

SECTION 208

WATER QUALITY MANAGEMENT PLAN

FOR THE STATE OF NEBRASKA

Nebraska Natural Resources Commission
July 1979

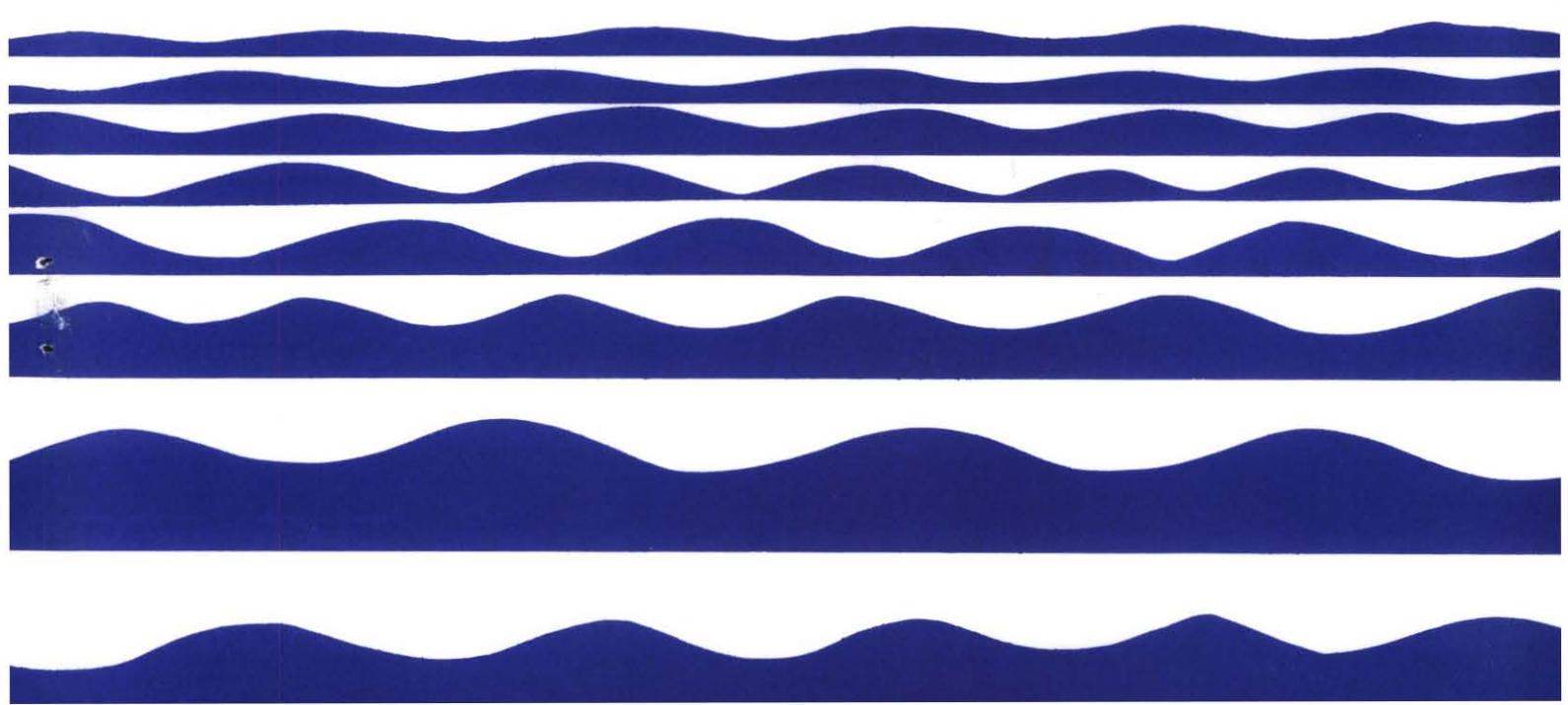


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SECTION I. THE PLANNING PROCESS

Introduction

The quality of the Nation's waters has become an issue of increasing concern to the public and their elected officials. Realizing water pollution can be a threat to our health and welfare, Congress enacted the Federal Water Pollution Control Act (Public Law 92-500 and amendments P. L. 95-217). The Act established a national goal that, wherever attainable, water quality which provides for the propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by 1983. Section 208 of the Act calls for the development and implementation of statewide water quality management plans. These plans are to coordinate all water quality programs and to modify existing and establish new programs as required to meet the goals of the Act. Applications for federal funds for projects not in compliance with the plan may not be approved.

The Nebraska Natural Resources Commission has been designated by the Governor of Nebraska as the agency responsible for water quality planning in Nebraska. A Federal grant has been awarded to the Commission by the United States Environmental Protection Agency. Through cooperative agreements, the Commission has been assisted by the Nebraska Department of Environmental Control and State Office of Planning and Programming. A number of other entities have also contracted to assist in this effort. They are:

Central Platte Natural Resources District
Chadron State College
Hoskins-Western-Sonderregger, Inc.
Lower Elkhorn Natural Resources District
Merritt Public Relations and Advertising
Nebraska Association of Resources Districts
Nebraska Game and Parks Commission
Omaha-Council Bluffs Metropolitan Area Planning Agency
Soil Conservation Service
United States Geological Survey
University of Nebraska-Lincoln
Upper Niobrara-White Natural Resources District

The Work Plan for Statewide Water Quality Management Planning for the State of Nebraska, June 1977, describes the steps in the planning process. A number of studies have been conducted as part of the water quality planning process to provide background information. Reports of these studies and other important information used in the planning process are listed below. These reports are available for public use from the Nebraska Natural Resources Commission. These references are listed at the end of this section.

As significant public participation is required in all steps of the planning process, citizen input was used to help develop the Water Quality Management Plan. The following committees have provided guidance in the preparation of the Plan:

Big Blue River Basin Policy Advisory Committee
Elkhorn River Basin Policy Advisory Committee
Little Blue River Basin Policy Advisory Committee
Loup River Basin Policy Advisory Committee
Lower Platte River Basin Policy Advisory Committee
Middle Platte River Basin Policy Advisory Committee
Missouri Tributaries River Basin Policy Advisory Committee
Nemaha River Basin Policy Advisory Committee
Niobrara River Basin Policy Advisory Committee
North Platte River Basin Policy Advisory Committee
Republican River Basin Policy Advisory Committee
South Platte River Basin Policy Advisory Committee
White River-Hat Creek Basin Policy Advisory Committee
Nebraska State Policy Advisory Committee
Nebraska State Technical Advisory Group

In Section II of the Plan, 11 problems are identified as being a significant detriment to water quality in Nebraska. Existing programs are not considered adequate to correct these problems. Some laws addressing these problems are not effective because of inadequate enforcement provisions. The solutions to these problems --- best management practices and management arrangements --- are described and subwatershed priorities are listed. Several additional items of a more general nature are discussed and recommendations are proposed.

Section III has been prepared to facilitate the Plan review by the Environmental Protection Agency. This section is arranged according to the 16 elements outlined in EPA rules and regulations for water quality management planning (40 CFR Part 131).

A priority list for subwatershed areas relating to agricultural runoff and nitrate contamination of groundwater is presented in Appendix A.

Plan Review and Revision

The Natural Resources Commission will annually review the status of the recommendations presented in Section II. The management agencies or their appropriate associations will be contacted and asked about their actions to implement the plan, the problems encountered, and any revisions they think are necessary. The status of the recommended legislation will be determined. A report with this information will be prepared and submitted to the Environmental Protection Agency. This report or a summary will be sent to interested entities and individuals.

The plan will be revised by the Natural Resources Commission when a change or addition is needed. Revisions will be made only after appropriate review by affected agencies and the public.

The Department of Environmental Control may need to use existing water pollution control authorities to expand their role in these areas if the recommendations are not adequately followed.

References

Work Plan for Statewide Water Quality Management Planning for the State of Nebraska, Nebraska Natural Resources Commission, June, 1977.

"Contingency Work Plan for Statewide Water Quality Management Planning", Nebraska Natural Resources Commission, August, 1978.

1978 Nebraska Water Quality Report, Nebraska Department of Environmental Control.

"Groundwater Protection Standards", Nebraska Department of Environmental Control, March, 1978.

"Nebraska Water Quality Standards for Surface Waters of the State", Environmental Control Council, October, 1977.

Edward J. Peters, "The Benefits of Irrigation Return Flow on the Biota of Nine Mile Creek, Scotts Bluff County, Nebraska", University of Nebraska-Lincoln, October, 1978.

R. J. Edling, "The Influence of the Silt Run on Seepage Losses in Irrigation Canals in the North Platte River Basin", University of Nebraska-Lincoln, 1978.

County Irrigated Land Maps, Soil Conservation Service, 1978.

County Land Cover Maps, Soil Conservation Service, 1977.

County Erosion Hazard Maps, Soil Conservation Service, 1977.

County Critical Eroding Area Maps, Soil Conservation Service, 1977.

Nebraska Conservation Treatment Needs, Soil Conservation Service, 1978.

"A Survey of Roadside Seeding Programs in Nebraska", Nebraska Natural Resources Commission, May, 1977.

Nonpoint Source Control Guidebook, Soil Conservation Service, April, 1978.

"A Survey of Center Pivot Irrigation Systems", Nebraska Natural Resources Commission, 1977.

"Present and Projected Nebraska Population Levels", State Office of Planning and Programming, January, 1978.

"Future Pollution Source Problems", Nebraska Natural Resources Commission, 1978.

"Present and Projected Nebraska Economic Development", State Office of Planning and Programming, February, 1978.

"Present and Projected Nebraska Land Use", State Office of Planning and Programming, 1978.

"Central Platte Nitrate Study", Central Platte Natural Resources District, March, 1979.

"Soil Interpretations for Application of Nontoxic Biodegradable Liquid and Solid Waste for Nutrient Removal by Plants", Soil Conservation Service, August, 1978.

"Best Management Practices", Nebraska Natural Resources Commission, June, 1979.

"Alternative Technical Measures for Water Quantity Problems as They Affect Water Quality, Nebraska Natural Resources Commission, 1978.

"An Evaluation of Environmental, Social, and Economic Impacts of Proposed Alternative Technical Measures", State Office of Planning and Programming, July, 1978.

A Report on Management Arrangements Capable of Solving Water Quality Problems in Nebraska, Lower Elkhorn Natural Resources District, March, 1979.

A Report on Financial Alternatives Available to Natural Resources Districts For Proposed Alternative Solutions to Water Quality Problems, Nebraska Association of Resources Districts, November, 1978.

Raymond J. Supalla and Henry J. Geu, "A Report on Alternative Methods of Financing Section 208 Water Quality Programs in Nebraska", University of Nebraska-Lincoln, November, 1978.

"Work Element 5400 - Evaluate Social, Economic, and Environmental Impacts of Proposed Alternative Solutions (Management Arrangements)", State Office of Planning and Programming, October, 1978.

Areawide Waste Treatment Management Plan, Omaha-Council Bluffs Metropolitan Area Planning Agency, April, 1979.

Nebraska Interim Plan for Agricultural Nonpoint Pollution Control, Nebraska Natural Resources Commission, September, 1978.

"Check Valve Survey Preliminary Report", Nebraska Natural Resources Commission, April, 1979.

"Public Participation in Non-point Source Planning, November Workshops", Nebraska Natural Resources Commission, 1977.

"Alternatives for Clean Water in Nebraska, 1978 Workshops", Nebraska Natural Resources Commission.

"Public Participation in Non-point Source Planning", 1976 Conference Proceedings, Nebraska Natural Resources Commission.

Groundwater Quality Atlas of Nebraska, R. A. Enberg and R. F. Spalding, University of Nebraska-Lincoln, 1978.

303(e) Basin Water Quality Management Plans, Nebraska Natural Resources Commission, 1974-76.

State of Nebraska Continuing Planning Process for Water Quality Management Planning and Implementation, Nebraska Natural Resources Commission, 1976.

Statistical Data for Selected Chemical Constituents, U.S. Geological Survey, 1977.

Nebraska Department of Environmental Control Program Plan Strategy.

A Social, Economic and Environmental Assessment of the Section 208 Water Quality Plan for the State of Nebraska, Policy Research Office, July, 1979.

