

**CHAPTER 9. GROUND WATER QUALITY**

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## CHAPTER 9 GROUND WATER QUALITY

### **9.1 Historical Review Regarding the Nebraska Ground Water Management and Protection Act (GWMPA) and NRD Authorities Concerning Nonpoint Source Ground Water Contamination**

"Since its original enactment in 1975, the Ground Water Management and Protection Act has been modified several times. The Nebraska State Legislature adopted the Ground Water Management Act (GWMA) in 1975, in response to the growing concern over ground water depletion through mining of the aquifers occurring in the state. This Act provided a method to control and regulate ground water depletion (quantity), but did not address ground water quality issues.

The Nebraska Legislature revised the GWMA to incorporate ground water quality concerns in 1982. The title of the Act was changed to the Ground Water Management and Protection Act (GWMPA). Ground water management area legislation in 1982 did not provide specific authority to prevent ground water quality degradation. However, it did establish a basis that would ultimately authorize the NRDs to administer nonpoint source regulations through the implementation of Ground Water Quality Management Areas (GWQMA). Legislation enacted in 1986 provided the NRDs with the option (authority) to establish ground water management areas after preparation of a District Ground Water Management Plan.

Legislative Bill 1106, enacted in 1984, mandated that each of the 23 NRDs develop a ground water management plan to inventory the ground water resources within each District, but contamination concerns were not a required component of the plan. "Revisions included in the 1986 update of the Act further defined the role of the Natural Resources Districts and the means by which they could address nonpoint source ground water contamination.

In 1983, LB 426 was the first Special Protection Area (SPA) bill introduced but not enacted. SPA legislation, LB 463, was introduced in 1985, and a compromise bill, LB 894, was adopted in 1986. LB 894 allowed the Nebraska Department of Environmental Quality (NDEQ) the ability to administer regulations for ground water nonpoint source contamination activities. In addition, this legislation gave NDEQ the ability to enter into a nonpoint source contamination issue at the request of other entities than just NRDs.

"Several pieces of legislation passed in the Nebraska Unicameral have affected the SPA program since its inception in 1986. LB 51, enacted in 1991, imposed that prior to July 1, 1993, each NRD shall amend its ground water management plan to identify to the extent possible: 1) levels and sources of ground water contamination within the area, 2) ground water quality goals, 3) long term solutions necessary to prevent the levels of ground water contaminants from becoming too high and to reduce high levels sufficiently to eliminate health hazards, and 4) practices recommended to stabilize, reduce, and prevent the occurrence, increase, or spread of ground water contamination.

LB 51 also gave the Director of Environmental Quality the authority to require an NRD which has established a Ground Water Quality Management Area to adopt an "action plan" as required for designated SPAs.

LB 21 was passed in the 1992 Nebraska Legislative Session and became effective July 15, 1993. The primary purpose of LB 21 was to allow a Natural Resources District with a Special Protection Area to increase its general tax levy by up to one-half cent per \$100 valuation. In such NRDs, the maximum levy will be five cents per \$100 valuation.

"The 1993 legislative session resulted in the passage of LB 439 which allows Reduction of Irrigated Acreage in Water Management Areas. This bill was introduced by the Central Platte NRD and authorizes NRDs with GWQMAs to adopt the type of acreage reduction program (equal percentage of acres reduced for all ground water irrigators) which Central Platte NRD uses for ground water quantity management. This bill also modified the definition of rotation to allow its use on a yearly basis. Previously, rotation could not be based on time periods longer than a month.

## **9.2 Methods of Formation for Ground Water Protection**

NRDs have two options available, GWQMAs or SPAs, to address nonpoint source ground water contamination concerns. These statutory authorities are provided to the NRDs through the Ground Water Management and Protection Act. Both the GWQMA and SPA programs allow the NRDs flexibility to confront non-point source contamination problems. Pollution source regulatory authorities in an SPA are substantially similar to GWQMA pollution control authorities already available to NRDs. A District may manage the use of water in a GWQMA for water quantity or quality purposes or both by any of the authorized controls in statutes NRS SS. 46-673.09. Prior to designating a management area, an NRD must have prepared a ground water management plan that includes a ground water reservoir life goal and which specifies how proposed controls will impact this goal. NRD Boards of Directors are provided greater local control in designating or modifying boundaries, and establishing rules and regulations consistent with the law as compared to an SPA.

