Contacts
Demonstration Projects
Workshops/Training
Special Events/Field Days
Information Packets
Newsletters, Newspaper, Radio,
Maps and Signage
Rural Children's Water Festival
Recognition Programs

If a public water supplier chooses to develop management strategies for land-use issues involving agricultural crops in the WHP area, education should be included as a component of the management plan, regardless of whether other methods are also used. **Many state and local agencies and organizations have already developed tools for educational outreach and assistance. The agencies and organizations listed in *Appendix D* should be contacted for assistance in identification of special concerns and development of appropriate educational campaigns. Also, an effective educational campaign must include those providing services to crop producers (e.g., fertilizer dealers, crop consultants, and fertilizer and pesticide applicators).** Messages to highlight in an educational program for crop producers might include:

- special concerns regarding production of crops in WHP areas, such as linking soil and crop management practices to possible groundwater (drinking water) impacts;
- promotion of nitrogen and pesticide Best Management Practices (BMPs), phosphorus management guidelines and recommended timing and rates for certain fertilizers, crops, rotations, soils and regions¹;
- promotion of grant programs and financial assistance services (see *Services* section of the document) to assess and address infrastructure needs that reduce or prevent environmental degradation from crop production and certain farm management practices;
- development and implementation of individual farm Nutrient Management Plans, Pest Management Plans and Residue Management Plans, which lay the foundation for proper nutrient, pesticide and soil loss accounting in crop production;
- promotion of adequate soil and manure testing and evaluation of test results in relation to University of Minnesota recommended fertilizer rates and nutrient accounting methods;
- potential advantages of crop producer participation in a variety of incentive, payment or acreage reserve programs, such as the USDA Conservation Reserve Program (CRP), the Minnesota River Basin Conservation Reserve Enhancement Program (CREP), or other federal and state programs that pay producers to keep environmentally sensitive acres out of intensive production; and
- promotion of pesticide BMPs (including Integrated Pest Management) in accordance with the state Pesticide Management Plan.

¹ Animal manures contain significant concentrations of crop nutrients (nitrogen and phosphorus) and are an important part of many farming operations. The nutrient load that manure supplies to a crop must be accounted for, manure spreaders/injectors must be properly calibrated, and the timing and method of application must be appropriate – if not, animal manures can lead to nonpoint source pollution problems and crop production inefficiencies. A separate publication, [Feedlots and Manure Management: Management Ideas for Wellhead Protection Programs](#), addresses the educational, service and regulatory aspects of manure as a crop nutrient and potential environmental contaminant.

Two additional, companion publications in this series include: [Turf, Lawn and Garden Care: Management Ideas for Wellhead Protection Programs](#), which addresses educational, service and regulatory aspects of turf and lawn care nutrients and pesticides; and [Agricultural Chemical Facilities and Applicators: Management Ideas for Wellhead Protection Programs](#), which addresses the registration, licensing and reporting requirements for retail operations, cooperatives and individuals that sell or handle agricultural chemicals.

The MDA has established a Water Protection and Nutrient Management team to address agriculture-related wellhead protection issues throughout the state (see *Appendix A* for map illustrating MDA Water Protection and Nutrient Management staff responsibilities and contact information). In addition, most Minnesota counties have several offices that can provide assistance to local water suppliers and that disseminate educational materials about crop production practices. These offices include local or regional offices charged with water planning, the Soil and Water Conservation District (SWCD), the Natural Resource Conservation Service (NRCS), the Farm Service Agency (FSA) and the state Board of Soil and Water Resources (BSWR). The University of Minnesota also maintains regional Research and Outreach Centers and employs educators with the Minnesota Extension Service (MES). **Public water suppliers should, therefore, coordinate agricultural educational activities with as many of these offices as possible, and rely in particular on those entities with a local agricultural mission (e.g., SWCD and MES).**

Listed below are a variety of educational activities that public water suppliers could consider when developing and coordinating a comprehensive educational plan for a WHP area. Development of a comprehensive, coordinated plan is critical to a successful educational campaign so that landowners, producers, dealers and others are not overwhelmed with duplicate and possibly conflicting outreach and efforts and requests for participation. Agricultural educational activities recommended for WHP areas include:

Focus on Potential Agricultural Contaminant Sources to Drinking Water: Nitrogen and Phosphorus	
NITROGEN	PHOSPHORUS
<p>Nonpoint Agricultural Sources: Commercial fertilizer, animal manures, annual and perennial legumes (soybeans, alfalfa).</p> <p>Concern for Public Water Supplies: All nitrogen sources are vulnerable to transformation into nitrate, a highly soluble molecule that can leach into drinking water aquifers. If present in drinking water at concentrations greater than 10 parts per million (the human health standard for consumption), pregnant women and infants are at risk for health problems.</p> <p>Protection Measures for <u>Aquifer</u> Sources of Drinking Water: Promote, adopt and evaluate crop production and nutrient BMPs and University of Minnesota recommended fertilizer rates. Develop and implement Nutrient Management Plans.</p>	<p>Nonpoint Agricultural Sources: Commercial fertilizer, animal manures, “build-up” in soil due to historic fertilizer practices.</p> <p>Concerns for Public Water Supplies: Phosphorus is primarily insoluble. Insoluble forms of phosphorus are the primary cause of oxygen depletion in lakes, streams and water resources that may feed surface water sources of drinking water. Insoluble phosphorus reaches surface waters by traveling overland with erosion sediments during snowmelt and rainfall events.</p> <p>Protection Measures for <u>Surface</u> Water Sources of Drinking Water: Evaluate phosphorus levels in soils through sampling, and testing by certified laboratories. Refer to University of Minnesota and Nutrient Management Plan recommendations. Implement residue management to minimize soil erosion.</p>

Personal Contacts: One of the best ways to educate crop producers in WHP areas is through personal contacts. Public water suppliers can team up with local staff where available (MDA, FSA, NRCS and SWCD staff, MES staff and trained volunteers) to contact each crop producer within a WHP area to personally talk with them about their crop production methods and available financial assistance

programs. As part of these contacts, which can be made by phone, letter, or in-person, it may be appropriate to distribute certain print materials. Such personal contacts can be an effective educational tool. The MDA has developed an analytical tool – the Farm Nutrient Management Assessment Process, or FANMAP – wherein individual crop producers in a WHP area are confidentially surveyed about their nutrient management by MDA field staff. The results of the FANMAP surveys can be very useful in designing effective water quality education programs while providing baseline data to determine program effectiveness over time.

Demonstration Projects: Public water suppliers should work with county water planners, local SWCD staff, MES staff, and federal, state and local agriculture and natural resource agencies and organizations to assess the feasibility of establishing and financing on-farm demonstration projects that put crop and livestock production BMPs into local context. Several demonstration projects have already been assembled in or near WHP areas² and have created awareness of potential crop production impacts on public water supplies. Many of the BMPs and fertilizer recommendations are developed on small-scale research plots designed by soil scientists and agronomists at University of Minnesota Outreach and Research Centers. While the BMPs are founded in rigorous science, most are, by design, applicable to wide geographic areas of the state and serve as a starting point for on-farm implementation. Some components of the statewide and geographical BMPs are critical regardless of location; other components must be considered in relation to local farming practices, individual soils, topography, crops, climatic patterns, irrigation practices and geology within a WHP area. (*Appendix B* includes a partial list of educational materials related to crop production, fertilizer recommendations and nitrogen BMPs.) The primary goal of on-farm demonstration projects is to promote or demonstrate nitrogen BMPs and other recommended agronomic practices. The interests of crop producers, agricultural dealers and merchants, seasonal homeowners, city planners and residents are all at stake in such demonstrations, so it is critical to obtain broad participation and understanding of the goals and anticipated outcomes of such demonstration projects.