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SECTION II. WATER QUALITY MANAGEMENT PLAN
FOR SELECTED PROBLEMS

Introduction

The early phases of the planning process consisted of the collection and assessment of the surface and groundwater quality data and point and nonpoint pollution source data. The water quality planning staff used this information and the recommendations of the basin policy advisory committees to develop a list of eleven water quality problems, i.e. sources of water pollution, that were considered of such significance to water quality as to require corrective action. Water quality problems not on the list were considered to be adequately controlled by existing programs or of lesser importance and were not addressed further in the 208 program. The State Policy Advisory Committee concurred and recommended this list to the Natural Resources Commission which approved it. These 11 problems are:

- (a) Agricultural Runoff
- (b) Leaching of Nitrates, Pesticides, and Other Chemicals into the Groundwater
- (c) Improper Operation and Maintenance of Wastewater Treatment Plants and Insufficient Operator Training
- (d) Roadside Erosion
- (e) Streambank Erosion
- (f) Irrigation Return Flows
- (g) Construction Site Runoff
- (h) Urban Runoff
- (i) Residual Waste Disposal Site Contamination of Surface and Groundwater and Land Application of Wastewater Effluent and Sludge
- (j) Feedlots
- (k) Septic Tanks

The discussion for each problem begins with a brief description of the problem and how it affects water quality. Best management practices are the most practical and effective technical measure or combination of measures which will prevent or reduce the generation of pollutants to a level compatible with water quality goals. Required management techniques are part of the best management practice. A list of approved technical measures that may be best management practices follows the introduction. These technical measures are further described in a separate report. A

single technical measure may be the best management practice in a given situation, but usually a combination of measures is needed. Best management practices must be chosen for each site; the selection of best management practices for a particular unit or area is a complex process. The list of approved technical measures is flexible and may be added to or modified as needed. It should be noted that programs which provide cost share or other assistance that may be used to help control the 11 problems have their own list of approved practices.

Management arrangements are the means to facilitate the application of best management practices; they primarily reflect the role of federal, state, and local units of government. A brief summary of existing management arrangements follows the list of best management practices for each problem. Following these summaries are recommendations for changes in the existing management arrangements that the Natural Resources Commission and assisting agencies, the Department of Environmental Control and State Office Of Planning and Programming, believe are needed to meet the water quality goals established by the Federal Water Pollution Control Act Amendments of 1972. All recommendations under each problem are advocated; their order has no particular significance.

In addition to the 11 water pollution source problems, several other issues relating to water quality have been recognized. They are federal agricultural policies and programs, diminishing streamflows, inadequate water quality data, water conservation, and further areas of study. Recommended changes to mitigate these concerns are also included in this section.

Agricultural Runoff

Sediment is the primary pollutant related to agricultural runoff. Through the physical process of water erosion, soil particles are dislodged and transported by water with a fraction of the particles reaching surface waters and being subsequently identified as sediment. Sediment can interfere with the feeding and reproduction of aquatic organisms. It can reduce light penetration into the surface water, thereby disrupting the photosynthetic process and reducing vegetative and oxygen production. It can also cause a scouring effect which can damage aquatic plants and organisms existing in a stream. Sediment also acts as a transporting medium for pesticides and fertilizer nutrients that become attached to the soil particles. These chemicals can also make the water unfit for its intended uses.

Best Management Practices

Best management practices to control nonpoint source pollution are the most practical and effective measure or combination of measures which, when applied to the agricultural management unit, will prevent or reduce the generation of pollutants to a level compatible with water quality goals. They often enhance the productivity of the soils as well as control pollution and add to the aesthetic value of the area. Because of the variability in production methods, crops and animals, soil types, topography, climate, etc., the best management practices for any specific agricultural management unit or area may vary. The selection of best management practices for a particular agricultural management unit or area is a complex process. Any measure or combination of measures applied to an agricultural management unit or area which will achieve water quality goals is a potential best management practice. However, the measures are generally the type that are incorporated into a soil and water conservation plan as developed by a landowner or land user with the assistance of a Natural Resources District and the Soil Conservation Service. The principal emphasis should be placed on measures that will prevent or control the runoff or seepage of pollutants from crop or animal production management units. Preventive measures must be fully integrated into the total production management system of the farm or ranch unit. The soils, nutrients, and pesticides should be kept on the land where they perform their intended agricultural function.

The selection and application of technical measures rests with the land owner or user. It is his responsibility to make use of the information and assistance available, both private and public, to arrive at the final decision. Decisions that involve the use of soil and water resources can be complex and may have a direct bearing on the quality of our water. Nebraska's Natural Resources Districts are in a strong position to provide professional and technical assistance in decision making that will benefit nonpoint pollution control. The Natural Resources District board, a locally elected unit of government, provides guidance and review of resource plans developed in their area. They have the responsibility to set planning priorities and to review each individual plan developed by the producer and the Soil Conservation Service and other agencies. The planning process applies to individuals, groups, and units of government.

The list of technical measures that may be the best management practices to control agricultural runoff is extensive and is shown below. In general, these measures act to prevent soil particles from being dislodged or to reduce the velocity of movement of the runoff. In addition to these benefits nonstructural measures also minimize the amount of agricultural chemicals available for transport.

Voluntary Structural Measures

Access Road

Dam, Floodwater Retarding

Dam, Multiple-Purpose

Diversion

Fencing

Floodwater Diversion

Grade Stabilization Structure

Grassed Waterway or Outlet

Irrigation Field Ditch

Irrigation Land Leveling

Irrigation Pit

Irrigation Storage Reservoir

Irrigation Water Conveyance, Ditch and Canal Lining

Irrigation Water Conveyance, Pipeline

Lined Waterway or Outlet

Open Channel

Pond

Regulating Reservoir

Sediment Basin

Spring Development

Streambank Protection

Structure for Water Control

Terrace

Tree Planting
Waste Storage Pond
Waste Storage Structure
Waste Treatment Lagoon
Waterspreading
Well

Voluntary Nonstructural Measures

Brush Management
Conservation Cropping System
Conservation Tillage Systems
Contour Farming
Cover and Green Manure Crop
Critical Area Planting
Crop Residue Use
Deferred Grazing
Emergency Tillage
Farmstead and Feedlot Windbreak
Field Border
Field Windbreak
Firebreak
Grasses and Legumes in Rotation
Grazing Land Mechanical Treatment
Irrigation System, Drip
Irrigation System, Sprinkler
Irrigation System, Surface and Subsurface
Irrigation System, Tailwater Recovery
Irrigation Water Management
Livestock Exclusion

Minimum Tillage
Mulching
Pasture and Hayland Management
Pasture and Hayland Planting
Planned Grazing Systems
Proper Grazing Use
Range Seeding
Reclamation of Surface Mined Land
Recreation Area Improvement
Stripcropping, Contour
Stripcropping, Field
Stripcropping, Wind
Stubble Mulching
Vegetated Filter Strip
Waste Management System
Waste Utilization
Wildlife Upland Habitat Management
Wildlife Wetland Habitat Management
Windbreak Renovation

Management Arrangements

The application of best management practices to abate pollution from agricultural runoff is now achieved on a voluntary basis in Nebraska. Existing management arrangements are limited to educational programs, technical assistance, and cost share programs available to the land-owners and operators, and programs that provide for the construction of structures to protect watersheds. Applicable programs include:

- (a) Agricultural Conservation Program
- (b) Great Plains Conservation Program
- (c) Local Natural Resources District Cost Share Program
- (d) Game and Parks Commission Habitat Program
- (e) Nebraska Water Conservation Fund
- (f) Resource Conservation and Development Program
- (g) Watershed Protection and Flood Prevention Program
- (h) Rural Clean Water Program
- (i) Natural Resources Development Fund

Recommendation No. 1. Expand the Educational Programs

The Natural Resources Commission should facilitate the development of long-term multi-media educational programs to improve water quality. Agricultural runoff is one of the water quality problems that should be addressed in an expanded program. The educational program should promote voluntary use of best management practices to protect water quality and should provide information on the effectiveness of these practices and their cost and selection. The program should also provide the designated management agencies with educational support and assistance. The educational delivery methods should include (a) direct assistance to management agencies in providing information to individuals and target groups, (b) direct communication and training assistance for management agencies, and (c) multi-media communications, including radio, television, and printed material.

Management Agency. The Natural Resources Commission would be responsible for the establishment of an expanded educational program for agricultural runoff in cooperation with appropriate federal, state, and local agencies.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. It is anticipated that federal cost sharing would be available for a minimum of two years from the Environmental Protection Agency to assist in this program. The proposed funding for the first year is approximately \$55,000 in federal money and \$21,000 in non-federal money.

Schedule of Implementation. The expanded educational program should be a long-term program and could be implemented by completing these steps on or before these dates:

July, 1979	NRC Develop Program and Request EPA Funds
August, 1979	EPA Approve Grant Request
September, 1979	NRC Contract with Appropriate Agency or Agencies

Recommendation No. 2. Adopt a State Goal
for Nonpoint Pollution Control

A state goal should be established for nonpoint pollution control. Compliance with the goal would remain voluntary unless required by contract, legislation, or rules and regulations. The goal should reflect differences across the state. Soil Conservation Service guidelines should be used as a model. The performance criteria would be in terms of such measurable outputs as soil loss, sediment delivery, visual damage, or surface and groundwater quality parameters. Surface water runoff should be delivered to a natural watercourse in a non-erosive manner. Predicted annual soil loss due to water and wind

erosion should not exceed the allowable soil loss established for each soil. Nutrient and pesticide applications and the management of irrigation return flows should also be addressed in the goal. Adequate opportunity for public and agency input would be provided before the state goal would be adopted. The goal could be modified as required.

Management Agency. The Natural Resources Commission in cooperation with appropriate federal, state, and local agencies, and the general public would be responsible for the preparation of a state goal for the control of nonpoint pollution. The Natural Resources Commission would be responsible for adoption of this goal.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The responsible agencies would pay the costs of establishing this goal. The estimated costs of this recommendation are:

NRC \$ 5,000

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

July, 1980 NRC Prepare Goal

January, 1981 NRC Adopt Goal

Recommendation No. 3. Promote the Project Area Approach

A significant amount of the water pollution due to agricultural runoff originates on relatively small parts of a river basin. A concentrated effort to promote the application of best management practices in these areas would be of considerable benefit to water quality. Areas with water quality problems due to agricultural runoff have been prioritized by watershed. (This priority list is shown in Appendix A.) The natural resources districts, in cooperation with appropriate state and federal agencies and committees, should intensify their efforts to promote the application of best management practices in these high-need areas. Existing cost share programs would be used in these project areas, including available natural resources district and state funds. An effort would also be made to acquire project program monies, as from the Watershed Protection and Flood Prevention Program, the Rural Clean Water Program, and any special project programs.

Management Agency. The natural resources districts would be responsible for promoting the project area approach to control agricultural runoff, in cooperation with other federal, state, and local agencies.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The natural resources districts, and to a lesser extent, other state and federal agencies, will have increased administrative costs for the promotion of the project area approach. This recommendation could be implemented by additional annual funding of approximately

\$3,000 per natural resources district, \$1,500 for the state, and \$2,000 for federal agencies. Public funds for construction and technical support will come from existing cost share programs.

Schedule of Implementation. This promotional effort could begin in December, 1979 and continue indefinitely.

Recommendation No. 4. Establish State Cost Share Fund For Control of Surface and Groundwater Pollution From Agricultural Activities

A State cost share fund should be established to provide funds for control of surface and groundwater pollution from agricultural activities. A portion of this fund should be reserved for use in critical problem areas.

Management Agency. The Natural Resources Commission would be responsible for administration of the State cost share fund.

Authority. The Water Conservation Fund would have to be modified or a new fund established to provide state monies for implementation of the program.

Funding. It is proposed that \$1,000,000 in state funds be provided for cost sharing for the adoption of best management practices to control surface and groundwater pollution from agricultural activities.

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1979	NRC Draft Legislation
January, 1980	Submit Draft to Legislature
March, 1981	Legislature Provide Authorities and Funds

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Leaching of Nitrates, Pesticides, and Other Chemicals Into the Groundwater

As water moves through the soil profile, it dissolves water soluble chemicals. These chemicals, including salts, nutrients, and pesticides, can be carried to the groundwater and can contaminate the groundwater supply so as to make it unfit for its intended uses. Of particular concern is the presence of nitrates in groundwater drinking supplies. Nitrates may endanger human and animal health.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control the leaching of chemicals into the groundwater is shown below. The proper combination of practices to solve a problem is not known until on-site planning is completed by a trained technician. These measures are structural and nonstructural in nature. The structural measures include those designed to minimize the movement of chemicals below the surface by constructing an impervious layer on the surface. Nonstructural measures include those practices to manage and reduce the use of agricultural chemicals and irrigation water resulting in a minimum quantity of chemicals leaching to groundwater.