Other consequences of forming a GWQMA include: 1) Permits required to construct water wells, 2) NRDs are required to adopt one or more of the authorized controls, and adopted controls must be identified in the NRDs' Ground Water Management Plan, 3) NRDs shall determine the total amount of water to be withdrawn consistent with the ground water reservoir life goal and adopt controls to allow the beneficial use of that amount of water, 4) After a public hearing, an NRD Board of Directors may dissolve a management area based on ground water returning to acceptable levels and land use practices that no longer pose a threat to ground water quality and 5) NRDs may levy tax up to 1.8 cents/\$100 valuation in a GWQMA.

The second approach to nonpoint source ground water quality problems is the designation and establishment of an SPA. "The SPA process begins at the local level. Any state agency or political subdivision of the state with evidence of nonpoint source ground

water problems may petition the NDEQ for an SPA designation. NRDs may protect ground water quality from nonpoint source contamination by the authorized controls provided in statute NRS SS. 46-674.09.

Other consequences of developing an SPA include: 1) NRDs involved are required to prepare "action plans" designed to stabilize or reduce the increase or spread of ground water contamination, 2) NRDs involved are required to hold hearings regarding the "action plan" and to submit it to NDEQ for approval, 3) NDEQ has authority to adopt protective measures if NRDs do not act, 4) Involved NRDs will need to monitor water quality and provide irrigators with information about fertilizer and chemical usage, 5) An NRD may petition the NDEQ Director to remove an SPA designation if an area has been stabilized or reduced to levels that are not detrimental to beneficial uses of ground water and 6) An NRD may levy tax **in whole District** up to 1/2 cent per \$100 actual valuation.

For both types of options, the primary enforcement tool is the issuance of cease and desist orders and suits against alleged violators who fail to abide by cease and desist orders. Violation of SPA statutory provisions for which penalties are not otherwise provided subject the violator to a civil penalty of up to \$500 or to prosecution for a Class III misdemeanor.

Before considering a GWQMA or requesting an SPA study designation, the District will evaluate all available alternatives for developing either a GWQMA or SPA. The ultimate decision on how the Board intends to proceed, either with a GWQMA or SPA, can not always be readily defined. The Board believes this decision should be made based upon each specific situation. When determining whether to designate a GWQMA or SPA, the District will consider its financial and technical capabilities; public input and concerns, and seek to identify the needs for any additional studies to confirm the District's contamination problem(s).

### **9.3 Twin Platte NRD Ground Water Quality Management Program**

The **Goal** of the Twin Platte NRD's Water Quality Management Program is to maintain or improve the quality of ground water to within tolerances established by the Federal EPA, and Nebraska Department of Environmental Quality to achieve the District's Ground Water Reservoir Life Goal as provided in Chapter 6. The District envisions their goal being accomplished through voluntary and mandatory educational programs, implementation of agricultural and conservation techniques such as the use of Best Management Practices (BMPs) and land use controls.

The District's Ground Water Quality Management Program will establish a Target Area in those parts of the District where ground water quality could become a problem.

The District's Ground Water Quality Management Program will establish a Ground Water Quality Management Area (GWQMA) or Special Protection Area (SPA) in those parts of the District where ground water quality is a problem.

Currently, the District recognizes that the major threat to ground water contamination in their jurisdiction is nonpoint source nitrate-nitrogen ground water pollution. Other nonpoint source contamination tolerances will be established by the Twin Platte Natural Resources District Board of Directors based on the Maximum Contaminant Levels (MCLs) set by the EPA and DEQ 118 NAC - Ground Water Quality Standards and Use Classification. The District began a ground water monitoring program for nitrates in 1982 and continues to monitor 78 sites annually. Reference may be made to Section 5 in regard to the District's data collection. The District on July 1, 1995 began a two year study to establish base-line water quality conditions in the District and develop a ground water monitoring program to monitor future conditions. Reference may be made to Section 5 in regard to the District's data collection. Depending on the scope and trends of other potential nonpoint source contaminants detected in the ground water, the District will proceed with addressing those problems within an area when ground water sample trends show a three year increase that reaches 50% of the MCL. The triggering mechanism will be based on the average of the data collected in each township and the average of the township data in each Major Land Resource Area. The District will approach all contamination problems utilizing the same procedure provided in this plan for nitrate-nitrogen contamination. Prior to establishing a Target Area or a Management or Special Protection Area for contamination other than nitrate-nitrogen, the District will consult with Local, Nebraska, or Federal agencies or organizations, research institutions and private manufacturers to determine the appropriate Best Management Practices and Controls.