Workshops/Training: Public water suppliers can encourage crop producers within the WHP area to attend agricultural workshops and seminars sponsored by county water planners, local SWCD staff, MES staff, and federal, state and local agriculture and natural resource agencies and organizations. Qualifying workshops should focus on financial assistance programs and on understanding and implementing BMPs specific to regional, crops, soils and production practices. Public water suppliers can co-sponsor such events with agricultural nutrient suppliers, and consider underwriting workshops or seminars. Public water suppliers, through their billing and advertising services, could provide crop producers with calendars of already scheduled or perennial workshops and seminars. It is important to consider the participation of non-governmental organizations in such workshops – such as the Minnesota Rural Water Association (MRWA), the Minnesota Lakes Association (MLA) and other non-profit organizations – that represent a diversity of water resource stakeholders. To ensure that crop producers are not discouraged from attending training due to cost, public water suppliers may want to consider providing cost-share assistance for workshop registrations.

² The Red Top Farm demonstration project in St. Peter, Minnesota is an on-farm demonstration that developed out of city concerns about nitrate-nitrogen contamination in St. Peter public drinking water supply wells. The city of Perham and the Lincoln-Pipestone Rural Water System have also developed on-farm demonstrations of BMPs in conjunction with their wellhead protection planning activities. *Appendix B* provides a synopsis of these demonstration projects as a tool for discussion.

Special Events/Field Days: As an educational technique, public water suppliers can sponsor special events and invite all interested audiences to attend. One suggestion is to plan an initial open house or field day entitled "Welcome to Wellhead Protection," after the contaminant inventory and wellhead delineation are complete. At this event, the significance of the WHP area can be explained, and information on the importance of managing all contaminant sources found in the inventory can be provided. Information on crop production methods and BMPs can be a part of this event. Many public water suppliers host and assist with free water testing clinics sponsored by the MDA or local authorities. While the focus of the clinics is on private well water quality, participants are provided with information on land use and other information that facilitates broad community understanding of nonpoint source pollution, its causes, and its remedies.

Follow-up special events specific to crop producers, such as the previously described on-farm demonstration projects, can also be planned. The demonstration project team could host a field day for other producers within the wellhead, allowing producers to learn from each other. Some counties offer field days or farm tours on specific agricultural issues and crop production methods. Where such events are already available, public water suppliers could encourage WHP area producers to attend.

Information Packets: Public water suppliers can work with county water planners, local SWCD staff, MES staff, and federal, state and local agriculture and natural resource agencies and organizations or a certified crop consultant to distribute packets of printed information to crop producers. It is important to carefully consider the usefulness, volume and tone of such materials in light of local perceptions about participating organizations. Print materials are available addressing financial assistance programs, particular crop production methods, fertilizers, rotations, soils and regions (see *Appendix B* for a partial list of educational materials related to crop production and BMPs). Additional materials are available from the local offices or World Wide Web pages of the organizations listed in this document (see *Appendix D* for a partial list of useful Internet addresses). These materials can be distributed through a variety of methods, ranging from personal or mail delivery to distribution at special booths at community-wide events. The delivery mechanism will depend on the local situation (numbers of producers within your WHP area, ways in which your community receives information, etc.). Costs will vary, depending on the delivery mechanism chosen.

Newsletters, Newspapers, Radio, Maps and Signage: Newsletters, articles in and press releases to local media can be useful in educating a wide variety of audiences. Public water suppliers may consider developing a newsletter specifically for crop producers in the WHP area. Qualified agency staff or a certified crop consultant should review newsletter and media items relating to agriculture. Items could highlight a variety of issues including crop production methods and BMPs. Developing a newsletter specifically for the WHP area will help to stress the concept of the "special protection area" and will allow public water suppliers to reach crop producers on a variety of topics. The public water suppliers can help promote awareness of the boundaries of the WHP area and associated agricultural activity via signs, maps and other means. Maps and signs help agricultural service providers like dealers and applicators know when they are active in a WHP area. Providing articles to existing newsletters that are read by many crop producers or dealers can be a cost-effective way to share information.

Rural Children's Water Festival: Public water suppliers, working with local units of government, may want to join local schools to provide direction and coordination for a rural children's water festival.

These half-day, or daylong events are designed to raise the awareness of 4th-grade students to issues related to groundwater. Programs include presentations from local agency experts, hands-on projects for the students and play times. Involving students in the development and presentation of projects at these events has proved to be very successful in several communities.

Recognition Programs: Public water suppliers might use recognition programs as an educational tool in conjunction with on-farm demonstration activities or special events and field days. Crop producers that participate in wellhead protection planning and BMP promotion and implementation deserve recognition for their involvement and concern. Cities could provide certificates, plaques, or other recognition awards to crop producers who meet certain criteria established by the public water supplier. The qualifying criteria could include: attending workshops, completion of nutrient management plans, improvement of on-farm infrastructure, machinery and conservation practices (e.g., manure handling systems, erosion control, conservation tillage), etc. All SWCD offices select a “conservator cooperator” for the year. The “River Friendly Farmer Program” acknowledges those producers using crop production methods that protect water quality. Public water suppliers may want to coordinate with these programs to create a “Wellhead Friendly Farmer” recognition awarded to cooperating producers in the WHP area. These programs and their criteria could be established in conjunction with the MDA, SWCD, NRCS, MES or other organizations that promote specific activities to reduce nonpoint source pollution impacts in the WHP area.

Focus on Pesticides

Nonpoint Agricultural Sources: Commercial insecticides, fungicides and herbicides applied to row crops or soil to prevent crop disease, weed or insect infestation, or to eliminate crop foliage (e.g., potato vines prior to harvest).

Concern for Public Water Supplies: Some pesticides are water-soluble and leach to drinking water aquifers. They may also adhere to soil particles that erode with overland runoff and contaminate surface waters used for public water supplies. Testing for certain pesticides is mandatory in public water supply management. Many pesticides are vulnerable to transformation as they move in the environment; the resulting “degradation compounds” or “breakdown products” may be more or less toxic than the original compound. Public water suppliers are not currently required to test for breakdown products of pesticides. Thus, the appearance of some compounds in a water supply may indicate future potential for water treatment needs. Most common pesticides have health risk data indicating their potential toxicity if present at certain concentrations. Contact the MDA and MDH for additional information on pesticides commonly observed in surface waters and groundwaters of the state.

Drinking Water Protection Measures: Promote, adopt and evaluate crop production and pesticide BMPs through the development of Pesticide Management Plans for crop producers within the WHP area. Promote the development and use of Integrated Pest Management approaches to pest control, wherein a crop rotation, intercropping, field scouting and other non-chemical management methods are used to reduce use of chemicals for crop pest control.

■ **Services:**

Technical/Financial Assistance Services Related to Crop Production in WHP Areas

Nutrient Management Planning and
Implementation
Certification and License
Programs for Agricultural
Technicians and Professionals
Soil Testing Laboratory
Certification Program
Manure Testing Laboratory
Certification Program
Irrigation Permits, BMPs
and Scheduling Assistance
Pesticide BMPs
Pesticide and Nitrate Groundwater and
Surface Water Monitoring -
Memoranda of Agreement
Grant & Loan Programs
Acreage Reserve and Land Purchase
Programs
BMP Insurance and Other Incentives
Computer Software/Internet
Assistance

In addition to education, public water suppliers should be aware of and can steer crop producers to services that help manage agricultural contaminant sources. Services go beyond education but do not involve regulation in the strictest sense of the word. For crop producers, services can include both technical assistance and financial assistance.