Voluntary Structural Measures

- Irrigation Land Leveling
- Irrigation Pit
- Irrigation System, Tailwater Recovery
- Irrigation Water Conveyance, Ditch or Canal Lining
- Irrigation Water Conveyance, Pipeline
- Lined Waterway or Outlet
- Pond Sealing or Lining
- Regulating Reservoir
- Subsurface Drain

Voluntary Nonstructural Measures

- Grasses and Legumes in Rotation
- Irrigation Water Management (Includes Irrigation Scheduling)
- Optimization of Chemicals Applied
- Plowing Under Green Legume Crops

Use of Alternative Pest Control Methods

Use of Animal Wastes for Fertilizer

Use of Chemical Release Inhibitors

Use of Winter Cover Crops

Management Arrangements

The application of best management practices to abate pollution from the leaching of nitrates, pesticides, and other chemicals into the groundwater is now achieved on a voluntary basis in Nebraska. Existing management arrangements are limited to (a) educational programs, (b) irrigation scheduling programs available through the Cooperative Extension Service, some natural resources districts, power companies, and commercial enterprises, and (c) cost share assistance and technical assistance available for some best management practices. Groundwater quality standards have been established by the Environmental Control Council. State law requires backflow preventive devices on groundwater irrigation systems through which fertilizers or pesticides are applied.

Recommendation No. 1. Expand the Educational Programs

The Natural Resources Commission should facilitate the development of long-term multi-media educational programs to improve water quality. Leaching of nitrates, pesticides, and other chemicals into the groundwater is one of the water quality problems that should be addressed in an expanded program. The educational program should promote voluntary use of best management practices to protect water quality and should provide information on the effectiveness of these practices and their cost and selection. The program should also provide the designated management agencies with educational support and assistance. The educational delivery methods should include (a) direct assistance to management agencies in providing information to individuals and target groups, (b) direct communication and training assistance for management agencies, and (c) multi-media communications, including radio, television, and printed material.

Management Agency. The Natural Resources Commission would be responsible for the establishment of an expanded educational program for agricultural runoff in cooperation with appropriate federal, state, and local agencies.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. It is anticipated that federal cost sharing would be available for a minimum of two years from the Environmental Protection Agency to assist in this program. The proposed funding for the first year is approximately \$55,000 in federal money and \$21,000 in non-federal money.

Schedule of Implementation. The expanded educational program should be a long-term program and could be implemented by completing these steps on or before these dates:

July, 1979	NRC Develop Program and Request EPA Funds
August, 1979	EPA Approve Grant Request
September, 1979	NRC Contract with Appropriate Agency or Agencies

Recommendation No. 2. Clarify and Strengthen the Law Regarding
Backflow Preventive Devices on Groundwater Irrigation Systems

State statutes regarding backflow preventive devices on groundwater irrigation systems through which fertilizers or pesticides are applied, Section 46-612.01, should be modified to establish minimum standards for acceptable devices and establish stronger penalties to help insure compliance. A system of two single check valves, one on the well and one on the line from the chemical tank, should be required rather than a single backflow prevention device. A well not in conformance with Section 46-612.01 as presently written is declared to be an illegal well by Section 46-657(8) of the Nebraska Groundwater Management Act. Pursuant to this act natural resources districts have authority to issue cease and desist orders to restrain the pumping of water from such a well. The natural resources districts should increase their utilization of this authority to help remedy the problem of non-compliance with the law regarding backflow preventive devices.

Management Agency. The Department of Water Resources would be responsible for drafting the required legislation. The Department of Water Resources and the natural resources districts would both be responsible for bringing violations of Section 46-612.01 to the attention of county attorneys. The natural resources districts would be responsible for increasing their efforts to remedy the noncompliance problem by utilizing their power to issue cease and desist orders. The University of Nebraska would be responsible for preparing minimum standards.

Authority. State statutes would have to be modified to clarify and strengthen the existing law regarding backflow preventive devices.

Funding. Costs associated with this recommendation include the cost of preparing the legislation and the minimum standards, administration costs, and the cost to the individual for installing the required equipment. Cost estimates for these items are:

Draft Legislation	\$ 1,000
Prepare Standards	\$ 1,000
DWR and NRD Administration/yr	\$10,000
Per Backflow Prevention System	\$150-\$600

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1979	DWR Prepare Draft Legislation
January, 1980	Submit Draft to Legislature
March, 1981	Legislature Provide Authority
July, 1981	NU Prepare Minimum Standards

Recommendation No. 3. Provide Authority to Establish
Groundwater Quality Control Areas

State statutes should be modified to provide for the establishment of groundwater quality control areas if groundwater quality parameters approach or exceed recommended safe drinking water limits. The procedure for the establishment of groundwater quality control areas would be similar to the procedure for establishment of groundwater quantity control areas as provided in the Groundwater Management Act. A program to monitor the groundwater quality in a control area would be established. Within the defined area the use of irrigation water and, to some extent, the use of fertilizer, pesticides, and other chemicals could be regulated. These regulations could include one or more of the following provisions:

- (a) Permits for the installation of any new irrigation systems, including the construction of new wells
- (b) Meters or other measuring devices on groundwater wells and stream diversions
- (c) Well spacing requirements
- (d) Limits on the total amount of irrigation water applied
- (e) Limits on the length of fields served by gravity irrigation systems
- (f) Minimum standards for irrigation systems
- (g) A requirement that each irrigator complete an acceptable training course on irrigation scheduling
- (h) A requirement that each irrigator in the area purchase and use soil moisture measuring equipment
- (i) A requirement that each irrigator implement an irrigation scheduling program that will, to the extent possible, schedule the application of water in amounts which will not move below the root zone
- (j) Restrictions on the application of nitrates, or other chemicals of particular concern, during the fall and winter months
- (k) A requirement that natural resources districts provide each landowner or operator with copies of current University of Nebraska fertilizer guidesheets.

Management Agency. The initiative to establish a groundwater quality control area would be a responsibility of the natural resources district board of directors. The Department of Environmental Control would be responsible for the establishment of the groundwater quality control areas, including holding the hearing, determining if a control area should be established, and establishing the boundary. The natural resources districts would establish and administer rules and regulations for the groundwater quality control areas.

Authority. State statutes would have to be modified to give the authority for the establishment and administration of groundwater quality control areas. This could be accomplished by amending the existing Groundwater Management Act or enacting new legislation. Authority to provide supplemental natural resources district funding may be required.

Funding. Costs associated with this recommendation include administrative costs of the Department of Water Resources and affected natural resources districts, and costs of the landowners or operators. The yearly cost for the establishment and administration of groundwater quality control areas is difficult to estimate. Administration of groundwater quality areas would be quite costly.

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1980	NRC Draft Legislation
January, 1981	Submit Draft to Legislature
March, 1984	Legislature Provide Authority

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Improper Operation and Maintenance of Wastewater Treatment Plants and Insufficient Operator Training

The removal of pollutants from wastewater to amounts acceptable for discharge is a relatively complex process. Wastewater treatment systems cannot function correctly without proper operation and maintenance. Therefore, the plant operator must be adequately trained to properly operate and maintain the system. Improper operation and maintenance and insufficient operator training cause many adequately designed treatment systems in Nebraska to function poorly.

Best Management Practices

The technical measures that may be the best management practices to control improper operation and maintenance of wastewater treatment plants are the maintenance and testing procedures and operating criteria that are recommended by the designer or manufacturer. Technical procedures recommended by the Department of Environmental Control or other appropriate agency may also be best management practices.

Management Arrangements

Abatement of improper operation and maintenance of wastewater treatment plants and insufficient operator training is now achieved primarily on a voluntary basis in Nebraska. Training can be required through an administrative order of the Department of Environmental Control. The performance of wastewater treatment systems is regulated by discharge requirements in the National Pollutant Discharge Elimination System permit program. All wastewater treatment plants with permits are inspected periodically by Department of Environmental Control personnel. Training is available upon request by the Department of Environmental Control on a tuition-free basis. Training is also available at several community colleges and through correspondence courses. Voluntary operator certification is available through the Department of Environmental Control.

Recommendation No. 1. Promote Circuit Wastewater Treatment Plant Operators

The concept of a circuit wastewater treatment plant operator should be promoted. An adequately trained and certified operator would serve several small wastewater treatment facilities which are in close proximity. This would result in improved operation and efficiency as long as the arrangement was able to deal with the many problems of treatment plant operation. This concept could be promoted by suggesting the sharing of an operator during normal contacts with the communities, particularly when problems with operation and maintenance are discussed.

Management Agency. The Department of Environmental Control should be responsible for promoting the concept of circuit wastewater treatment plant operators. Cities and villages would have the responsibility to

enter into agreements with one another and hire a circuit operator. Councils of government and natural resources districts could provide leadership in bringing communities together and initiating such a program.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The costs of this recommendation include that for promotion and, if a circuit operator system is established by communities, salary and administrative costs. The costs should be paid by the responsible agencies; communities sharing an operator would have to arrange to share personnel costs. Costs are estimated to be:

Promotion	\$1,000 per year
Operator Salary	\$1,200-1,400 per month
Community Administration	\$ 100 per month

Schedule of Implementation. This recommendation could be implemented by the Department of Environmental Control by December, 1979 and could continue indefinitely.

Recommendation No. 2. Require Sanitary and Improvement Districts To Provide for Wastewater Treatment System Operation and Maintenance

Sanitary and improvement districts are established in unincorporated urban areas to provide any of a number of services including wastewater treatment and disposal. Operation and maintenance of wastewater treatment systems by sanitary and improvement districts have, in some cases, been very poor. In order to help insure that sanitary and improvement districts provide adequate treatment, the county and/or city with authority to approve subdivisions in these districts should review a district's plans for operation and maintenance. Sufficient resources should be committed to operation and maintenance before a new development is approved. Also, as communities grow and new treatment systems are required, they should regionalize wastewater treatment, taking this responsibility from the sanitary and improvement districts wherever this proves to be cost effective.

Management Agency. Cities and counties, in using their authority for reviewing applications for subdivision development, would have the responsibility to see that sanitary and improvement districts have sufficient resources committed to operation and maintenance of the wastewater systems in proposed subdivisions. Communities, with assistance from the Department of Environmental Control, would assume the responsibility for wastewater treatment from sanitary and improvement districts as this becomes cost effective.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The cost of the additional subdivision application review would be borne by the cities and counties and would be approximately

\$100 more per application. Any additional costs of operation and maintenance would have to be paid by the landowners in the districts. Additional planning costs would be involved in a regional approach to wastewater treatment but it could result in long-term savings as larger facilities are normally more efficient to operate.

Schedule of Implementation. This recommendation could be implemented by the management agencies by December, 1979 and could continue indefinitely.

Recommendation No. 3. Require Wastewater Treatment Plant Operator Training and Certification

State statutes should be amended to require all wastewater treatment plant operators to be trained and certified. The level of required training should correspond with the size and complexity of the facility.

Management Agency. The Department of Environmental Control would be responsible for drafting legislation and enforcing this requirement, including certifying the operators. Training would be provided by those entities that now do so.

Authority. State statutes would have to be amended to require wastewater treatment plant operator training and certification.

Funding. Department of Environmental Control costs to implement this program would be minimal. Training costs will be from zero to \$2,000 per operator.

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1979	DEC Draft Legislation
January, 1980	Submit Draft to Legislature
March, 1981	Legislature Provide Authority

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Roadside Erosion

The major pollutant stemming from roadside erosion is sediment. Through the physical process of water erosion, soil particles are dislodged and transported by water with some of the particles reaching bodies of water. Roadside erosion is accelerated by removing the ground cover for maintenance or construction or by cultivation. Sediment can make the receiving water unfit for fish and wildlife, recreation, and other intended uses.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control roadside erosion is shown below. The proper combination of practices to solve a problem is not known until on-site planning is completed by a trained technician. In general, structural measures act to prevent soil particles from being dislodged, to reduce the velocity of runoff, or to trap sediment. Nonstructural measures primarily serve to establish and maintain vegetative growth which reduces erosion potential and filters sediment-laden runoff.

Voluntary Structural Measures

- Fencing
- Grade Stabilization Structure
- Lined Waterway or Outlet
- Sediment Basin
- Water Control Structure

Voluntary Nonstructural Measures

- Critical Area Planting (Roadside Seeding)
- Field Border
- Livestock Exclusion
- Mulching
- Proper Fertilization
- Proper Pesticide Application
- Proper Road Design

Management Arrangements

The application of best management practices to abate pollution from roadside erosion is now achieved on a voluntary basis in Nebraska. The county is the primary unit of government responsible for roadside erosion control in Nebraska. Existing management arrangements which facilitate the application of best management practices to control roadside erosion include (a) educational programs to promote roadside erosion control and educate road maintenance personnel, (b) programs which help control roadside erosion conducted by some townships, counties, natural resources districts, Resources Conservation and Development areas, and the Nebraska Department of Roads, (c) the Game and Parks Commission roadside seeding program, and (d) Federal Aid Secondary road requirements.