### **9.3.1 Target Areas**

The District's Ground Water Quality Management Program for Target Areas will be implemented within Townships to address the nitrate-nitrogen contamination problem. The triggering mechanism established will be 5.0 ppm (50 % of MCL) to guide the District when considering a Target Area to address nitrate-nitrogen problems in the ground water. The triggering mechanism will be based on the average of the last three years of testing.

#### **Actions:**

Development of Ground Water Advisory Committees: The District will develop an advisory committee within each Township designated a Target Area. Adjoining Townships designated a Target Area in sparsely populated areas within the District may have one advisory committee. The advisory committee will be appointed by the District Board of Directors and will be made up of landowners and/or operators within the Township. The advisory committee will develop recommendations for the District Board of Directors and will promote voluntary actions for the landowners and operators within the Township. The advisory committee will meet a minimum of two times annually in the Spring prior to the beginning irrigation and in the Fall after irrigation has ended for the season. The District will provide a staff person to work with the advisory committee.

Individual Contacts: The District staff will meet annually with each landowner and operators within Target Areas to discuss the advisory committee's recommendations. The District staff will promote voluntary actions for the landowners and operators within the Target Area. The District staff will discuss the hazards associated with using contaminated ground water and options available for using contaminated ground water with the landowners and operators within the Target Area.

Target Information and Education: The District will target information and education for the landowners and operators within Target Areas. The District will attempt to establish and maintain demonstration sites within or near a Target Area.

Target Cost-Share Assistance: The District will target cost-share assistance for land within Target Areas. Outlined below are possible items that cost-share funding could be available through District, State and Federal programs.

- 1) Flow Meters
- 2) Moisture Meters and Blocks, Tensiometers, and Soil Probes
- 3) Surge Systems
- 4) Irrigation Scheduling Services
- 5) Modified Atmometers
- 6) LEPA Systems
- 7) Well Abandonment Program

Recommend and Promote Voluntary Activities:

Best Management Practices: Information and training for Best Management Practices will be available on a continuing basis. A list of recommended Best Management Practices are summarized in Table 9-1 (Located at end of Chapter 9).

Tests: Test soil (3' deep), irrigation water, and manure; if applied, for nitrate-nitrogen content. The landowner or operator will be asked and encouraged to submit a report on:

- a) Water testing results for each irrigation well
- b) Soil testing results for each forty (40) acres
- c) Manure application rates and analysis for nitrogen
- d) Crop to be grown and the realistic yield goal
- e) Total nitrogen needed for yield goal
- f) Nitrogen available from water
- h) Residual nitrogen available in three feet of soil
- i) 50% of the pounds of nitrogen per acre available from manure, if applicable
- j) Nitrogen available from past crop
- k) Recommended use of commercial fertilizer to achieve realistic

Yield Goal

- l) Actual commercial fertilizer (nitrogen) applied
- m) Beginning and ending flow meter readings, if available
- n) Inches of water applied (actual or estimate)
- o) Irrigation scheduling method used
- i) Actual yield achieved

Water Measuring Devices: Flow meters or other approved water measuring devices (including surface water flow measuring equipment) to measure the amount of water applied to each irrigated field.

Commercial Fertilizer: Commercial Fertilizer not applied on all soils before March 1st.

Spring Applications: Spring Applications either split between preplant and sidedress applications or split applications through a pivot chemigation system or applied with an inhibitor if the split application is not administered.

Irrigation Scheduling: Implement irrigation scheduling to increase irrigation efficiency and the conservation of water.

Integrated Pest Management: Development of Integrated Pest Management Programs.