Using the services described in this section, public water suppliers might consider the following approaches to enlist crop producers in protection of vulnerable drinking water sources:

- provide financial assistance or incentives to farmers to develop nutrient management plans and to practice BMPs;
- provide financial assistance or incentives to farmers for use of certified and licensed agricultural technicians and professionals;
- explore the possibility of providing cost-sharing for insurance policies to cover potential crop yield loss resulting from decreased use of nutrients and pesticides when BMPs alone are insufficient to provide the necessary environmental protection;
- facilitate placement of production acreage into conservation easements and acreage reserve

programs within the WHP area; and establish a city-funded budget for purchase and development rights to agricultural lands critical to WHP areas.

Details of possible services are provided below.

Nutrient Management Planning and Implementation: Crop producers in the WHP area who prepare and then implement Nutrient Management Plans are best positioned to make meaningful contributions to the protection of public water supplies. However, preparing and implementing such plans often requires outlays of time and money that are not readily available to the producer. Additionally, a trained or certified nutrient management planner is in the best position to make the necessary management recommendations. Public water suppliers can do a great service to the producer and the community by assisting with the financing, planning or implementation of such plans. Various planning tools have been developed (e.g., NRCS offices have developed computerized planning software). County water planners, local SWCD staff, MES staff, and federal, state and local agriculture and natural resource agencies and organizations can work with public water suppliers to identify qualified personnel and cost-sharing programs to assist producers in the WHP area with development and implementation of Nutrient Management Plans.

Certification and License Programs for Agricultural Technicians and Professionals:

Various organizations and state agencies certify the activities or competency of agricultural technicians and professionals so that standards of scientific and ethical practice are maintained in the area of providing agricultural services. Public water suppliers could promote the use of these individuals by publishing lists (where available from the certifying authority) of qualified personnel providing services to or in the WHP area. Public water suppliers might directly hire or share the cost of hiring a qualified professional to work with crop producers in the WHP area. Listed below are a few of the more common licensure and certification programs, the purpose of the programs and the authority that maintains the program:

- The **Certified Crop Adviser (CCA)** has achieved proficiency in understanding plant, soil, pest and nutrient interactions that assist crop producers in maintaining economic viability while protecting soil and water resources. The CCA may provide advice on crops and planting, nutrient and pesticide management planning, erosion control, water management and whole-farm analysis. The American Society of Agronomy maintains the certification program.
- **Commercial and Private Pesticide Applicators** are registered and trained to properly handle and apply certain pesticides in specified applications. The properly trained applicator can recognize classes of chemicals, determine proper application rates and techniques, properly maintain and calibrate pesticide application equipment, and properly dispose of waste. The MDA maintains the licensing and certification programs.
- The **Licensed Commercial Manure Applicator** obtains a mandatory license and is trained to properly handle and apply manure to agricultural fields. The licensed individual can properly calculate nutrient content of various manures, determine spreading rates required under state rule (when/where applicable), and properly maintain and calibrate manure application equipment. The MDA maintains the licensing program.

Soil Testing Laboratory Certification Program: This voluntary MDA program ensures accurate and credible soil test results for Minnesota producers, and promotes use of soil testing and use of U of M fertilizer recommendations in nutrient management planning. Participating laboratories must maintain standards for equipment, facilities, personnel, record keeping, methods and procedures. Soil analysis must follow uniform reporting methods. Soil fertility recommendations made by the laboratory must include land grant university soil fertility recommendations as a basis for comparison by the crop producer. A public water supplier could work with county water planners, local SWCD staff, MES staff, and federal, state and local agriculture and natural resource agencies and organizations to support ongoing soil testing through promotion and cost-sharing. Crop producers within WHP areas should use Minnesota-certified laboratories and base management practices on the analytical results and U of M guidelines.

Manure Testing Laboratory Certification Program: This voluntary MDA program is similar to the soil testing laboratory certification program and was developed in response to economic and environmental concerns related to land application of animal manures. Despite increasing numbers of livestock in the state, most producers do not test their manure on a regular basis, in part due to concerns

about the value of the testing. Use of MDA-certified laboratories will be required for development of manure management plans by certain livestock producers under provisions of the new Minnesota Pollution Control Agency Feedlot Permit Rule; however, testing is recommended regardless of whether a producer is required to conduct manure analysis.

Irrigation Permits, BMPs and Scheduling Assistance: The number of irrigated agricultural acres in Minnesota is on the rise, and so is the concern for the possibility of related environmental impacts. Of primary concern are irrigation's impacts on water resource supplies and quality. The DNR is responsible for issuing irrigation permits based on a variety of conditions, including impacts to local water supplies, aquifer capacity, and in some instances, potential environmental impacts and proposed mitigation measures. Public water suppliers should work closely with those requesting permits and with permitting authorities to explore whether issuance of permits competes with overall WHP goals. MDA, NRCS, SWCD and MPCA are working with other state agencies, community planners, producers, and various members of the farm service industry, including irrigators, statewide in order to determine how best to assess and, if necessary, alter irrigation's environmental impacts. Public water suppliers can contact members of these organizations to team up on evaluating and providing access to services related to irrigated crop production. Special Situation BMPs exist for nitrogen use on irrigated, coarse-textured soils and for potato production. Working with the above-mentioned federal, state and local entities, public water suppliers can support producers by promoting:

- adoption of agricultural Best Management Practices specific to the coarse and sandy soils present in select areas of the state;
- adoption of University of Minnesota fertilizer recommendations for specific irrigated crops; and
- fine-tuning crop water and nutrient needs through the utilization of available irrigation tools that aid with evapotranspiration calculations, timing, and fertigation estimates (contact NRCS and MES).

Pesticide BMPs: Pesticide use is regulated exclusively by the U.S. Environmental Protection Agency (EPA) and the MDA. The MDA, U of M and NRCS have created pesticide BMPs addressing handling, use, timing, selection, spills, mixing, loading and the management of waste. Following all of the applicable BMPs can reduce point and nonpoint sources of pesticide contamination. Public water suppliers can work with NRCS and SWCD staff to develop and provide cost-sharing for Integrated Pest Management Plans, and Weed and Pest Management Plans for crop producers within a WHP area. The NRCS also developed the "Windows Pesticide Screening Tool" (WinPST), which the Minnesota-based non-profit Institute for Agriculture and Trade Policy has incorporated into a "Pesticide Decision Tool" (PDT). Together, WinPST and PDT provide a user-friendly method of evaluating pesticide use, fate and transport along with environmental and human health impacts.

Pesticide and Nitrate Groundwater and Surface Water Monitoring – Memoranda of Agreement: The Monitoring and Assessment Unit of the MDA has established memoranda of agreement (MOAs) with various organizations and local units of government. These MOAs can be a long-term cooperative monitoring agreement wherein MDA water monitoring programs provide technical assistance to water quality monitoring projects that are funded, in part, by local entities through grants or other sources.