Recommendation No. 1. Revise State Law Regarding Agricultural Cultivation of Roadways

State Statute 39-703 regarding agricultural activities in rural road right-of-way should be revised to clearly prohibit agricultural cultivation of rural road right-of-way. After enactment by the Legislature, county attorneys could readily process violations of the statute.

Management Agency. The Natural Resources Commission will develop suggested legislation with assistance from the Association of County Officials and the Association of County Highway Superintendents, Engineers, and Surveyors. The Commission and the Nebraska Association of County Officials would notify all counties of the revisions in the statutes.

Authority. State Statute 39-703 would have to be revised by the Legislature.

Funding. Implementation of this recommendation would cost the Natural Resources Commission and the Association of County Officials approximately \$500 and \$1,000, respectively.

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1979	NRC Draft Legislation
January, 1980	Submit Draft to Legislature
April, 1980	Legislature Provide Authority

Recommendation No. 2. Local Subdivisions Of Government Share Roadside Seeding Equipment

Counties and natural resources districts that have the need should purchase roadside seeding equipment such as narrow grass drills, hydro-seeders, and mulchers on a voluntary but coordinated basis. The equipment could then be shared by the cooperating entities to their best advantage. The counties and natural resources districts should be encouraged to consider such arrangements.

Management Agency. The Natural Resources Commission, Nebraska Association of Resources Districts, and Nebraska Association of County Officials would be responsible for promoting this concept. The counties and natural resources district would be responsible for entering into cooperative agreements for the purchase and use of this equipment.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The responsible agencies would bear the costs associated with this recommendation. Equipment would be the major cost item. Grass drills cost approximately \$4,000 to \$5,000; mulchers cost approximately \$7,000 to \$10,000; and hydroseeders cost from \$3,000 to \$50,000. Costs for promotion may be approximately \$500 per year for each agency. Sharing this equipment may result in considerable savings.

Schedule of Implementation. This recommendation could be implemented on or before December, 1979 and continue indefinitely.

Recommendation No. 3. Establish a Recommended Back Slope for Rural Roads

The Nebraska Board of Public Roads Classifications and Standards should change its design standards for back slopes on rural roads. The standards, which currently state that the back slope is variable, should recommend a minimum back slope for rural road construction. The minimum needs to be different for different soils and areas of the state. Compliance by counties and townships would be on a voluntary basis because in some cases this standard would be infeasible. It is felt that this recommended back slope standard would give leverage to counties and townships in their dealings with landowners to acquire adequate right-of-way for road construction and reconstruction.

Management Agency. The Board of Public Roads Classifications and Standards would be responsible for making this change in the standards. Counties and townships would be responsible for compliance on a voluntary basis.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The Board of Public Roads Classifications and Standards would absorb the administrative cost involved with this revision of the standards which is estimated at \$250. Counties and townships would bear the implementation costs which would vary depending upon the costs of easements, extra dirt moving, fencing, and labor arrangements.

Schedule of Implementation. The back slope standard could be revised by December, 1979.

Recommendation No. 4. Require Seeding
Along New and Reconstructed Roads

The Nebraska Board of Public Roads Classifications and Standards should change its minimum design standards for rural roads to require seeding of all disturbed areas during the reconstruction of a road or the construction of a new road. Physical maintenance activities would not be affected by this change in the standards.

Management Agency. The Board of Public Roads Classifications and Standards would be responsible for making this change in the standards. Counties and townships would be responsible for compliance.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The Board of Public Roads Classifications and Standards would absorb the administrative cost involved with this revision of the standards which is estimated at \$250. Counties and townships would bear the costs associated with implementation which would vary depending upon type and amount of seed, fertilizer, and mulch used. This may cost \$500 to \$1,000 per mile of roadway which is about 4.8 acres. The Game and Parks Commission will pay \$150 per mile to reimburse the counties and townships for the cost of seed. Some natural resources districts may also provide financial assistance.

Schedule of Implementation. This revision in the standards could be made by December, 1979.

Streambank Erosion

Streambank erosion is a natural process which is often accelerated by clearing of protective cover from banks or by channel straightening or realignment. Soil particles dislodged from the streambank become sediment in the stream. This sediment can cover the bottom of the stream interfering with feeding and reproduction of aquatic organisms. It can cause a scouring effect which can damage aquatic organisms existing on the stream bottom. It can reduce light penetration into the stream, thereby disrupting the photosynthetic process reducing vegetative and oxygen production. Other impacts due to sedimentation include loss of reservoir capacity, reduced recreation demand, increased drainage maintenance costs, and reduced capacity of waterways.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control streambank erosion is shown below. The proper combination of practices to solve a problem cannot be known until on-site planning is completed by a trained technician. Structural measures include those aimed at preventing the undermining of streambanks and sloughing of soil into the stream. Nonstructural measures act to stabilize the streambank by protecting the vegetation on the bank.

Voluntary Structural Measures

Clearing and Snagging

Dam, Diversion

Dam, Multiple-Purpose

Floodwater Diversion

Grade Stabilization Structure

Grassed Waterway or Outlet

Lined Waterway or Outlet

Open Channel

Stream Channel Stabilization

Streambank Protection

Structure for Water Control

Voluntary Nonstructural Measures

Critical Area Planting

Mulching

Vegetative Filter Strip

Wildlife Upland Habitat Management

Management Arrangements

The application of best management practices to abate pollution from streambank erosion is now achieved on a voluntary basis in Nebraska. Most existing management arrangements to control streambank erosion have been established to reduce loss of land and damage to structures such as bridges. No management arrangements have been established principally to reduce water pollution from streambank erosion, but programs which reduce land loss and structural damage are also beneficial to water quality. The Watershed Protection and Flood Prevention Act (Public Law 566) and the Agricultural Conservation Program help to control streambank erosion, particularly through construction of grade stabilization structures. Other programs address flood protection or affect the land near the streams and therefore, affect streambank erosion. Local, state, and federal agencies take part to some degree in the above mentioned activities. The Section 404 permit program, which regulates the discharge of dredged and fill material into surface waters, does address water quality and may have an important effect on streambank erosion.

Recommendation No. 1. Promote Riparian Lands Protection

Natural resources districts should encourage landowners to participate in the existing habitat programs administered by the districts and the Game and Parks Commission. The purpose of these programs is protection and development of wildlife habitat but they also serve to protect riparian lands and reduce streambank erosion. Preservation of existing habitat and conversion of marginal lands would be included. This could help to preserve a vegetative strip along streams that would provide additional protection against streambank erosion.

Management Agency. The natural resources districts participating in this program would be responsible for promoting these habitat programs. The Game and Parks Commission and the natural resources districts would continue to administer the program.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The cost of promoting the program would be minor. The program will continue to be funded by the Game and Parks Commission and participating natural resources districts. Payments under the habitat program are established by the natural resources districts. The Game and Parks Commission provides cost sharing of 75 percent up to a maximum rate as follows:

- (a) \$25/acre/year under contracts for 3 to 10 years for establishing permanent cover on marginal cropland.
- (b) \$15/acre/year under 10 year contracts for protecting existing wetlands or areas with mixed woody and herbaceous cover.

- (c) \$7.50/acre/year under 10 year contracts for protecting herba-
ceous cover.

Schedule of Implementation. Implementation of this recommendation could begin on or before December, 1979.

Recommendation No. 2. State Assume Responsibility
Of Section 404 Permit Program

The Department of Environmental Control should assume responsibility for the Section 404 permit program, which regulates the discharge of dredged and fill materials into surface waters, as soon as they are able to do so. A permit must be obtained before channel alterations can be made. Projects which would result in significant streambank erosion can be stopped in this way. Enforcement of this program by a state agency is more acceptable to the public. Department of Environmental Control personnel would be closer to the problem and could better coordinate the review with other state agencies. The Environmental Protection Agency should expedite development of appropriate rules and regulations to allow for the Department of Environmental Control to assume this responsibility from the Corps of Engineers. The Department of Environmental Control should initiate an educational program to improve public awareness of the 404 permit program and also the floodplain permit program authorized by Legislative Bill 108 and administered by the Department of Water Resources. The Department of Environmental Control should work closely with the Department of Water Resources to regulate stream channel alteration projects; these agencies should coordinate their efforts with the Game and Parks Commission and the Natural Resources Commission.

Management Agency. The Department of Environmental Control would be the agency responsible for administration of the Section 404 permit program.

Authority. State statutes would have to be modified to give the Department of Environmental Control authority to administer the Section 404 permit program. The Environmental Protection Agency would have to transfer the responsibility to administer the Section 404 permit program to the Department of Environmental Control.

Funding. The cost of administering the Section 404 permit program for Nebraska is estimated to be \$18,000 per year.

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1980	Prepare Draft Legislation, DEC
January, 1981	Submit Draft to Legislature
March, 1981	Legislature Provide Authorities
June, 1981	EPA Transfer Program

Recommendation No. 3. Revise State Legislation
Regarding Permits for Proposed Channel Modifications

State statutes should be amended to include consideration of potential downstream effects on water quality and flood hazard that may result from proposed channel modifications. The present Department of Water Resources floodplain permit program authorized by Section 2-1506.14 - 1506.17 (Legislative Bill 108) provides for a review of proposed channel modifications to assess the potential flood hazard to upstream and adjacent lands. Channel modifications, particularly realignments, present other potential erosion and flood problems which should be considered before state permits are issued. Realignments generally involve decreasing the original length of a given stream reach, which causes the velocity to increase. Increased velocities often result in bank and channel erosion. These problems continue upstream as the altered channel slope stabilizes. This material is transported and deposited downstream where velocities are lower. Potential flooding is also caused by channel realignment because channel storage is reduced.

The amendments could be accomplished as part of a state assumption of the Section 404 permit program or, if Section 404 program assumption does not occur, by amending the Department of Water Resources floodplain authority. If the latter route is taken, assessment of the water quality impacts should be provided by the Department of Environmental Control prior to issuance of the LB108 permit by the Department of Water Resources.

Management Agency. The Department of Water Resources would be responsible to review permit applications for channel modifications and assess downstream as well as upstream effects. The Department of Environmental Control would also be required to review applications for downstream effects.

Authority. State statutes would have to be amended to provide this authority.

Funding. The additional costs to administer this modified floodplain permit program is estimated at \$50,000 per year.

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1979	DWR and DEC Draft Legislation
January, 1980	Submit Draft to Legislature
March, 1982	Legislature Provide Authority

Recommendation No. 4. Promote Accelerated Land
Treatment and Watershed Protection

The benefits of land treatment and watershed protection to stream-bank erosion control should be recognized and acceleration of these practices should be promoted. The Watershed and Flood Prevention Act, Agricultural Conservation Program, Rural Clean Water Program, Water Conservation Fund, and appropriate natural resources district cost share

programs should be more adequately funded. Additional technical measures to assist in streambank stabilization should be included in these programs.

Management Agency. The Natural Resources Commission and natural resources districts should promote accelerated land treatment and watershed protection, in cooperation with other federal, state, and local agencies.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. Federal, state, and local funding should be increased to accelerate land treatment and watershed protection.

Schedule of Implementation. This recommendation could be implemented by the management agencies by December, 1979, and continue indefinitely.

Recommendation No. 5. Discourage Land Clearing and Cultivation near Streambanks

Land clearing and cultivation near streambanks should be discouraged to preserve a vegetative strip along streams. A vegetative strip would provide protection against streambank erosion.

Management Agency. The Natural Resources Commission, natural resources districts, and other federal, state, and local entities should discourage land clearing and cultivation near streams. Individual landowners must make the decision on these activities.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The cost of discouraging these practices would be minor.

Schedule of Implementation. Implementation of this recommendation could begin on or before December, 1979.

Recommendation No. 6. Encourage Proper Disposal of Dead Trees and Other Vegetation

The practice of placing dead trees and other vegetation in stream channels and immediately adjacent to the channel should be discouraged as it results in damage to structures in the channel and contributes to streambank erosion. Removal of dead trees and other vegetation from the area adjacent to the stream should be encouraged to prevent this material from eventually reaching the stream and contributing to structural and erosion problems. The proper utilization or disposal of these materials should be encouraged.

Management Agency. The Natural Resources Commission, natural resources districts, and other federal, state, and local entities should encourage proper disposal of dead trees and other vegetation. Individual landowners and, to some degree, counties and other units of government have the responsibility for disposal of these materials.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The cost of encouraging proper disposal would be minor.

Schedule of Implementation. Implementation of this recommendation could begin on or before December, 1979.