Irrigation Rotation: Adopt a rotation system of use of ground water. Rotation shall mean a recurring series of use and nonuse of irrigation wells on an hourly, daily, weekly, monthly or yearly basis.

Livestock Management: Implementation of livestock waste management practices

Implement Additional Monitoring Activities: An intensive ground water monitoring program and network throughout the District is important in order to determine any changes in the condition of the ground water. This program has been explained in greater detail in Chapter 5. Increase the monitoring sites within and surrounding the Target Area with a maximum of 9 monitoring sites within a Township.

### **9.3.2 Management or Special Protection Areas**

The District's Ground Water Quality Management Program for GWQMA of SPA will be implemented within Major Land Resource Areas in three phases to address the nitrate-nitrogen contamination problem. The TPNRD prefers to utilize the statutory provisions authorized for a GWQMA and the plan is written with the intent of using the GWQMA statutory provisions. The TPNRD, however, will consider utilizing the statutory provisions authorized for a SPA prior to initiating management. The triggering

mechanism established below will be used to guide the District when considering a GWQMA or SPA to address nitrate-nitrogen problems in the ground water. The triggering mechanism will also be used to move from one management phase to another based on data received from the District's ground water monitoring system. The triggering mechanism will be based on the average of the last three years of testing.

Phase I :	7.0 ppm	(70 % of MCL)
Phase II :	8.5 ppm	(85 % of MCL)
Phase III:	10.0 ppm	(MCL)

Prior to implementation of a SPA Action Plan or GWQMA Action Plan/controls, the NRD will develop rules and regulations to address the requirements that would be spelled out in an SPA/GWQMA Action Plan or the District's Ground Water Management Plan.

**Phase I: Initiation**

An Area, either designated as an GWQMA or SPA, will be established when the average nitrate-nitrogen level within a Major Land Resource Area reaches 7.0 parts per million (70% of MCL).

**Phase I: Controls**

In a Phase I Area, the NRD will develop a mandatory and voluntary multifaceted educational program for water users. The program, will emphasize crop nutrients, irrigation, and pesticide management through information, education and site demonstrations. In a Phase I area, all landowners/operators of agricultural land (e.g. landowners/operator that apply fertilizer or pesticides to planted dryland and/or irrigated crops) will be required to become certified by attending a class and training session on best management practices. Best management practices training and certification will be mandatory only within a GWQMA or SPA, and would be optional outside an area.

A list of recommended best management practices are summarized in Table 9-1 (Located at end of Chapter 9). The cited practices have been established through federal and state research and demonstration projects, and have shown to be effective in reducing nitrate levels. These practices will be incorporated into the general education program and certified training workshops.

Landowners will be encouraged to voluntarily integrate selected practices into their management system. Table 9-2 (Located at end of Chapter 9) outlines assistance programs that can be developed by the NRD to support landowners in addressing ground water contamination concerns (nitrate-nitrogen, etc.) in a given area(s).

**Phase II: Initiation**

Phase II, in either a GWQMA or SPA, will be established when the average nitrate-nitrogen level within a Major Land Resource Area reaches 8.5 parts per million (85% of MCL).

### **Phase II: Controls**

- 1) In a Phase II Area, all requirements in Phase I will be continued.
- 2) In addition, irrigators will be required to test soil (3' deep), irrigation water, and manure; if applied, for nitrate-nitrogen content. The landowner/operator will be required to submit an annual report on:
  - a) Water testing results for each irrigation well
  - b) Soil testing results for each forty (40) acres
  - c) Manure application rates and analysis for nitrogen
  - d) Crop to be grown and the realistic yield goal
  - e) Total nitrogen needed for yield goal
  - f) Nitrogen available from water
  - h) Residual nitrogen available in three feet of soil
  - i) 50% of the pounds of nitrogen per acre available from manure, if applicable
  - j) Nitrogen available from past crop
  - k) Recommended use of commercial fertilizer to achieve realistic Yield Goal
  - l) Actual commercial fertilizer (nitrogen) applied
  - m) Beginning and ending flow meter readings, if available
  - n) Inches of water applied (actual or estimate)
  - o) Irrigation scheduling method used
  - i) Actual yield achieved

### **Phase II: Alternative Controls**

"Alternative Controls" are intended to supplement the base controls listed under Phase II. The Twin Platte Board and Advisory Committees will make the decisions whether or not to include the alternative controls when developing an action plan(s). One or more of the alternative controls may be selected for implementation with the listed controls.