Grant & Loan Programs: There are many grant and loan programs designed to assist local units of government in improving and protecting water resources, including resources used for drinking water supplies. Public water suppliers should work with county water planners, local SWCD staff, MES staff, and federal, state and local agriculture and natural resource agencies and organizations to develop grant or loan proposals geared toward addressing agricultural sources of nonpoint source pollution in WHP areas. The list below includes frequently used, agriculture-related programs that have benefited community efforts to improve groundwater quality:

- Environmental Quality Incentives Program – The Environmental Quality Incentives (EQIP) Program is administered by NRCS and BWSR offices and provides technical, financial and educational assistance related to cropping, tillage and nutrient management and environmental protection practices in designated priority areas. EQIP education grants have funded demonstration projects, workshops, farm surveys and cost-sharing for various project-related inputs.
- Clean Water Partnership Program – The Clean Water Partnership (CWP) Program is administered by the MPCA. The program provides grants, loans, and technical assistance to local units of government to address nonpoint source pollution. CWP Phase I grants are awarded for diagnostic projects in which the type and extent of nonpoint source pollution in a lake, river or aquifer are determined and response/implementation plans are developed. CWP Phase II grants or loans are awarded to implement practices to improve or protect water resources identified in the CWP Phase I report or an equivalent diagnostic and planning process. CWP Phase I projects might include compiling existing data, ground water flow modeling, well sampling and water level monitoring, observation well installation, geologic assessments, geophysical investigations, age-dating of well waters, delineation of recharge areas, contaminant source inventories, data interpretation and the development of an implementation plan. CWP Phase II projects might include development of specific farm surveys, interviews of producers, demonstration projects, other educational activities, individual sewage treatment upgrades and various agricultural and urban BMPs.
- The Minnesota Board of Soil and Water Resources (BWSR) offers a wide-variety of block and challenge grants to counties, watershed districts and watershed management organizations for water planning and natural resource protection. Many grant proposals submitted to BWSR for comprehensive local water planning contain objectives linked to agricultural BMP promotion, implementation and evaluation.
- Section 319 Grants – Section 319 of the Clean Water Act provides grants to non-federal units of government to implement activities to reduce nonpoint source pollution. The MPCA is the principal administrator of this grant program. The grants may fund various implementation activities including development of specific farm surveys, interviews with producers, demonstration projects, other educational activities, and various agricultural and urban BMPs. The program may fund some monitoring, especially if the monitoring is intended to assess the effectiveness of BMPs. However, Section 319 grants are generally not awarded for projects that are primarily diagnostic in nature.
- The MDA administers a BMP Loan Program to counties, SWCDs and Joint Power Boards. Loans are provided for the implementation of select agricultural BMPs addressing infrastructure needs that reduce or prevent nonpoint environmental degradation from crop production and certain farm management practices. Loans are provided for agricultural waste management, structural erosion control measures, conservation tillage and manure handling equipment, on-farm individual sewage treatment system upgrading or replacement, and proper sealing of abandoned wells. The BMPs must

be identified as priorities by local units of government in their water planning activities, including WHP plans. Contact the MDA BMP Loan Program staff for more information.

- The MDA also offers the Energy and Sustainable Agriculture Program, designed to provide grants and loans to demonstrate and promote alternative agricultural practices which are energy efficient, environmentally sound, profitable and which enhance the self-sufficiency of Minnesota farmers.

Acreage Reserve and Land Purchase Programs: Federal and state agencies have created a variety of acreage reserve or “set aside” programs that shift agricultural acreage out of row crop production and into perennial grasses or forage/cover crops for environmental benefit. Landowners, working with the USDA (through its NRCS and FSA offices), can enroll land into the Conservation Reserve Program. Acreage within the Minnesota River watershed can be enrolled in a hybrid federal-state Conservation Reserve Enhancement Program administered through BWSR and the SWCDs. The Environmental Quality Incentives Program (EQIP) provides grants to counties that are able to designate an area as a Conservation Priority Area. EQIP funds can be used to pay crop producers for environmentally beneficial improvements to infrastructure or for nutrient, pest and grazing land management plans and practices. Payments can also be used to pay for contracting services from Certified Crop Advisers (see above). Public water suppliers can play critical roles in supporting producers and local NRCS, SWCD and BWSR offices in establishing acreage reserve programs within or near the WHP area, in some cases by purchasing and leasing vulnerable acreage. Public water suppliers could also assist crop producers in preparing feasibility analyses of switching from row crop production to perennial grass or forage production, and defray a certain amount of the producer-borne costs. Other acreage reserve programs, many administered and partly financed by BWSR and the SWCDs, are geared toward wetlands, wildlife, forestry, flood risk reduction and grazing. A public water supplier can assist with the identification of qualifying acreage and with providing any technical or cost-share inputs.

In addition to acreage reserve programs sponsored by federal and state government offices, public water suppliers may also want to investigate the feasibility of purchasing land rights to vulnerable portions of the WHP area in order to maintain control over land use management. Land can sometimes be purchased through conservation easements, and careful coordination with surrounding landowners is usually required. Local or state legislative initiatives may be required to raise the money necessary to purchase land rights.

BMP Insurance and Other Incentives: Because crop production occurs in a very competitive economic market, many farmers are reluctant to change nutrient management practices if such a change means potential economic loss. This is a reasonable response to a difficult situation. A new approach to reducing risk for crop producers in areas where nutrient management is critical to vulnerable water supplies is the concept of “BMP Insurance.” Farmers, public water suppliers, non-farming rural residents and others may mutually benefit from purchase of new insurance products that obligate a crop producer to apply fertilizer at recommended rates. The insurance policy could protect the crop producer from any potential losses due to the change in practice. Losses are only anticipated in years when unexpected forces (extraordinary weather or outbreaks of pests or disease) are so great that normally adequate fertilizer rates fail to produce an economic yield. Contact the MDA for more information.

Other incentive programs are in the early developmental stage and include concepts such as benefits for adoption of whole farm conservation practices. Contact the Minnesota Project (in conjunction with the University of Minnesota Institute for Sustainable Agriculture) for more information on their efforts to sustain rural economies while protecting natural resources.

Computer Software/Internet Assistance: Many educational, analytical and planning tools are readily available to public water suppliers through online computer connection to the Internet and the World Wide Web of information sources. State and federal organizations mentioned in this document all maintain “home pages” that contain information maintained by the organization or that contain links to other home pages. Some organizations offer online software tools for nutrient, pest and crop residue management planning. Staff from these organizations can assist WHP planning teams and crop producers with use of such software in WHP areas. See *Appendix D* for a partial list of useful Internet addresses.

■ **Regulation:**

Regulatory Options Related to Crop Production in WHP Areas

Work with Federal, State and Local Programs
Nitrogen Fertilizer Management Plan
Three-Phase Structure
Pesticides
Adoption of New Ordinances
Zoning and Permitting

Local ability to regulate the use of crop inputs such as commercial fertilizers and pesticides may be limited by state and federal laws. A public water supplier may want to become familiar with the existing state regulatory process that can complement local efforts to address crop production issues in a WHP area. Because many MDA, NRCS, SWCD, MES and other federal, state and local programs and services are designed to address environmental protection – including groundwater and surface waters used for drinking water – public water suppliers should work with these organizations on any regulatory activities. Public water suppliers may want to focus their

management activities for crop producers on education and services, rather than regulation. Regulatory activities may be more difficult to implement by public water suppliers because of cross-jurisdictions between local governmental units and the state.

Work with Federal, State and Local Programs: Most crop production educational programs and technical/financial services provided by organizations listed in this document are designed to be non-regulatory. Furthermore, most programs are designed to provide incentives to crop producers to change the way in which they might otherwise farm. *Management-based incentives* are geared towards eliminating inefficiencies in nutrient and pesticide use, thus reducing environmental impact while sustaining farm profitability. *Land-based incentives* are geared towards removing from production acreage that is too vulnerable to agricultural nonpoint pollution or for which BMP implementation is potentially ineffective at reducing nonpoint pollution impacts.

Various federal and state laws limit or assign to certain agencies the regulation of agricultural nitrogen and phosphorus as potential environmental pollutants. Many federal and state laws and rules, including the 1989 Comprehensive Groundwater Protection Act [Minn. Stat. § 103H], require that groundwater be adequately protected from agricultural nutrients and pesticides, and that regulatory rules be established in the event that groundwater quality monitoring indicates degradation trends. Finally, the federal Safe Drinking Water Act [CFR 40, Part 141, Section 1428] and the state Wellhead Protection Rule [Minn. Rules, §§ 4720.5100 to 4720.5590] jointly require that wellhead protection measures be established for all public water supply wells. Bringing crop producers into “compliance” with the intent of various environmental protection statutes and rules requires finding a balance between a crop producer’s need to sustain production (and economic viability) and the need to protect the public’s supply of drinking water.