Irrigation Return Flows

Irrigation return flows include water diverted from a stream to irrigate cropland that returns to a stream or seeps to the groundwater aquifer and excess well irrigation water that flows to a stream or seeps into the groundwater aquifer. Salts, nutrients, pesticides, sediment, bacteria, and floating debris may be contained in surface return flows in greater concentrations than the original water supply. These materials can affect surface water usage in many ways. Drainage water that moves through the soil profile may contain higher concentrations of salts and nutrients and pesticides than in the original water supply. It should be pointed out, however, that irrigation return flows have become an expected water source for some uses.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control irrigation return flows is shown below. The proper combination of practices to solve a problem is not known until on-site planning is completed by a trained technician. These measures reduce the use of materials that may become pollutants or restrict the movement of the pollutants.

Voluntary Structural Measures

Diversion

Irrigation Canal or Lateral

Irrigation Field Ditch

Irrigation Land Leveling

Irrigation Pit

Irrigation Storage Reservoir

Irrigation System, Drip

Irrigation System, Sprinkler

Irrigation System, Surface and Subsurface

Irrigation System, Tailwater Recovery

Irrigation Water Conveyance, Ditch and Canal Lining

Irrigation Water Conveyance, Pipeline

Irrigation Water Management

Lined Waterway or Outlet

Open Channel
Regulating Reservoir
Sediment Basin
Structure for Water Control
Terrace

Voluntary Nonstructural Measures

Conservation Cropping System
Conservation Tillage Systems
Crop Residue Use
Field Border
Minimum Tillage
Pasture and Hayland Management
Proper Fertilization
Proper Pesticide Application

Management Arrangements. The application of best management practices to abate pollution from irrigation return flows is now achieved primarily on a voluntary basis. Irrigation water runoff from groundwater sources are regulated on a complaint basis by natural resources districts under authority of the Nebraska Groundwater Management Act of 1975.

Recommendation No. 1. Expand Educational Programs

The Natural Resources Commission should facilitate the development of long-term multi-media educational programs to improve water quality. Irrigation return flows is one of the water quality problems that should be addressed in an expanded program. The educational program should promote voluntary use of best management practices to protect water quality and should provide information on the effectiveness of these practices and their cost and selection. The program should also provide the designated management agencies with educational support and assistance. The educational delivery methods should include (a) direct assistance to management agencies in providing information to individuals and target groups, (b) direct communication and training assistance for management agencies, and (c) multi-media communications, including radio, television, and printed material.

Management Agency. The Natural Resources Commission would be responsible for the establishment of an expanded educational program for agricultural runoff in cooperation with appropriate federal, state, and local agencies.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. It is anticipated that federal cost sharing would be available for a minimum of two years from the Environmental Protection Agency to assist in this program. The proposed funding for the first year is approximately \$25,000 in federal money and \$10,000 in non-federal money.

Schedule of Implementation. The expanded educational program should be a long-term program and could be implemented by completing these steps on or before these dates:

July, 1979	NRC Develop Program and Request EPA Funds
August, 1979	EPA Approve Grant Request
September, 1979	NRC Contract with Appropriate Agency or Agencies

Recommendation No. 2. Provide Authority to Require
Surface Withdrawal Metering

State statutes should be amended to clearly give the Department of Water Resources the authority to require surface water appropriators that use pumps for diversion to use meters or other measuring devices. This authority would be used only when needed to administer Department of Water Resources water rights administration programs. This authority would help to reduce over-irrigation that can result in excess irrigation return flows. The ability to measure diverted water would help the irrigator to schedule irrigation and therefore make more efficient use of the water. The appropriators would be required to keep records of their diversions and periodically report to the Department of Water Resources. The Department of Water Resources would have authority to make checks to verify these diversion records.

Management Agency. The Department of Water Resources would be responsible for the administration of surface withdrawal metering requirements.

Authority. State statutes would have to be modified to clearly give authority to require metering of surface water withdrawals.

Funding. Costs for administration and for the measuring devices are associated with this recommendation. Administrative costs would be proportionate to the number of appropriators required to meter water use. The cost of a measuring device depends upon the type of device and may be between \$100 and \$500. This cost would have to be paid by the irrigator.

Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1979	DWR Draft Legislation
January, 1980	Submit Draft to Legislature
March, 1982	Legislature Provide Authority

Construction Site Runoff

The major pollutant stemming from construction site runoff is sediment. Through the physical process of water erosion, soil particles are dislodged and transported by water with a fraction of the particles reaching streams, lakes and other surface water and being subsequently identified as sediment. Along with adversely affecting aquatic organisms and their habitat, other impacts due to sedimentation include loss of reservoir capacity, reduced recreation demand, increased drainage maintenance costs, and reduced capacity of waterways.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control construction site runoff is shown below. The proper combination of practices to solve a problem is not known until on-site planning is completed by a trained technician. In general, these measures act to prevent soil particles from being dislodged, transported, and deposited in surface water. Structural measures are primarily designed to reduce the velocity of sediment particles and settle out these particles. Nonstructural measures serve to maintain vegetative growth which reduces erosion potential and filters sediment laden runoff.

Voluntary Structural Measures

Check Dam
Chutes/Flumes
Diversion Dike
Erosion Check
Filter Berm
Flexible Downdrain
Gabions
Interceptor Dike
Level Spreader
Sandbag Sediment Barriers
Sectional Downdrain
Sediment Retention Basins
Straw Bale Sediment Barrier

Voluntary Nonstructural Measures

Chemical Mulch
Chemical Mulch Tack
Chemical Temporary Soil Stabilizer
Excelsior Blanket
Fiber Glass Matting
Grassed Waterway or Outlet
Jute Netting
Liquid Asphalt
Mulch Blankets
Netting
Seeding
Straw or Hay
Vegetative Filter Strip
Woodchips
Wood Fiber Mulch

Management Arrangements

The application of best management practices to abate pollution from construction site runoff is achieved on a voluntary basis in most parts of Nebraska. Some cities and counties have passed ordinances to control construction runoff.

Recommendation No. 1. Require Construction Site Runoff Control

City and county governments should adopt rules and regulations to require developers and owners to submit and implement sediment and erosion control site plans in order to control construction site runoff and limit sedimentation to acceptable limits. Sediment control plans should be required for all developments that require grading, except for minor activities, agricultural activities, or sites covered by the National Pollutant Discharge Elimination System. Cities and counties should (1) review the sediment control plans or contract with another party such as a natural resources district to review them, (2) approve the plans if requirements were met, (3) make periodic inspections of the construction sites and (4) provide enforcement if required. The construction runoff control program should be tied to existing processes such as subdivision approval wherever possible.

Management Agency. Cities and counties would be responsible for the construction site runoff control programs.

Authority. Existing authorities are adequate to allow city and county governments to require controls for construction site runoff.

Funding. Sediment control plan preparation and plan implementation costs are variable and would most likely be passed from the developers to the consumers. Costs for program management, including plan approval, inspection, and enforcement, have been estimated to be about \$120 per developed acre.

Schedule of Implementation. Implementation of this recommendation could begin on or before July, 1980.

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Urban Runoff

Runoff leaving developed residential, commercial, and industrial areas carries with it sediment, fertilizer nutrients, pesticides, heavy metals, and oils. Sediment can adversely impact aquatic organisms and their habitat. The fertilizer nutrients enrich surface water resulting in the imbalance of animal and plant organisms coexisting in the surface water. Pesticides can eliminate nontarget plant and animal aquatic organisms. Heavy metals, although not always toxic to smaller organisms in the aquatic food chain, can become concentrated in the tissue of larger aquatic organisms, becoming toxic in some cases, and resulting in such abnormalities as stunted growth and lack of reproduction. Other uses of surface waters, such as recreation, agriculture, industrial, and water supply, are also adversely affected by pollution from urban runoff.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control urban runoff is shown below. The proper combination of practices to solve a problem is not known until on-site planning is completed by a trained technician. These measures reduce the amount of runoff reaching surface water or limit the pollutant load carried by urban runoff to surface waters. Structural measures are designed primarily to retain urban runoff and prevent urban runoff pollutants from reaching surface water. Nonstructural measures include those that limit the amount of pollutants that come in contact with runoff.

Voluntary Structural Measures

- Benches and Berms
- Dam, Multiple-Purpose
- Diversion
- Floodwater Diversion
- Grade Stabilization Structure
- Grassed Outlet
- Infiltration Systems
- Lined Waterway or Outlet
- Open Channel
- Parking Lot Ponding
- Pond
- Porous Pavement

Rooftop Ponding
Sediment Basin
Storm Sewer
Streambank Protection

Voluntary Nonstructural Measures

Anti-Litter Practices
Cleaning of Catch Basins
Contour Development
Critical Area Planting
Heavy Use Area Protection
Mulching
Optimizing the Use of Fertilizers and
Pesticides in Urban Areas
Proper Open Storage
Street Cleaning
Substitution of Salt for Deicing Streets
Vegetative Filter Strip

Management Arrangements

Management arrangements are the means to facilitate the application of best management practices; they primarily reflect the role of federal, state, and local units of government. Each city and village now has primary responsibility for urban drainage. Other local, state, and federal agencies also have some authority pertaining to drainage and flooding. A few storm sewers discharging to streams in Nebraska have National Pollutant Discharge Elimination System permits due to industrial drainage.

Recommendation No. 1. Cities and Counties
Evaluate Urban Runoff Pollution

Cities and counties should periodically evaluate the potential for water pollution from urban runoff in their jurisdictions. Areas that should be reviewed include street cleaning practices, open storage of materials such as pesticides, petroleum products, paper, and solid

waste, industrial and commercial activities, and construction activities. (Construction activities are specifically addressed under construction site runoff.) The cities and counties should request assistance in this evaluation from the Department of Environmental Control. The entire hydrologic system for stormwater runoff should be included in this evaluation. If a significant pollution potential becomes evident, the following items may need to be developed or improved to reduce pollution from urban runoff to an acceptable limit: (a) street cleaning; (b) anti-litter laws; (c) open storage regulations; (d) erosion control regulations; (e) zoning laws; and (f) building codes. Construction of stormwater detention facilities or other modifications in the stormwater runoff system could also be needed.

Management Agency. The cities and counties would be responsible to implement this recommendation. The Department of Environmental Control should assist these entities and conduct their own investigations when urban runoff is suspected of polluting waters of the state.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. Funds would be required for the evaluation, for the implementation of any new programs, and for construction if that is required. Costs cannot be estimated at this time.

Schedule of Implementation. Implementation of this recommendation could begin on or before July, 1980 and continue indefinitely.

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Residual Waste Disposal Site Contamination of Surface and Groundwater
and
Land Application of Wastewater Effluent and Sludge

Considerable quantities of sludge are produced by conventional wastewater treatment. The sludge is normally buried in landfills or spread on agricultural land or incinerated. Wastewater effluent is also applied to land by a small but growing number of communities. Land application of sludge or effluent if done properly is not only an environmentally sound method of disposal but also a method of resource recovery. Surface and groundwater quality problems can result if the site is not carefully selected, if the rate of application is too great, or if the waste is not properly incorporated into the soil. The pollutants of concern include organic material, nutrients, bacteria, and heavy metals in sludge and suspended solids, bacteria, and biochemical oxygen demand in effluent.

Another environmentally sound method for recovery of this resource is composting, which results in a stable material with qualities similar to black dirt. An excellent soil amendment, it is also used in reclaiming strip-mined areas, as landfill cover, and when simply disposed of in a landfill it does not create problems that sludge-slurries cause.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control residual waste disposal site contamination of surface and groundwater is shown below. The proper combination of practices to solve a problem is not known until on-site planning is completed by a trained technician. Measures applying to pollutant runoff are primarily structural in nature and are designed to reduce the velocity of movement of the sediment particles and attached pollutants. With velocity reduction, suspended particles will settle out. Measures to deal with leachate are primarily non-structural in nature and are designed to prevent pollutants from leaving the surface and moving through the soil profile to the groundwater.