- 1) Flow meters or other approved water measuring devices (including surface water flow measuring equipment) may be required to measure the amount of water applied to each irrigated field.
- 2) Require irrigation scheduling to increase irrigation efficiency and the conservation of water

### **Phase III. Initiation**

Phase III, in either a GWQMA or SPA, will be established when the average nitrate-nitrogen level within a Major Land Resource Area reaches 10.0 parts per million (MCL).

### **Phase III. Controls**

- 1) In a Phase III Area, all requirements in Phases I & II will be continued.
- 2) Flow meters or other approved water measuring devices (including surface water flow measuring equipment) will be required to measure the amount of water applied to each irrigated field.
- 3) Commercial Fertilizer application on all soils before March 1st will be banned for spring planted crops.
- 4) Spring Applications will either be split (preplant and sidedress) application, split applications through a pivot chemigation system or will be applied with an inhibitor if the split application is not administered.
- 5) Implementation of an allocation schedule, and allocating the total permissible withdrawal of ground water (NRS SS. 46-673.09(1). Allocation shall mean the allotment of a specified total number of acre-inches of irrigation water per irrigated acre per year or an average number of acre-inches of irrigation water per irrigated acre over any reasonable period of time not to exceed five years (NRS SS. 46-657).

### **Phase III: Alternative Controls**

"Alternative Controls" are intended to supplement the base controls listed under Phase 111. The Twin Platte NRD Board and Advisory Committees will make the decisions whether or not to include the alternative controls when developing an action plan(s). One or more of the alternative controls may be selected for implementation with the listed controls.

- 1) Require irrigation scheduling to increase irrigation efficiency and the conservation of water
- 2) Development of Integrated Pest Management Programs
- 3) Adopt a rotation system of use of ground water. Rotation shall mean a recurring series of use and nonuse of irrigation wells on an hourly, daily, weekly, monthly or yearly basis.
- 4) Adopt a system for reducing irrigated acres (equal percentage of acres reduced for all ground water irrigators).
- 5) Implementation of livestock waste management practices

### **9.3.3 Strategic Subareas for Management or Special Protection Areas**

Strategic subareas may be identified within Major Land Resource Areas for implementation of a Management or Special Protection Area. The TPNRD prefers to utilize the statutory provisions authorized for a GWQMA and the plan is written with the intent of using the GWQMA statutory provisions. The TPNRD, however, will consider utilizing the statutory provisions authorized for a SPA prior to initiating management. Strategic subareas would be considered in target areas previously implemented three years following the implementation of the target area and annually thereafter. Strategic subareas will be identified and implemented if subsequent contamination levels increase in a target area or if subsequent contamination levels in a target area are above 10.0 parts per million (MCL) and have not decreased. The triggering mechanism for a strategic subarea for a management or special protection area will be based on the average of the previous three years of testing compared to the levels which initiated a target area. The triggering mechanism for Phase II and Phase III management will be based on the average of the previous three years of testing compared to the levels which initiated the previous phase of management. Phase II will be considered two years following the implementation of Phase I and annually thereafter and Phase III will be considered two years following the implementation of Phase II and annually thereafter.

Triggering mechanism for a strategic subarea for contamination levels that are less than 10.0 parts per million (MCL) and are increasing.

- Phase I: Contamination levels equal to or greater than 150% of the contamination level which initiated the Target Area or 10.0 parts per million (MCL)
- Phase II: Contamination levels equal to or greater than 130% of the contamination level which initiated Phase I or 10.0 parts per million (MCL)
- Phase III: Contamination levels equal to or greater than 130% of the contamination level which initiated Phase II or 10.0 parts per million (MCL)

Triggering mechanism for a strategic subarea for contamination levels above 10.0 parts per million (MCL) and are not decreasing.