Public water suppliers should work closely with federal, state and local contacts listed in this document to ensure that existing regulatory tools – and any proposed initiatives in the WHP area – are coordinated with current interpretation of statute and rule.

Nitrogen Fertilizer Management Plan Three-Phase Structure: The 1989 Comprehensive Groundwater Protection Act (the Act) directed the MDA to develop a Nitrogen Fertilizer Management Plan (NFMP) for the prevention, evaluation and mitigation of nonpoint source occurrences of nitrogen fertilizer in the waters of the state. The Act mandates that the NFMP contain both a voluntary BMP component and a component that allows for regulatory action in the form of Water Resource Protection Requirements (WRPRs). The legislature did not provide dedicated funding for implementation of the NFMP, so NFMP goals (such as evaluation of BMPs) has only been partially achieved and only in limited geographic areas.

The *voluntary* BMPs, developed as an outgrowth of the Act, have been reviewed earlier in this document, and information on how to obtain BMPs for specific regions of the state can be found in *Appendix B*.

The NFMP has a three-phase structure for responding to nitrogen fertilizer nonpoint contamination. Regulation of nitrogen fertilizer use can only occur in the third, or “Response” phase and only after joint designation of a Special BMP Promotion area by the MDA, SWCD and the county water planning authority. To date, no Special BMP Promotion Areas have been designated in the state.

The NFMP three-phase structure is further described as follows:

- 1) **BMP Promotion Phase:** Promotion of voluntary adoption and implementation of BMPs (*NOTE: BMP development and promotion is an ongoing process*);
- 2) **BMP Evaluation Phase:** Evaluation of the adoption and effectiveness of voluntary BMPs; (*NOTE: the state is currently developing and implementing BMP evaluation efforts in a limited number of Wellhead Protection Areas – see Appendix C for examples*); and
- 3) **Response Phase:** Response to instances wherein voluntary BMPs have not been adopted or are ineffective in mitigating the occurrence of nitrate in local ground or surface water. The Response Phase will be implemented when initial attempts to resolve nitrogen contamination problems through voluntary action fail. Regulation governing nitrogen fertilizer use in vulnerable areas is possible after a series of intense BMP and groundwater monitoring efforts justifies rule writing.

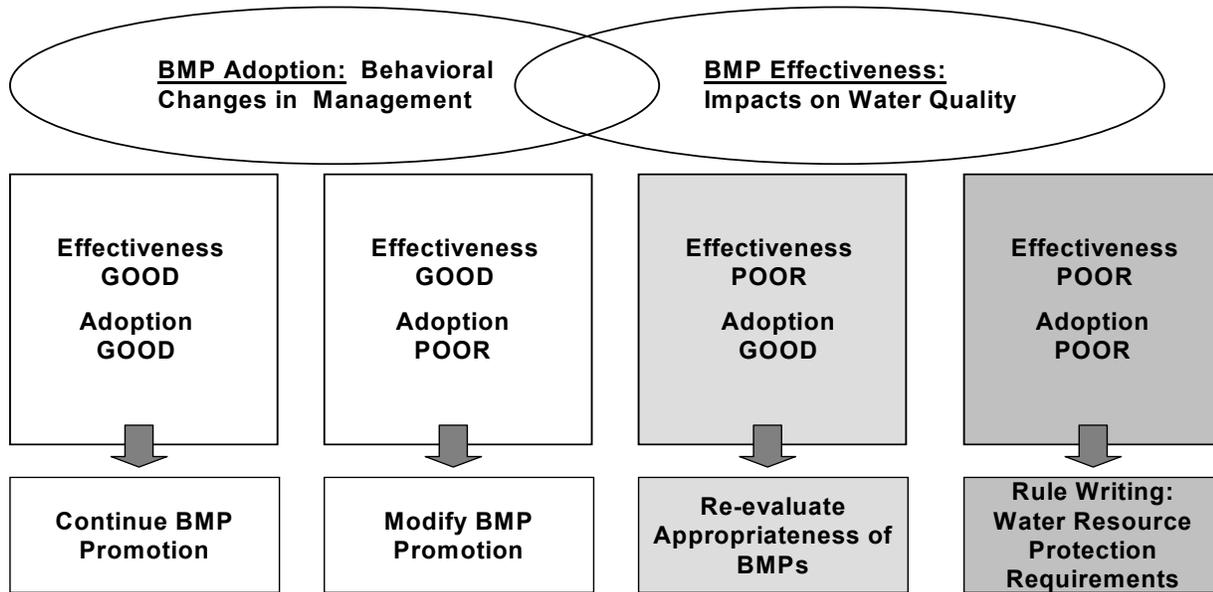
The Response Phase (which incorporates additional BMP promotion and evaluation efforts) is comprised of the following steps:

- a. Special BMP Promotion Areas – Before regulatory action can be taken, the MDA, SWCD and the county water planning authority must designate a localized Special BMP Promotion Area in which various evaluation efforts must occur. Time allotted for the BMPs to be further implemented and evaluated must be in proportion to the degree of the problem identified.
- b. Nitrogen Management District – If, after the creation of the localized Special BMP Promotion Area, agricultural sources of nitrate in drinking water remain problematic for at least a four year period, the area should be reclassified as a Nitrogen Management District. The establishment of the district initiates a process of change from a voluntary to a regulatory situation.
- c. Water Resource Protection Requirements – If BMP adoption and water quality remain unacceptable in the Nitrogen Management District after annual reviews, the MDA shall commence the promulgation of localized Water Resource Protection Requirements through rule-making.

Only after all required steps are taken does the NFMP process recommend that state rules be promulgated to establish Water Resource Protection Requirements for the localized area in question. Details of the NFMP and the Three-Phase Structure are provided in the Recommendations of the Nitrogen Fertilizer Task Force on the Nitrogen Fertilizer Management Plan to the Minnesota Commissioner of Agriculture, August 1990, available from the MDA. The chart below illustrates the overall approach to responding to nitrogen contamination as established by the Nitrogen Fertilizer Task Force under statutory mandate in the 1989 Comprehensive Groundwater Protection Act:

Nitrogen Fertilizer Management Plan:

From Voluntary BMP Promotion & Evaluation to Regulatory Response



Pesticides: Regulatory responses to pesticide use within a WHP area are described in a companion publication in this series, [Agricultural Chemical Facilities and Applicators: Management Ideas for Wellhead Protection Programs](#), which addresses the registration, licensing and reporting requirements for retail operations, cooperatives and individuals that sell or handle agricultural chemicals.

Adoption of New Ordinances: Public water suppliers could explore with appropriate state and local authorities the possibility of adopting ordinances in support of BMPs and U of M fertilizer recommendations. A public water supplier should coordinate with federal, state and local authorities on any proposed regulations of agricultural chemicals and fertilizers in a WHP area. Because of the authority MDA was granted in the 1989 Ground Water Protection Act regarding many agricultural chemicals and fertilizers, any local regulations would need to be evaluated in relation to existing laws and authorities prior to proposal and implementation. For agricultural pesticides, state law prohibits local units of government from developing policies for some ag chemicals that are more restrictive than, in conflict with, or inconsistent with those set by the MDA, and only allows local regulation in the context of a delegation agreements with the commissioner of the MDA. Contact the MDA for more information.