Voluntary Structural Measures

Access Road
Dam, Floodwater Retarding
Dam, Multiple-Purpose
Diversion
Fencing
Floodwater Diversion
Grade Stabilization Structure
Grassed Waterway or Outlet

Irrigation Field Ditch
Irrigation Land Leveling
Irrigation Pit
Irrigation Storage Reservoir
Irrigation Water Conveyance, Ditch and Canal Lining
Irrigation Water Conveyance, Pipeline
Lined Waterway or Outlet
Open Channel
Pond
Regulating Reservoir
Sediment Basin
Streambank Protection
Structure for Water Control
Terrace
Tree Planting
Waste Storage Pond
Waste Storage Structure
Waste Treatment Lagoon

Voluntary Nonstructural Measures

Brush Management
Composting
Conservation Cropping System
Conservation Tillage Systems
Contour Farming
Cover and Green Manure Crop
Critical Area Planting
Crop Residue Use
Deferred Grazing

Emergency Tillage

Farmstead and Feedlot Windbreak

Field Border

Field Windbreak

Firebreak

Grasses and Legumes in Rotation

Grazing Land Mechanical Treatment

Incorporation into the Soil

Irrigation System, Drip

Irrigation System, Sprinkler

Irrigation System, Surface and Subsurface

Irrigation System, Tailwater Recovery

Irrigation Water Management

Lab Analysis of Waste

Livestock Exclusion

Minimum Tillage

Mulching

Pasture and Hayland Management

Pasture and Hayland Planting

Planned Grazing Systems

Proper Grazing Use

Range Seeding

Reclamation of Surface Mined Land

Recreation Area Improvement

Residual Waste Application Management

Soil Tests

Stripcropping, Contour

Stripcropping, Field

Stripcropping, Wind

Stubble Mulching
Toxic Salt Reduction
Vegetated Filter Strip
Waste Management System
Waste Utilization
Wildlife Upland Habitat Management
Wildlife Wetland Habitat Management
Windbreak Renovation

Management Arrangements

Land application of effluent and composting are alternatives to disposal considered in the municipal wastewater treatment facility construction grants program managed by the Department of Environmental Control. In addition, the following guidelines are available:

- (a) State of Nebraska, Department of Environmental Control - "Standards and Guidelines for Reviewing Waste Water Irrigation Systems in the State of Nebraska".
- (b) State of Nebraska, Department of Environmental Control - "Guidelines and Requirements for the Application of Municipal Waste Sludges on Agricultural Land in Nebraska".
- (c) State of Nebraska Department of Environmental Control - "Rules and Regulations Pertaining to Compost Sites".

Recommendation No. 1. Promote Proper Residual Waste Utilization

Proper sludge and effluent utilization should be promoted in an educational program conducted by the Department of Environmental Control. As part of this program the Department of Environmental Control should distribute the guidelines for wastewater irrigation systems, land application and composting of sludges to cities, natural resources districts, and other pertinent entities. These guidelines are "Standards and Guidelines for Reviewing Waste Water Irrigation Systems in the State of Nebraska", "Guidelines and Requirements for the Application of Municipal Waste Sludges on Agricultural Land in Nebraska" and "Rules and Regulations Pertaining to Compost Sites". These guidelines should be updated as needed due to new advances in effluent and sludge application.

Management Agency. The Department of Environmental Control should be responsible for this educational program.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The costs would be minimal and would fall within the Department of Environmental Control's normal operating budget.

Schedule of Implementation. This recommendation could be put into effect by December, 1979.

Recommendation No. 2. Communities Share Sludge Application Equipment

Various types of sludge application equipment and composting equipment have become available in recent years. Neighboring communities, including sanitary and improvement districts, that elect to apply sludge on agricultural land should consider the joint purchase and use of such equipment. Arrangements should be made in situations where efficiency and cost savings, in addition to proper sludge disposal, are projected.

Management Agency. The cities and villages and sanitary and improvement districts would be responsible for entering into equipment sharing agreements. Councils of government and natural resources districts could provide leadership in bringing communities together and initiating such a program.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. The equipment mentioned in this recommendation may cost \$10,000 to \$20,000 or more. Sharing of the equipment may result in a savings for the communities.

Schedule of Implementation. This recommendation could be implemented by December, 1979.

Recommendation No. 3. Prepare Soil Limitations Maps

Maps that show soil limitations for accepting nontoxic biodegradable liquid and solid waste for nutrient removal by plants should be prepared. Soils data from modern soil surveys and soils interpretations for land application of liquid and solid waste would be stored in the Natural Resources Commission Data Bank so that these maps could be produced by computer. The degree of soil limitations would be shown as slight, moderate, or severe. County or township maps would be available. A copy of these maps should be prepared for the Department of Environmental Control so they could be used to assist communities in making decisions regarding waste treatment and disposal.

Management Agency. The Natural Resources Commission would be responsible for storing the soils data and for map production and distribution. The Soil Conservation Service would assist the Commission in compilation of the data for storage.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. Once the soil survey data and soils interpretations are coded and stored for computer use, the cost of preparing soils limitations maps would be approximately \$10 per county.

Schedule of Implementation. Maps for counties with soils information already stored in the computer system could be produced by July, 1979.

Feedlots

Manure produced by domestic animals in feedlots is characterized by large quantities of organic material, nitrogen compounds, phosphorus, and coliform organisms. Uncontrolled, these pollutants can be carried with runoff from rain or snowmelt and reach surface waters. Organic material when reaching surface waters can deplete the dissolved oxygen in the water and can lead to fish kills. Nitrogen and phosphorus can cause accelerated eutrophication and seriously degrade a water body. The presence of coliforms in surface waters indicates the potential for disease for those utilizing the water.

Best Management Practices

The list of technical measures that individually or in combination may be the best management practices to control feedlot runoff is shown below. The proper combination of practices to solve a problem is not known until on-site planning is completed by a trained technician. These measures can be divided between structural and nonstructural measures. Structural measures are designed primarily to retain feedlot runoff and prevent pollutants from reaching surface waters. Nonstructural measures include those that limit the amount of pollutants that come in contact with runoff.

Voluntary Structural Measures

Diversion
Fencing
Grade Stabilization Structure
Grassed Waterway or Outlet
Lined Waterway or Outlet
Open Channel
Sediment Basin
Subsurface Drain
Terrace
Waste Storage Pond
Waste Storage Structure
Waste Treatment Lagoon

Voluntary Nonstructural Measures

Critical Area Planting

Vegetated Filter Strip

Waste Management System

Waste Utilization

Management Arrangements

The livestock waste control program, which was initiated in 1968 as a feedlot registration program, is administered by the Department of Environmental Control. Each feedlot with a water pollution problem or potential water pollution problem is inspected by Department of Environmental Control personnel to determine if waste control facilities are required. If it is determined that controls are required, the feedlot operator is notified and compliance dates are issued for submittal of plans and construction completion. After the plans and specifications are approved, a State construction permit will be issued to the operator. Upon completion of the facilities, a Soil Conservation Service or registered professional engineer must certify that the facilities were constructed pursuant to the approved plans and specifications. The United States Department of Agriculture and some natural resources districts provide cost share funds to construct the facilities.

The livestock waste control program has been found to be adequate and no recommendations are offered.

Septic Tanks

Septic tank systems, when properly constructed, located, and maintained, can be a satisfactory means of treating wastewater from single family dwellings. However, all too often the proper precautionary steps are not taken and water quality and public health may be affected. An improperly constructed, located, or maintained septic tank system can discharge viruses, bacteria, chlorides, nitrates, and detergents to surface or groundwater. These pollutants may cause water quality degradation and make water unsafe for human consumption. Detergents can be carcinogenic; nitrates can cause methemoglobinemia; bacteria and viruses can lead to many diseases.

Best Management Practices

Technical solutions to septic tank problems include proper site selection utilizing soils data and percolation tests, proper design of percolation systems to insure that the groundwater is not contaminated, and proper installation and maintenance, including sludge pumping as required. Alternatives to conventional septic tank systems, such as mound absorption systems, complete retention lagoons, or storage and periodic pumping and disposal, should be used where percolation systems will not function properly. Connection to municipal wastewater treatment facilities is not considered as an alternative as it should be the first choice.

Management Arrangements

Until recently, septic tanks were regulated only in heavily populated counties where a city or county health department existed. This changed when the Environmental Control Council adopted rules and regulations governing septic systems. These regulations apply statewide. They are enforced on a complaint basis and also through review and approval for federally guaranteed loans. This program is aided by training workshops conducted by the Department of Health for septic tank installers, manufacturers, and pumpers.

Recommendation No. 1. Expand Educational Programs

The Natural Resources Commission should facilitate the development of long-term multi-media educational programs to improve water quality. Individual home sewage systems are one of the water quality problems that should be addressed in an expanded program. The educational program should promote voluntary use of best management practices to protect water quality and should provide information on the effectiveness of these practices and their cost and selection. The program should also provide the designated management agencies with educational support and assistance. The educational delivery methods should include (a) direct assistance to management agencies in providing information to individuals and target groups, (b) direct communication and training assistance for management agencies, and (c) multi-media communications, including radio, television, and printed material.

Management Agency. The Natural Resources Commission would be responsible for the establishment of an expanded educational program for agricultural runoff in cooperation with appropriate federal, state, and local agencies.

Authority. Existing authorities are adequate to implement this recommendation.

Funding. It is anticipated that federal cost sharing would be available for a minimum of two years from the Environmental Protection Agency to assist in this program. The proposed funding for the first year is approximately \$33,000 in federal money and \$11,000 in non-federal money.

Schedule of Implementation. The expanded educational program should be a long-term program and could be implemented by completing these steps on or before these dates:

July, 1979	NRC Develop Program and Request EPA Funds
August, 1979	EPA Approve Grant Request
September, 1979	NRC Contract with Appropriate Agency or Agencies

Recommendation No. 2. License Septic Tank Manufacturers, Installers, and Pumpers

State statutes should be modified to require septic tank manufacturers, installers, and pumpers to be licensed. To be licensed, these people would have to demonstrate sufficient knowledge and ability to practice their trade without creating a potential for surface or groundwater pollution. They would have to be knowledgeable of (a) existing rules and regulations regarding septic tank systems and disposal of solid and liquid wastes and (b) the possible effects on water quality and public health of faulty manufacture or installation of septic tank systems or improper sludge disposal. Individuals who install their own septic tank systems would not have to be licensed, but would have to follow the minimum standards.

Management Agency. The Nebraska Department of Health would be responsible for licensing the septic tank manufacturers, installers, and pumpers.

Authority. State statutes would have to be modified to provide this authority.

Funding. The cost to license the approximately 1,600 septic tank manufacturers, installers, and pumpers in the state is estimated at between \$30,000 to \$35,000. Part of this cost could be paid for by license fees.

Recommended Schedule of Implementation. This recommendation could be implemented by completing these steps on or before these dates:

December, 1979	Prepare Draft Legislation, DOH
January, 1980	Submit Draft to Legislature
March, 1983	Legislature Provide Required Authority

Recommendation No. 3. Cities and Counties Adopt
Septic Tank Permit Programs

Cities and counties should adopt regulatory programs for septic tank installations for single family dwellings. Other establishments should be included as standards are developed for them. This could be made part of their building ordinances. State septic tank regulations should be adopted as minimum standards. Construction permits would be issued by the city or county after plan review. Permitted septic tanks would be subject to an inspection.

Management Agency. The city and county health departments or other appropriate departments would be responsible for the septic tank permit program under the discretion of the Nebraska Department of Health or Department of Environmental Control.

Authority. Cities and counties have authority to adopt ordinances to regulate septic tanks.

Funding. The estimated statewide total cost of these programs is \$250,000 per year assuming 3,500 plan reviews and inspections.

Schedule of Implementation. Implementation of this recommendation could begin on or before December, 1979.

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Issues Relating to Water Quality

In addition to the 11 water quality problems previously discussed, some issues which affect water quality management have been identified. These issues need to be resolved if comprehensive water quality management is to be cost effective. These issues are (a) federal agricultural policies and programs, (b) diminishing streamflow, (c) inadequate water quality data, (d) water conservation, and (e) further areas of study. General recommendations to resolve these issues are proposed in this section.

Federal Agricultural Policies and Programs

Federal agricultural policies are inconsistent. Farm programs, in general, are currently directed toward promoting agricultural production. This has led to exploitation of our natural resources and degradation of water quality. Thousands of acres of grassland, woodland, and other marginal lands in Nebraska have been put into crop production during the past few years, partly because it has been economically advantageous to do so. Much of this land has a high erosion hazard and is not adequately protected by proper land treatment measures. During this same period of time the installation and maintenance of land treatment measures, as promoted by the Soil Conservation Service, has decreased due to inflation. In addition, the continued availability of cost-sharing assistance for practices associated with increasing cash grain production rather than improving erosion control has further reduced the effectiveness of the federal soil conservation programs. Such trends are detrimental to water quality.

It is appropriate for a water quality plan to recommend that resource conservation be given a higher national priority. Soil stewardship and sustained yield concepts, which would insure continued productivity of our resources as well as water quality protection, should be promoted by our national policy. The following recommendations are offered:

- (1) That a decision be made on the national level regarding the degrees of emphasis to be placed on conservation and that U.S. Department of Agriculture programs be adjusted accordingly;
- (2) That any subsidy programs should be available to those operators who follow sound conservation principles despite the possibility of reduced production, rather than to those operators who maximize production at the expense of natural resources;
- (3) That federal agricultural conservation programs be more adequately funded;
- (4) That maintenance of agricultural conservation measures installed with federal cost sharing funds be required for the established life of the practice regardless of changes in ownership unless released by the original funding agency;

- (5) That the federal cost share for agricultural conservation measures be increased from \$3,500 to \$5,000 per landowner per year;
- (6) That the federal cost share for agricultural conservation measures be revised to a percentage of actual cost, not to exceed a specified rate for each practice; and
- (7) That the federal income tax deduction for land clearing be evaluated to determine its effect upon land resources and water quality.