- Phase I: Contamination levels decreasing annually less than 10% of the amount of the contamination levels which initiated the Target Area less 10.0 parts per million (MCL) (Example 10% of 12.0 ppm - 10.0 ppm = 0.2 ppm)
- Phase II: Contamination levels decreasing annually less than 10% of the amount of the contamination levels which initiated Phase I less

10.0 parts per million (MCL) (Example 10% of 12.0 ppm - 10.0 ppm = 0.2 ppm)

Phase III: Contamination levels decreasing annually less than 10% of the amount of the contamination levels which initiated Phase II less 10.0 parts per million (MCL) (Example 10% of 12.0 ppm - 10.0 ppm = 0.2 ppm)

For a strategic subarea implemented for contamination levels exceeding 10.0 parts per million (MCL), when contamination levels in the strategic subarea fall below 10.0 parts per million (MCL) based on the average of the previous three years of testing, the strategic subarea will be dissolved and a Target Area will be implemented if the contamination levels remain above 5.0 parts per million (50% of MCL).

Controls identified in Section 9.3.2 would be utilized for each management phase in a strategic subarea.

Strategic subareas will provide the District flexibility to establish management in an area to address ground water contamination.

The TPNRD recognizes that townships would have different trigger levels and therefore could have the same or similar management procedures for different levels of ground water contamination. The TPNRD believes that the existence of target areas in the effected townships and the advisory committees that would be in place and functioning within the townships and the individual contacts that would have occurred within the townships for a minimum of three years prior to the designation of a strategic subarea will minimize or eliminate any belief by the citizens involved that there is unfair treatment. The TPNRD Board of Directors will annually during the month of November consider any concerns by the citizens involved.

#### **9.4 Other District Actions to be considered for Implementation to Protect Water Quality:**

- 1) The NRD will pursue urban soil testing and the use of slow release fertilizer applications and/or split applications of fertilizer for city owned property and city dwellers.
- 2) The NRD will work with cities/villages to: a) improve lawn and garden water use efficiency and establish voluntary water use conservation guidelines, and b) develop programs to monitor urban surface water runoff quality.
- 3) The NRD will work with the Nebraska Department of Environmental Quality to reduce point source ground water contamination concerns within an area.

## **9.5 Implementation Time Frame for Establishing a Target Area or GWQMA or SPA**

The main reason for establishing a Target Area GWQMA or SPA is to prevent the degradation of water quality.

Whenever ground water quality is threatened based on EPA/DEQ's Safe Drinking Water Standards or pollution is detected, meaningful data is necessary to make informed decisions. Extensive studies must be done to define the source, extent, mechanisms and affects of pollution and to identify the extent of a boundary area(s).

The District will implement Target Areas annually on January 1st.

The District will proceed slowly before implementing GWQMA or SPA - taking up to three years before moving into any of the three (3) management phases. The three year window will allow the District to systematically evaluate the problem area(s). The District's monitoring activities will move towards developing an assessment program. Monitoring requirements for an assessment program are more detailed than those involved in a detection program. In an assessment program the ground water situation must be characterized sufficiently to plan further investigative or remedial activities. Furthermore, the three year time interval will allow the District to plan for an orderly administration, and promote public awareness and input regarding ground water concerns.

Data collected within an area, consecutively over the three year period, will provide the District with an opportunity to observe the seasonal effects of sampling activities and potential nitrate-nitrogen trends. The average levels based on this information will be used to determine the management phase (either I, II, or III) to address contamination or potential for contamination of ground water within a given area.

The District Board of Directors reserve the option to proceed immediately for implementing GWQMA or SPA and into a management phase area if information based on contamination levels or contamination potential indicates that action is warranted.

## **9.6 Identifying and Establishing Boundaries**

### **9.6.1 Target Areas**

The boundaries of a Target Area will be Townships within the Twin Platte Natural Resources District.

### **9.6.2 Ground Water Quality Management Area or Special Protection Area Boundaries**

The boundaries of a GWQMA or SPA will be the Major Land Resource Area within the Twin Platte Natural Resources District as identified by the USDA Natural Resources

Conservation Service or townships identified as strategic subareas.

### **9.7 Enhance District's Ground Water Monitoring System**

It will be important to maintain a reliable ground water monitoring system. Future decisions and will be based on data from the monitoring system. The District's Ground Water Monitoring Program is located in Chapter 5. The data collected through the monitoring program will be accessible to landowners and operators within the monitoring network.