Zoning and Permitting: A public water supplier might consider exploring land use controls to address crop production, certain crop production methods, the use of lands for irrigation, or the use of certain non-regulated agricultural chemicals within the WHP area. In some parts of the United States, prohibitive zoning is used to establish WHP areas as “green zones” within which environmental protection is rigorous. If this option is chosen, public water suppliers must work closely with appropriate state agencies and with local units of government with jurisdiction over zoning, permitting and agricultural chemical regulation and authority.

APPENDIX A

**MINNESOTA DEPARTMENT OF AGRICULTURE
WATER PROTECTION AND NUTRIENT MANAGEMENT STAFF
AND CONTACT INFORMATION**

**Minnesota Department of Agriculture
Water Protection and Nutrient Management Staff**

Contact these staff to coordinate –

- Educational, Service and Regulatory activities related to agriculture and Wellhead Protection
- Farm Survey services (Farm Nutrient Management Assessment Process – FANMAP)

MDA Special Projects

Unit Supervisor

Bruce Montgomery
90 West Plato Blvd.
St. Paul, MN 55107-2094
651-297-7178

bruce.montgomery@state.mn.us

**State Nutrient and Pesticide
Management Plan Implementation**

Joe Zachmann
651-205-4788

joseph.zachmann@state.mn.us

**GIS Mapping and Nutrient
Management Demonstration Plots**

Don Sirucek
800-930-0518 (cellular)
218-894-0086 (office)

don.sirucek@state.mn.us

**Manure Management, Soil and
Manure Nutrient Testing**

Jerry Floren
651-297-7082

jerry.floren@state.mn.us

Farm Survey Services (FANMAP)

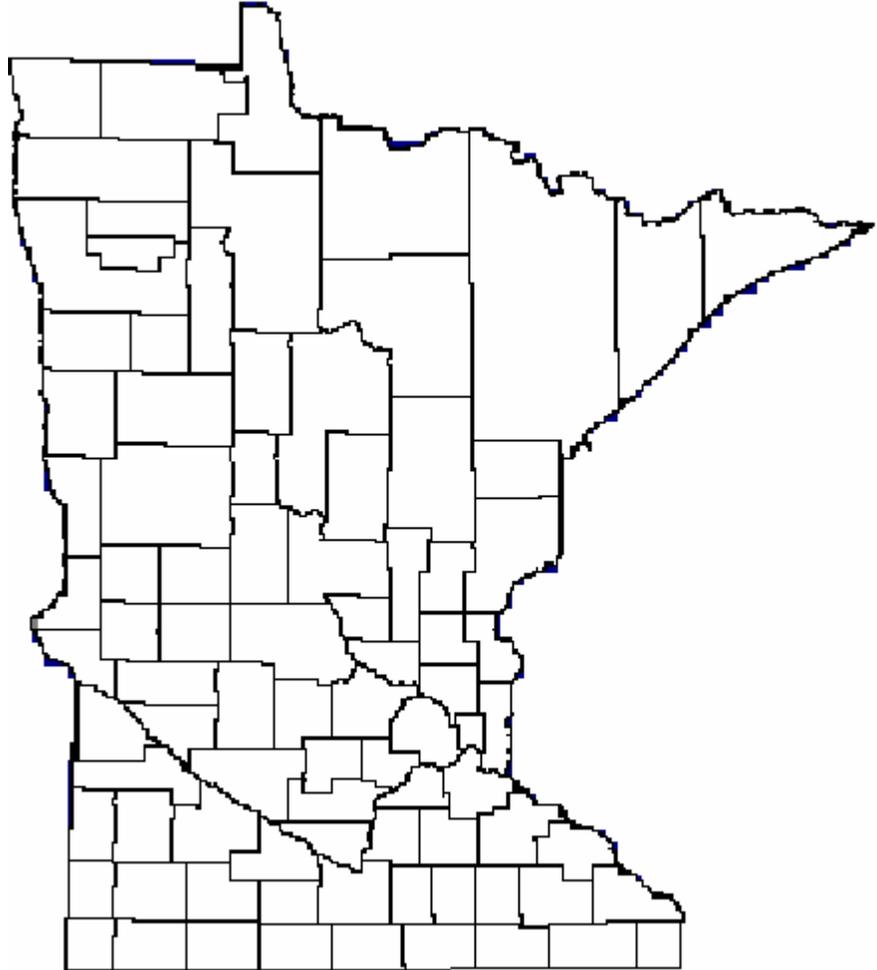
Denton Bruening
651-297-4400

denton.bruening@state.mn.us

Urban Nutrients and Pesticides (Turf, Lawn and Garden Care)

Jerry Spetzman
651-297-7269

jerome.spetzman@state.mn.us



Regional responsibilities are not rigidly defined. Phone numbers and e-mail addresses are subject to change. If you have trouble reaching the above-listed staff, please call the Minnesota Department of Agriculture at 651-215-9097

APPENDIX B

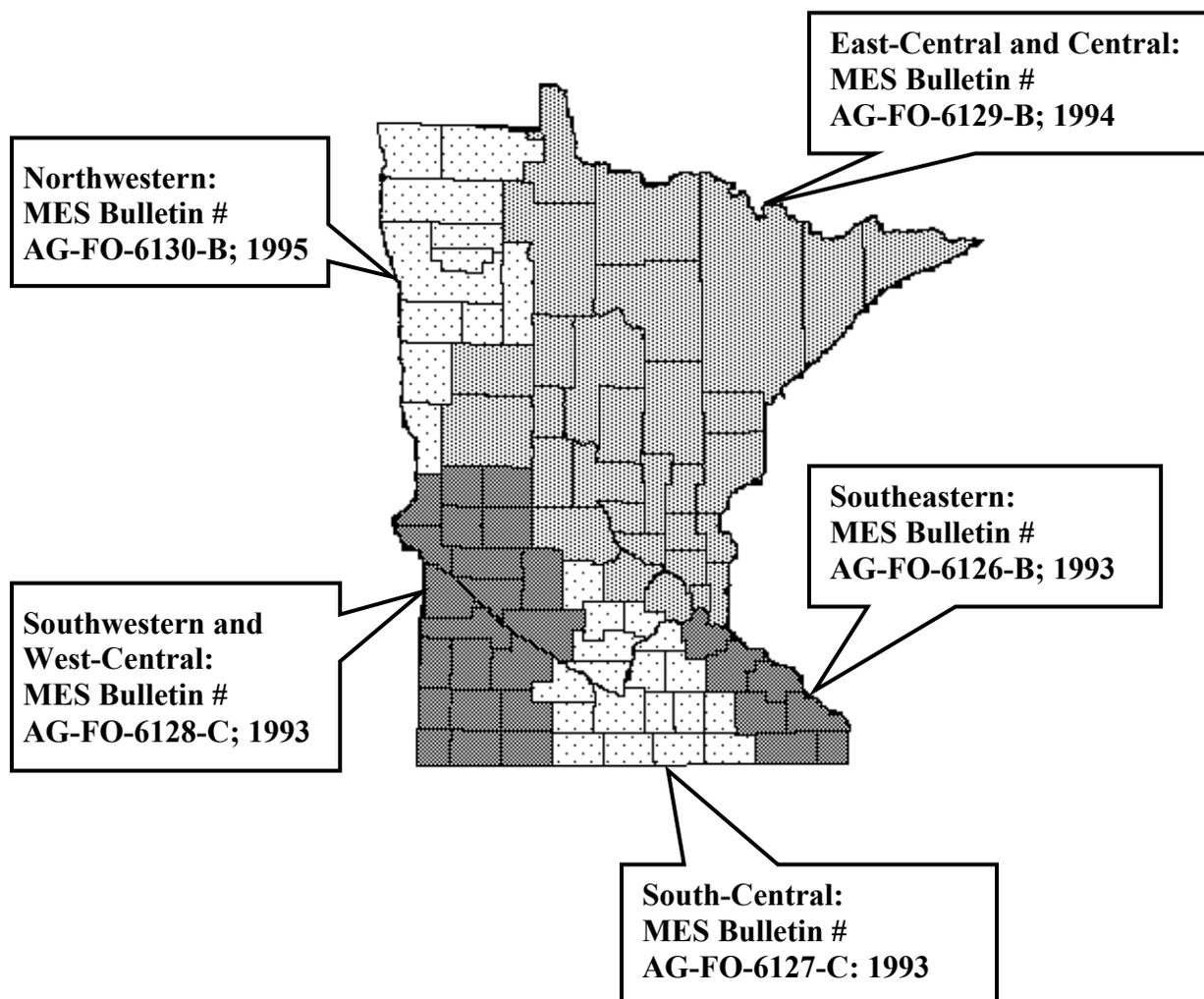
**INFORMATION ON NITROGEN BEST MANAGEMENT PRACTICES,
PHOSPHORUS AND MANURE MANAGEMENT PRACTICES, AND
PESTICIDE BEST MANAGEMENT PRACTICES**