Diminishing Streamflow

There is a direct relationship between water quantity and water quality. Basically, as streamflow decreases the assimilative capacity of the stream also decreases. During the last few years, excessive withdrawals of surface water have depleted the natural flow of many streams throughout Nebraska. Groundwater pumping has also depleted the flow of many streams. These depletions have reduced the assimilative capacities and fish and wildlife populations of these streams. Diminishing streamflow can cause a stream to become polluted at a faster rate and to a greater degree, and make it more likely to be in violation of the State of Nebraska's surface water quality standards. Wastewater treatment may need to be upgraded to prevent violations of water quality standards. Upgrading treatment would mean additional costs for construction and operation.

Nebraska's water quality standards recognize fish and wildlife as a beneficial use of surface water. The community structure of fish and other aquatic species indicate both water quantity and quality and in turn these organisms are responsible in part for the assimilative capacity of streams.

The objectives of section 208 of the Federal Water Pollution Control Act cannot be achieved in Nebraska in the absence of legislation insuring the protection of streamflow.

Due to financial and other limitations of the section 208 planning process it was not possible for a thorough analysis of the diminishing streamflow problem to be presented here. A detailed analysis of the issue will be presented in the Instream Flow Policy Study presently being conducted by a number of state agencies and the University of Nebraska. This study will present the Nebraska Legislature with the information necessary to determine whether instream values such as water quality and fish and wildlife protection should be provided legal protection, the means of providing such protection and an evaluation of the potential impacts of extending legal protection to instream values.

It is therefore recommended that the policy issue analysis portion of the State Water Planning and Review Process give strong consideration to:

(1) The development of alternative methods to achieve water quality objectives including designation of waste assimilation and fish and wildlife protection as legally protected values;

(2) The recognition of the interrelationship between surface water and groundwater; and

(3) The development of measures to insure that in the future reservoirs will be designed and operated to provide for low flow augmentation of streams, where feasible.

Inadequate Water Quality Data

The lack of adequate groundwater and surface water quality data proved to be a problem in the assessment portion of the water quality management planning process. It was especially difficult to accurately assess available data in respect to water quality standards and goals. In order to correct the problems associated with inadequate water quality data, the following recommendation is offered:

(1) That the State Water Data Coordination Committee should continue their efforts to review and coordinate the existing programs regarding water quality data acquisition, including biological, pesticide, and sediment monitoring, and streamflow gaging.

Water Conservation

Water conservation is the cornerstone of our national water policy. Water conservation practices can serve to reduce water quality degradation, especially with respect to the leaching of agricultural chemicals into groundwater and irrigation return flows. The following recommendation is offered:

(1) That water conservation principles and practices be given due consideration in Nebraska's State Water Planning and Review Process, and by all governmental units and individuals who use water.

Further Areas of Study

These additional recommendations regarding further areas of study are offered:

(1) The effects of land use and management practices upon water quality in Nebraska are not well documented. Projects such as the Dee Creek Study, the Maple Creek Model Implementation Project, and the Hall County Special Water Quality Project will provide valuable data and should be continued.

(2) The Department of Environmental Control, Department of Health, Department of Water Resources, and the Natural Resources Commission presently have responsibilities relating to water quality. Methods of improving efficiency and effectiveness regarding water quality responsibilities should be developed and evaluated.

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SECTION III. WATER QUALITY MANAGEMENT PLANNING ELEMENTS

This section will be prepared to facilitate plan review by the Environmental Protection Agency. This section will be arranged according to the 16 elements outlined in EPA rules and regulations for water quality management planning (40 CFR Part 131). A description of the planning process and appropriate reference to Section II, to appendices to the Plan, and to existing water quality programs will be included in this section. The 16 elements to be addressed are:

- (a) Planning Boundaries
- (b) Water Quality Assessment and Segment Classification
- (c) Inventories and Projections
- (d) Nonpoint Source Assessment
- (e) Water Quality Standards
- (f) Total Maximum Daily Loads
- (g) Point Source Load Allocations
- (h) Municipal Waste Treatment Systems Needs
- (i) Industrial Waste Treatment Systems Needs
- (j) Nonpoint Source Control Needs
- (k) Residual Waste Control Needs
- (l) Urban and Industrial Stormwater Needs
- (m) Target Abatement Dates
- (n) Regulatory Programs
- (o) Management Agencies
- (p) Environmental, Social, and Economic Impacts

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APPENDIX A
SUBWATERSHED PRIORITIES
FOR
AGRICULTURAL RUNOFF
AND
NITRATE CONTAMINATION OF GROUNDWATER

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SUBWATERSHED PRIORITIES

Introduction

A numerical rating system to aid in selection of the most critical problem areas by subwatersheds of approximately 200,000 acres or less was developed. A numerical rating was assigned using certain guidelines considering primarily known physical factors of the area. A ten-point system was used on five separate categories. The five categories are:

1. Potential high nitrate contamination of groundwater
2. Stream beneficial use
3. Land treatment needs
4. Erosion hazard potential
5. Other identified water quality problems

The rating system is intended for use in the Rural Clean Water Program to help determine the order of priority for applications received under this program.

Background

There are 388 subwatersheds identified in Nebraska based on the Watershed Project Inventory of 1966. A numbering system, with name and acreage of each subwatershed within each basin has been developed. The base map was prepared by USGS and the numbering system and acreages have been kept current by the SCS River Basin Staff. There are a few minor differences from NRC basin boundaries for the Policy Advisory Committee planning areas.

Basic Evaluation

The five categories of problems selected were scored on a ten-point system depending on the degree of impact described as follows:

<u>EXTENT</u>	<u>IMPACT ON BENEFICIAL WATER USE BECAUSE OF NON-POINT SOURCE POLLUTION</u>	
None	0	
Insignificant	1	No limitation
	2	
Low	3	NPS pollutants at or near expected back-ground levels
	4	
	5	Minor limitations to some potential beneficial water uses
Medium	6	
	7	Major limitations to some beneficial uses or several minor limitations
High	8	
	9	Major limitations on beneficial use of water because of NPS pollution
	10	

Detail of Each Category

1. Potential High Nitrate Contamination of Groundwater

A statewide map was prepared by Dr. Roy F. Spalding using a Nebraska Soil Association Map. Heavily irrigated areas were located within excessively well drained and well drained soils. Potential for leaching of nitrates into the groundwater is present when these soils are irrigated. Soil associations identified were:

- 1) Moody - Thurman - Valentine
- 2) Hall - Hord - Wood River
- 3) Keith - Rosebud - Canyon
- 4) Anselmo - Keith - Bush
- 5) Valentine - Thedford
- 6) Thurman - O'Neill - Holt

Score determined as follows:

<u>SCORE</u>	1	2	3	4	5	6	7	8	9	10
Indicator	None		Well drained soils		Excessively drained soils		Well drained soils in heavily irrigated areas		Excessively well drained soils in heavily irrigated areas	

2. Stream Beneficial Use

Two basic sources of information were used.

- (1) Beneficial use of stream map as prepared by the Department of Environmental Control. Stream segments are classified across the state as agricultural, fish and wildlife, full body contact, partial body contact, and industrial. No area received a score less than four (agricultural).
- (2) Stream Evaluation Map (1978) of the state which classifies streams according to their fishery resource use and potential. The map was prepared by the Game and Parks Commission in cooperation with their fish and wildlife agencies. Streams are classified in I Highest value, II High priority, III Substantial, and IV Limited fishery resources. When two or more stream classifications occurred in a subwatershed, the highest rating was used. When no classified stream was shown in a subwatershed, a score of one was used and averaged in with the nearest classified stream downstream. In areas remote from a stream or undrained, a score of one was used.

The following chart was used.

STREAM BENEFICIAL USE										
<u>Rating Factor</u>										
	10	9	8	7	6	5	4	3	2	1
Value Class			I		II		III		IV	
Use			FB		P FW		Ag		Ind WS	
Average the 2 factors	-----									

FB - Full Body Contact
 FW - Fish and Wildlife
 PB - Partial Body Contact
 WS - Water Supply
 Ag - Agricultural
 Ind - Industrial

Example of no classification in a subwatershed:

Beneficial Use Map	Ag	PB	4	6	
			=		
Fishery Map	--	II	<u>1</u>	<u>6</u>	
		(Downstream Classified Stream)	5 + 12	= 17/4 = 4.2	(Score to be used)

3. Land Treatment Needs

The Conservation Needs Inventory (1969) information was used as base information from each county. One factor was the percent of cropland needing treatment. The second factor was determined by multiplying the percent of cropland times the percent of crop land needing treatment times the ton loss per acre on cropland. For example, in Adams County $.83 \times .60 \times 8.4 =$ a factor of 4.18. (4.2) The two rating factors were then averaged for the land treatment score. The following chart was used:

		<u>Rating Factor</u>									
		10	9	8	7	6	5	4	3	2	1
Percent of	%	85	80	75	70	65	60	55	50	40	
Agricultural											
Land Needing	Factor	17	15	13	11	9	7	5	3	1	
Treatment											

(Average the 2 factors)

Based on Conservation Needs Inventory.

Example: 60% land treatment needs and

$$4.2 \text{ factor} = \text{a score of } 4.3 \text{ (} 5.0 + 3.6 = 8.6 \quad 2 = 4.3 \text{)}$$

If more than one county was involved, the scores were averaged.

4. Erosion Hazard Potential

County erosion hazard maps prepared by the Soil Conservation Service indicating potential soil loss were used. These maps consider soil and land use as of 1977. Each county map was used that was in the subwatershed and an estimate made of the soil loss potential. The following chart was used to determine the score.

	10	9	8	<u>Rating Factor</u>			4	3	2	1
				7	6	5				
Soil Loss										
Potential in d 25+		75		50		25		10		
Average Less c 15-25			75		50		25		10	
Per Acre Per b 5-15						75		50		
Year in Tons a 0-5										50

Units-Percent of Land Area

Based on Statewide Erosion Hazard Map prepared by SCS as a part of 208 contract.

5. Identified Water Quality Problems

The Department of Environmental Control prepared a numerical rating factor and has documentation of the value assigned for each stream segment. This data was based on existing sampling data on six parameters. Dissolved oxygen, nitrates, conductivity, turbidity, phosphates, and chlorides. Some adjustment was made on chlorides and conductivity where they were natural occurring. The scoring system included a composite of all six parameters. When more than one stream segment score appeared in a subwatershed, the one nearest the outlet was used. The following chart was used.

Water Quality Problems

	10	9	8	<u>Rating Factor</u>			4	3	2	1
				7	6	5				
DEC Value	30	27	24	21	18	15	12	9	6	3

Parameters Used

Dissolved oxygen, nitrate, conductivity, turbidity, phosphate, and chlorides.

Example DEC total points of 15 = a score of 5.

Conclusion

Nitrates were considered separately. The other four categories were added together for a total score.

Tie Breakers

To assist in determining final priority designation two additional categories may be added.

1) Sedimentation Delivery Rate Estimates

Information is available in the Platte Level B Report, Republican Basin, and in areas with watershed projects. Use basin chart to determine impact of the problem.

2) Existing Project or Program Activity

Some areas of the state already have projects or programs underway and have a need to accelerate land treatment. Sponsors and land owners may already be prepared to apply treatment measures. The activities may involve PL-566 watershed projects, State Development Fund projects, NRD special projects, Model Implementation Program, irrigation projects, recreation area development, etc. Use basic rating chart to determine impact.