**Table 9-1.**  
**Recommended Best Management Practices**

The following are recommended as best management practices and will be incorporated into the general education program and certified training workshops. Detailed descriptions are not given for each practice. Descriptions used by the UN-L Cooperative Extension, Natural Resources Conservation Service and/or other recognized authorities will be used to define the practices.

1. Fertilizer Management Practices
  - a. Deep (3') soil tests and analysis
  - b. N credits for residual nitrate
  - c. Realistic yield goals
  - d. Use of fertilizer inhibitors
  - e. Split applications/side dressing
  - f. Delay of fall applications
  - g. Use integrated management services
  
2. Irrigation Water Management
  - a. Flow meters
  - b. Irrigation scheduling
  - c. Surge valves
  - d. Buried pipe lines
  - e. Reuse pits, return lines
  - f. Measurement of field moisture conditions with moisture blocks, tensiometers, soil probes, etc.
  - g. Determine crop water use using modified atmometers
  - h. Measurement of uniformity of water application by sprinklers
  - i. Development of an irrigation water management plan on each farm
  
3. Alternative Crop/Crop Rotation
  - a. Select species requiring less fertilizer
  - b. Consider scavenger crops that will recover residual fertilizers
  - c. Use crop rotation to reduce pesticide and fertilizer applications

**Table 9-1 (Con't).**  
**Recommended Best Management Practices**

4. Integrated Pest and/or Fertilizer Management
  - a. Select pest and disease resistant varieties
  - b. Follow recommended rates and handling for chemicals
  - c. Coordinate pest control services with fertilizer program
  - d. Use professional consultants
  
5. Livestock Waste Management
  - a. Follow NDEQ Rules and Regulations for proper design, and management of livestock waste storage facilities
  - b. Application of livestock waste to cropland at rates that do not exceed the nitrogen requirements of the crops to be grown
  - c. Alternative disposal sites
  
6. Conservation Tillage
  - a. To control wind and water erosion
  
7. Proper Well Abandonment (Required by Nebraska Law)
  - a. Follow state standards and statues to plug unused wells
  - b. Use bentonite seals as recommended by NRD
  - c. Report proper abandonments to NRD or NDWR

**Table 9-2.**  
**Potential TPNRD Assistance Programs**

Technology Transfer: As development of agricultural and landscape technology becomes available and which will benefit land use decisions, the NRD will communicate information to rural and urban landowners.

The NRD will hold public meetings to provide an open forum to discuss new technologies or programs. Exhibits, rural and urban demonstration projects, newsletters, and reports by agencies/organizations will be used. Local news media will be used to keep public informed of activities.

Development of Ground Water Advisory Committees: The District will develop advisory committees for the purposes of becoming familiar with NRD regulatory authorities pertaining to ground water management and protection; to promote public understanding of ground water concerns; to advise the Twin Platte NRD Board of Directors on policy making to ensure that all viewpoints are considered, and to communicate on-going District programs and projects.

Cost-share Assistance: The District maintains the option to develop incentive programs to encourage the use of best management practices. Outlined below are possible items that cost-share funding could be available for through the District. Similar cost share arrangements may be available through state and federal programs.

- 1) Flow Meters
- 2) Moisture Meters and Blocks, Tensiometers, and Soil Probes
- 3) Surge Systems
- 4) Irrigation Scheduling Services
- 5) Modified Atmometers
- 6) LEPA Systems
- 7) Well Abandonment Program
- 8) Independent Ag. Consultant

Additional Monitoring Activities: An intensive ground water monitoring program and network throughout the District is important in order to determine any changes in the condition of the ground water. This program has been explained in greater detail in Chapter 5 of the District's Ground Water Management Plan.

**Figure 9-2 (Con't).**  
**Potential TPNRD Assistance Programs**

The District will augment the above activity with random nitrate water sampling in a GWQMA and/or SPA. Random deep (3') soil samples and core samples will be collected each year in an area to evaluate the effectiveness of management programs. Core samples will be taken to identify movement of nitrates and possibly pesticides in the vadose zone.

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