Nitrogen Best Management Practices: In Minnesota, Best Management Practices (BMPs) for nitrogen use are assembled and adopted by the Minnesota Department of Agriculture (after public comment) under Minn. Stat. § 103H.151; they are usually published by the U of M Extension Service. BMPs are based on a three-tier strategy, with each succeeding tier enhancing or refining the previous tier. **Statewide BMPs** (Tier 1) apply to all areas of the state and are published in U of M Extension Service bulletin **AG-FO-6125-C; 1993**.

The map below illustrates the boundaries of the **Regional BMPs** (Tier 2) and associated U of M Extension Service publication numbers. Regional BMPs take into account some of the local variation in soils, hydrogeologic and climatic conditions. The areas shown do not denote the exact boundaries for each region, but are listed as a guide to nitrogen users where prevalent conditions may apply.

Special Situation BMPs (Tier 3) are reserved for areas or practices that require additional management considerations and where environmental susceptibility to nitrogen is high. Special Situation BMPs have been developed for **nitrogen use on irrigated, coarse-textured soils** and **potato production** (available from the MDA) on those soils. A list of BMP publications appears at the end of this appendix.

All U of M Extension Service publications can be obtained by contacting local County Extension Offices or by calling **800-876-8636**. Some publications are available in part or in whole at www.extension.umn.edu



Phosphorus Management Practices: Phosphorus is a pollutant of major concern for every major drainage basin in Minnesota. The MPCA has developed a control strategy (MPCA's Phosphorus Strategy, 1998, available from the MPCA) that relies primarily on education and non-regulatory approaches. Nonpoint-source phosphorus comes primarily from runoff and soil loss from agricultural fields and heavily grazed pastureland; however, small amounts of dissolved phosphorus may also leave tile drained fields with soils having a low ability to absorb or adsorb phosphorus. The mechanisms of phosphorus movement in the environment make it primarily a concern for public water suppliers that obtain their drinking water from *surface* bodies of water, rather than from aquifers. U of M Extension Service publications that address phosphorus management in crop production are listed in the table at the end of this appendix. Also check with local SWCD and NRCS offices for additional information.

Manure Management Practices: Animal manures can contain significant amounts of crop nutrients (nitrogen and phosphorus) and are an important part of many farming operations. Often, the nutrient load that manure supplies to a crop is not properly accounted for, the farm machinery used to apply the manure is not properly calibrated, and the timing and method of application is not appropriate – all of which can lead to nonpoint source pollution problems and crop production inefficiencies. A separate publication in this series, Feedlots and Manure Management: Management Ideas for Wellhead Protection Programs, addresses the educational, service and regulatory aspects of manure as an agricultural “waste,” a crop nutrient and potential environmental contaminant. MDA, U of M Extension Service and MPCA publications that address manure management in crop production are listed in the table at the end of this appendix. Also check with local SWCD and NRCS offices for additional information.

Pesticide Best Management Practices: Effective control of pests – weeds, insects and diseases – is critical to assuring healthy crops. Pesticide BMPs include preventing the introduction of pests, optimum timing of activities, crop rotation, mechanical control techniques, and encouraging natural enemies of pests. Pesticide movement in the environment can affect both ground and surface water sources of drinking water. The MDA, U of M Extension Service and NRCS have jointly published a series of pesticide BMPs that reduce or eliminate point and nonpoint sources of pesticides in drinking water and the environment. These publications and other sources of information on pesticides are listed in the table at the end of this appendix. Also check with local SWCD and NRCS offices for additional information.

A Note on Nutrient Management for Commercial Fruit & Vegetable Crops

Commercial fruit and vegetable crop production in WHP areas can also be the source of nonpoint pollution. Information regarding proper nutrient management for these crops can be found in U of M Extension Service Bulletin #BU-5886-E (Revised 1996): Nutrient Management for Commercial Fruit and Vegetable Crops in Minnesota

Select Publications on Crop, Nitrogen, Phosphorus, Manure and Pesticide Management

From the Minnesota Extension Service

contact the County Extension Office, call 800-876-8636, or go to www.extension.umn.edu

Nitrogen Management:

- A Soil Nitrogen Test Option for Nitrogen Recommendations with Corn (AG-FO-6514-B)
- Best Management Practices for Nitrogen Use Statewide in Minnesota (AG-FO-6125-C)
- Best Management Practices for Nitrogen Use in Southeastern Minnesota (AG-FO-6126-B)
- Best Management Practices for Nitrogen Use in South-Central Minnesota (AG-FO-6127-C)
- Best Management Practices for Nitrogen Use in Southwestern and West-Central Minnesota (AG-FO-6128-C)
- Best Management Practices for Nitrogen Use in East-Central and Central Minnesota (AG-FO-6129-B)
- Best Management Practices for Nitrogen Use in Northwestern Minnesota (AG-FO-6130-B)
- Best Management Practices for Nitrogen Use on Irrigated, Coarse-Textured Soils (AG-FO-6131-B)

Phosphorus Management:

- The Nature of Phosphorus in Soils (FO-6795-B)
- Phosphorus Transport to and Availability in Surface Waters (FO-6796-B)
- Agronomic and Environmental Management of Phosphorus (FO-6797-B)
- Understanding Phosphorus Fertilizers (FO-6288-B)

Fertilizer Recommendations for Specific Crops:

- Fertilizing Corn in Minnesota (AG-FO-3790-C)
- Fertilizing Soybeans in Minnesota (AG-FO-3813-B)
- Fertilizing Alfalfa in Minnesota (AG-FO-3814-B)
- Fertilizing Wheat in Minnesota (AG-FO-3772-B)
- Fertilizing Barley in Minnesota (AG-FO-3773-B)
- Fertilizer Management for Corn Planted in Ridge-Till or No-Till Systems (AG-FO-6074-B)
- Nutrient Management for Commercial Fruit and Vegetable Crops in Minnesota (AG-FO-5886-F)

Manure Management:

- Self-Assessment Worksheets for Manure Management Plans (AG-FO-5883-C)
 - Manure Application Planner Computer Program —from the Center for Farm Financial Management, University of Minnesota, St. Paul (Department of Applied Economics)
 - Livestock Manure Sampling and Testing (AG-FO-6423-B)
-

From the Minnesota Department of Agriculture (contact the Agricultural Marketing and Planning Division or the Agronomy and Plant Protection Division by calling 651-297-2200)

Nitrogen Management:

- Nitrogen BMPs for Irrigated Potatoes (Minnesota *State Register*, Volume 20, March 18, 1996)
- Nitrogen Fertilizer Management Plan, August 1990

Pesticide Management:

- Non-Pesticide Voluntary Best Management Practices that Help Control Pests
- Handling Pesticides Safely
- Pesticide Use: Application How-To's
- Pesticide Use: Selection How-To's
- Timing of Pesticide Use: Before or After Infestation
- Be Prepared with a Spill Response Plan
- Mixing and Loading Pesticides
- Managing Pesticides, Waste Pesticides and Empty Pesticide Containers

Manure Management

- Feedlot and Manure Management Directory
- Manure Management Planning Guide for Livestock Operators
- Manure Management Alternatives: A Supplemental Manual
- Planning and Zoning for Animal Agriculture in Minnesota: A Handbook for Local Government
- Planning for Agricultural Land Preservation in Minnesota: A Handbook for Planning Under Minnesota Statutes, Chapter 40A

From the Minnesota Pollution Control Agency (Contact the MPCA at 612-296-6300)

Phosphorus Management:

- MPCA's Phosphorus Strategy

Manure Management and Feedlot Rules:

- Minnesota Rules Chapter 7020—animal feedlots
- Permit Application for Construction and Operation of an Animal Feedlot
- Feedlot Permit Application Process
- Completing a Feedlot Permit Application
- Example Applications for Construction and Operation Permit for Feedlots
- Concrete Pit Requirements
- Waste Storage Pond Information
- Land Application of Waste Site Review Checklist
- Role of the County in Feedlot Permit Program
- Permitting Process
- Dead Animal Disposal (regulated by the Board of Animal Health)
- Seepage from Earthen Manure Storage Systems
- Closure and Abandonment of Manure Storage Structures
- Well Setbacks (under revision)

APPENDIX C

**EXAMPLES OF ON-FARM DEMONSTRATION PROJECTS AND
AGRICULTURAL SECTOR COLLABORATION IN WELLHEAD
PROTECTION AREAS**

The Minnesota Department of Agriculture is in the process of developing comprehensive case studies about successes and failures in obtaining grants, promoting BMPs and implementing nutrient management strategies in the following three WHP areas, as well as for other WHP areas. Please contact the MDA Source Water Protection Coordinator (see *Appendix A* for further information).

Red Top Farms – City of St. Peter WHP Area: The City of St. Peter had observed long-term problems with nitrates in the city’s water supply. This observation prompted the city to become one of the state’s first to develop wellhead protection strategies. The MDA joined a consortium of interested parties to address St. Peter’s WHP concerns. Local farmers, county health staff, extension agents, and city water planners, among others, came together to assess the problems and develop appropriate responses. The need for the development of nitrogen demonstration work and accelerated educational efforts were the result of these discussions.

Red Top Farms, located near the WHP Area and owned and operated by Rob and Janice Meyer, had an existing tile-drainage system that was ideal for monitoring the water quality and quantities from two 30 acres parcels in a corn-soybean rotation. Nitrate concentration data has been collected since the 1995-cropping season. In 1996, MDA added a pesticide-monitoring component. The site now provides continuous year-round monitoring for water flow, nitrate, and pesticides. One of the long-term goals at this site is to determine if *site-specific* technology can reduce nitrogen leaching losses while producing profitable corn and soybean yields. The data will be used to make management decisions when applying the N fertilizer in a “site specific” fashion to future corn and soybean crops.

City of Perham WHP Area: The MDA joined the East Ottertail SWCD in applying for an Environmental Quality Incentives Program (EQIP) grant from the Natural Resource Conservation Service (NRCS). An aid in securing additional funding was the results of the two MDA Farm Nutrient Management Assessment Program (FANMAP) surveys of farm practices within the WHP Area. The grant is an educational grant that allows cooperators to work with farmers to set up nutrient demonstration plots on individual farms within the Perham WHP area. In addition to the demonstrations of BMPs and U of M fertilizer recommendations, it was decided to install suction tube lysimeters in the nutrient test plots to help with the evaluation of appropriateness of BMPs on area soils under specific crops. The grant provided funding to purchase the materials needed to assemble 80 suction tube lysimeters, conduct soil and manure sampling analysis, hold educational workshops and field days, and provide nutrient management planning assistance to producers within the WHP area.

Lincoln-Pipestone Rural Water System: LPRWS well fields are located in shallow aquifers. Cooperating agencies have conducted several meetings with producers and dealers to promote the BMPs as a means of protecting the aquifers beneath area farms while protecting farm profitability. There were two nitrogen rate test plots located in the WHP areas. MDA staff conducted FANMAP surveys in the WHP Area and made initial contacts with participating producers to conduct on-farm nutrient management demonstrations under an Environmental Quality Incentives Program (EQIP) grant. Under a separate grant from the Legislative Commission on Minnesota Resources (LCMR), the Minnesota Extension Service established test plots to assess manure utilization, fertilizer formulation, application rates and timing. The USDA Agricultural Research Service is irrigating perennial forages using nitrate-contaminated groundwater as a fertilizer source. This process, referred to as “phytofiltration,” might reduce the cost of expensive nitrate-removal treatment technologies for rural water suppliers.

APPENDIX D

**A PARTIAL LIST OF INTERNET ADDRESSES FOR ORGANIZATIONS
PROVIDING EDUCATIONAL, SERVICE AND REGULATORY
INFORMATION ON WATER RESOURCES, CROP PRODUCTION,
NUTRIENTS AND PESTICIDES**

Federal, state and local government, educational and research contacts	Internet Address	Topics
Minnesota Department of Agriculture	www.mda.state.mn.us/	Information on BMPs; BMP Loan Program; FANMAP services; water testing clinics; permitting and regulatory assistance related to fertilizer and pesticide applicators; Energy and Sustainable Agriculture Program; development of local ordinances.
University of Minnesota Extension Service	www.extension.umn.edu/	BMPs and fertilizer recommendations for specific crops, lawns, turf; Extension Education services
University of Minnesota Outreach and Research	www.maes.umn.edu/index.html	BMPs and fertilizer recommendations; current research results, field days, educational opportunities
Minnesota Board of Soil and Water Resources	www.bwsr.state.mn.us/	Provides technical, financial and administrative assistance
Minnesota Soil and Water Conservation Districts	www.mn.nrcs.usda.gov/partners/maswcd/maswcd.html	Contacts for local programs, outreach and technical and financial assistance
U.S. Department of Agriculture	www.usda.gov	National programs, outreach and technical and financial assistance
Natural Resource Conservation Service	www.nrcs.usda.gov/	National and local programs, outreach and technical and financial assistance; Nutrient Management Planning services and software
Farm Service Agency	www.fsa.usda.gov/pas/default.asp	National and local programs, outreach and technical and financial assistance
Department of Natural Resources	www.dnr.state.mn.us	Water appropriation permits for irrigation, surface and groundwater
Minnesota Pollution Control Agency	www.pca.state.mn.us	Feedlot permitting requirements and regulatory assistance
Minnesota Department of Health	www.health.state.mn.us/	Wellhead and Source Water Protection state and federal program rules and educational tools
U.S. Environmental Protection Agency	www.epa.gov	General environmental legislation, regulations, rules; technical and regulatory assistance
Nonprofit educational and research organizations	Internet Address	Topics
Minnesota Rural Water Association	www.mrwa.com	On-site technical assistance, training and outreach assistance
Minnesota Lakes Association	www.mnlakesassn.org	Educational and outreach assistance
Institute for Agriculture and Trade Policy	www.iatp.org	Sustainable solutions to challenges facing farmers and rural communities
The Minnesota Project	www.misa.umn.edu	Strengthen rural communities and protect natural resources
The Land Stewardship Project	www.landstewardshipproject.org	Promotion of sustainable farming practices that protect land and water
Various other non-profit organizations	Use Internet search engine to find information on specific topics	