NEBRASKA WATER QUALITY PROBLEM EVALUATION
BY SUBWATERSHED AREA

Missouri Tribs Basin

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
00	1	Boyd - Missouri Tribs	46,000	11.7	1	270	I
	2,3	Bazile Creek (Upper) Little Bazile Creek	174,200	21.5	7	63	S
	4	Bazile Creek (Lower)	132,900	21.2	5	68	M
	5	Lewis & Clark (Lower)	69,400	17.5	1	133	I
	6,7,8	Antelope - Beaver Sunny Side Tribs Bow Valley Creek	175,600	21.2	1	67	I
	9,10	Bow Creek (Upper) Bow Creek (Lower)	203,200	21.3	1	65	I
	11	Cedar - Dixon - Missouri Tribs	69,600	12.2	1	261	I
	12	Aowa Creek	56,000	26.0	1	9	I
	13	South Creek	92,100	21.4	1	64	I
	14	Elk Creek	103,800	24.8	1	22	I
	15	Omaha Creek	174,000	26.3	1	6	I
	16	Blackbird Creek	95,200	23.7	1	34	I
	17	Decatur Tribs	102,100	16.7	1	155	I
	18	Tekamah - Mud	51,700	22.8	1	43	I
	19,20, 21	Blair - Herman Tribs Mill - Long Omaha Tribs	162,400	20.2	1	84	I
	22	Papillion	246,000	30.8	1	1	I
	23,24	Plattsmouth Murray Tribs	37,500	18.5	1	109	I
	25	Weeping Water	166,300	21.8	1	60	I

* See page A-21

Missouri Tribs Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
00	26,27	Nebraska City - Peru Tribs Beadow - Deroin, etc.	144,300	17.0	1	142	I
	28	Winnebago - Bean	12,200	18.6	1	106	I
Kansas	1	Cedar - Miller - Missouri	6,500	11.7	1	271	I
<u>White-Hat Basin</u>							
24 & 24d	7,1,4, 5	Horsehead Creek Indian Creek (Upper) Indian Creek (Lower) Hat Tribs (East)	88,300	14.2	1	222	I
	2,3	Hat Creek (Lower) Hat Creek (Upper)	220,800	16.2	3	177	L
26	1	White River (Upper)	155,700	14.3	3	221	L
	2	Crawford Tribs	121,000	15.2	3	196	L
	3	Whitney - Big Cottonwood	75,000	14.2	1	223	I
	4	Ash - Chadron, etc.	150,400	14.1	3	224	L
	5	Lone Tree Creek, etc.	147,400	13.1	1	246	I
	6,7	Big Bordeaux Bordeaux Creek	75,300	15.1	3	202	L
	8	Beaver Creek	101,200	14.1	3	225	L
	9,11, 12,17, 1	Lime Kiln Creek White Clay Creek Wolf Creek Wounded Knee Creek Little White (Upper)	228,700	12.8	3	253	L
	3	Hay Creek	19,600	10.0	3	285	L
<u>Niobrara Basin</u>							
27	2,3	Ponca Creek Ponca Creek (Middle)	124,800	13.9	1	229	I
27	4	Ponca Creek (Lower)	153,400	14.5	1	216	I
28	2,3	Van Tassell Creek Niobrara - Harrison	111,800	8.5	3	289	L

Niobrara Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
28	4	Niobrara - Agate	167,700	15.2	3	199	L
	5	Whistle Creek	95,400	15.2	3	201	L
	6	Niobrara - Marshland	210,100	15.2	3	200	L
	7	Sand Creek	75,400	12.4	7	258	S
	8	Dunlap Tribs	125,800	13.4	3	240	L
	9	Mirage Flats	114,900	15.5	3	192	L
	10	Box Butte Creek	158,700	11.9	7	266	S
	11	Snake Creek (Upper)	184,300	8.5	3	288	L
	12	Point of Rocks Creek	95,500	10.4	7	282	S
	13	Berea - Hemingford Creeks	117,200	9.5	7	287	S
	14	Snake Creek (Lower)	218,400	9.6	9	286	H
	15	Rush Creek	142,900	13.9	3	230	L
	16,17	Niobrara - Sheridan Tribs Antelope Creek	182,700	16.3	5	172	M
	18	Niobrara Sand Hills	2,648,200	16.6	5	161	M
	19	Minnechaduzza Creek	162,300	15.7	3	187	L
	20	Niobrara Tribs - Cherry - Keya Paha	118,600	12.9	3	250	L
	21	Plum Creek (Upper)	200,600	11.4	7	276	S
	22	Plum Creek (Lower)	90,400	11.8	7	268	S
	23	Bone Creek	126,800	11.6	7	272	S
	24	Long Pine Creek	166,300	13.6	5	238	M
	25	Riverview Tribs	106,700	11.3	3	277	L
	26	Mariaville Tribs	179,000	12.3	3	259	L
	27	Big Sandy - Brush Creek	142,600	12.2	9	260	H
	28	Turkey Creek, etc. Tribs	77,700	12.7	9	255	H

Niobrara Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
28	29	Eagle Creek	132,300	13.4	9	241	H
	30	Redbird Creek	104,100	12.2	9	264	H
	31	Verdigre Creek (Upper)	207,200	22.5	7	50	S
	32,33	North Branch Verdigre Creek Verdigre Creek (Lower)	147,200	20.7	9	76	H
	34	Niobrara River (Lower)	137,400	18.2	9	115	H
28a	2,3	Sandy Shady Creek Lost - Holt, etc.	190,200	12.1	1	265	I
	4	Burton - Spring, etc.	121,500	10.0	3	284	L
	5	Keya Paha Tribs (Lower)	106,500	12.5	1	256	I

Middle Platte Basin

35	1	Maxwell Sandhills & Tribs	272,000	15.7	5	186	M
	2	Bignall Tribs	102,300	16.2	3	175	L
	3	Gothenburg Tribs	208,900	15.6	7	188	S
	4	Tri-County Tribs	151,200	17.8	1	125	I
	5	Spring Creek (Dawson)	175,000	13.3	7	244	S
	6	Plum Creek	205,900	16.8	1	151	I
	7	Buffalo Creek	240,000	12.8	7	251	S
	8	Platte Tribs (Phelps)	119,500	14.6	9	215	H
	9	Hall - Buffalo Bottom	169,300	14.1	7	226	S
	10	Dry Creek	223,500	16.9	9	145	H
	11	Wood River	157,900	18.6	1	105	I
	12	Wood River (Lower)	243,700	17.2	7	136	S
	13,16	Box Elder Prairie Creek (Upper)	162,000	14.8	5	210	M

Middle Platte Basin (cont.)

<u>Basin</u> <u>No.</u>	<u>No.</u>	<u>Subwatershed</u>	<u>Acres</u>	<u>Score</u> <u>Nonpoint</u>	<u>Nitrates</u>	<u>Rank</u> <u>NP NO₃*</u>	
35	14	Warm Slough - Silver Creek	165,700	11.8	9	269	H
	15	Platte Tribs (Hamilton)	72,400	13.0	7	248	S
	17	Prairie Creek (Lower)	222,600	16.8	7	152	S
	18,19	Jones Creek Clear Creek	116,600	12.8	1	252	I
	20,22, 25	Bellwood Bone Creek Skull Creek	159,900	18.5	1	107	I
	21	Lost Creek	89,500	16.6	1	160	I
	23	Shell Creek	213,000	26.2	1	7	I
	24	Loseke - Taylor	91,000	22.6	1	46	I
	26	North Bend Drains, etc.	113,600	14.4	1	219	I
	27	Platte Tribs (Saunders)	53,100	18.4	1	112	I
	28,29	Platte Tribs (Sarpy) Turtle Creek	81,900	25.9	1	10	I
	30	Platte Tribs (Cass)	117,200	21.9	1	58	I
<u>North Platte Basin</u>							
35a	58	Sheep Creek	163,700	13.4	3	242	L
	59	Spotted Tail Creek	109,300	13.9	3	229	L
	60,62	South Mitchell Gering	106,200	12.8	3	254	L
	61	Lake Alice	137,600	13.3	3	243	L
	63,65, 66	Nine-Mile Triple Wild Horse	116,500	15.6	3	189	L
	64	Chimney Rock	125,100	13.8	5	234	M
	67	North Port Tribs	119,200	15.3	3	194	L
	68	Broad Water Tribs	128,500	14.6	3	211	L

North Platte Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
35a	69	Deep Holes - Cedar, etc.	161,000	15.0	5	205	M
	70	Rush Creek	232,300	15.6	3	190	L
	71	Lost Creek, etc.	98,600	14.4	5	218	M
	72,73	Ash Hollow Ash - Plum	158,900	16.3	3	168	L
	74	North Platte Sand Hills	2,608,400	12.2	5	263	M
34a4	7	Kiowa Creek	82,500	14.6	3	212	L
35a5	1	Pumpkin Creek (Upper)	163,900	14.6	5	214	M
	2	Pumpkin Creek (Middle)	190,800	15.4	5	193	M
	3	Lawrence Fork	182,200	17.8	3	123	L
	4	Middle - Greenwood	90,300	11.1	3	279	L

South Platte Basin

35b	50	Cottonwood Creek, etc.	57,800	13.2	3	245	L
	63	Western Canal Tribs	76,900	14.4	3	220	L
	64	O'Neil Draw	12,400	16.8	3	150	L
	65	Big Springs Tribs	244,200	17.2	3	135	L
	66,67 68	Brule Ogallala - Sutherland Tribs Cure	114,100	16.6	3	159	L
	69	Roscoe Draw, etc.	167,800	15.8	7	184	S
	70	Sutherland Reservoir - Lake Mahoney Area	158,400	17.8	5	124	M
35b7	5	Bushnell Tribs	69,000	16.3	3	169	L
	6	Kimball Tribs	167,100	16.3	3	171	L
	7	Potter Tribs	163,500	16.5	3	166	L
	8	Southwest Nebr.	169,300	16.3	3	173	L

South Platte Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
35b7	9	Sidney Draw	198,700	16.7	3	157	L
	10	Sioux Ordinance Dept Tribs	199,700	16.8	3	153	L
	11	Cow Creek, etc.	130,000	16.2	3	176	L
	12	Lodgepole Creek (Lower)	53,600	17.0	3	141	L

Loup Basin

35c	1	Farwell	162,400	22.4	5	51	M
	2	Loup Bottom (Upper)	135,900	16.5	5	164	M
	3	Spring Creek (Howard)	211,800	20.3	1	83	I
	4	Plum Creek (Boone)	78,300	21.2	1	69	I
	5	Beaver Creek Sandhills	198,000	17.7	5	126	M
	6	Beaver Creek (Lower)	245,500	25.3	1	18	I
	7,8,9	Looking Glass Creek Cherry - Dry Loup Bottom (Lower)	136,100	22.7	7	44	S
35c1	1	South Loup Sandhills	354,300	13.9	5	232	M
	2	Callaway Tribs	164,200	13.6	1	237	I
	3	Ash - Deer - Box Elder - Oak Creeks	161,200	10.9	1	281	I
	4	Cat - Elk - Dry Creeks	116,800	15.2	1	195	I
	5	Other - Death Creeks & Tribes	88,400	13.6	1	239	I
	6	Muddy Creek (Upper)	246,600	14.6	1	213	I
	7	Clear Creek	156,000	11.6	1	273	I
	8	Muddy Creek (Lower)	103,200	20.7	5	75	M
	9	Cedar - Sweet - Cherry Creeks	114,500	17.9	5	118	M

Loup Basin

Basin No.	No.	Subwatershed	Acres	Score		Rank	
				Nonpoint	Nitrates	NP	NO ₃ *
35c2	1	Middle Loup Sandhills	2,713,000	14.9	5	208	M
	2	Anselmo Area	158,000	13.8	5	233	M
	3	Lillian - Spring Creek, etc.	124,500	15.8	1	183	I
	4	Sargent Tribs	136,600	17.0	1	142	I
	5	Loup City Tribs (West)	119,700	16.2	1	178	I
	6,7	Hawthorne Creek Loup City Tribs (East)	127,400	16.1	1	179	I
	35c3	1	North Loup Sandhills	1,473,400	15.9	5	181
2		Taylor - Ord Canals Tribes	172,300	16.3	1	174	I
3,4		Burwell - Sumter Canal Tribes Haskell Creek	71,700	17.9	1	117	I
5		North Loup Tribs (Lower)	173,300	17.6	5	131	M
6		Miry - Doris - Munson Creeks	185,100	17.9	1	120	I
35c(a)		1	Calamus River	678,000	15.0	5	204
35c4	1	Cedar Creek Sandhills	478,000	14.4	5	217	M
	2	Cedar Creek (Middle)	181,500	19.5	1	94	I
	3,4	Timber Creek Cedar Creek (Lower)	157,400	24.1	1	29	I

Elkhorn Basin

35d	1	Elkhorn River (Upper)	249,300	17.1	5	138	M
	2	Stuart - Atkinson Tribs	160,500	17.5	9	134	H
	3	Holt Creek	194,300	11.5	5	274	M
	4	Dry Creek Sandhills	214,500	17.5	9	132	H
	5	South Fork Elkhorn River	213,200	17.0	7	144	S

Elkhorn Basin (cont.)

<u>Basin No.</u>	<u>No.</u>	<u>Subwatershed</u>	<u>Acres</u>	<u>Score Nonpoint</u>	<u>Nitrates</u>	<u>Rank</u>	
						<u>NP</u>	<u>NO₃*</u>
35d	6	O'Neill Tribs	106,600	22.5	7	49	S
	7	Cache - Clearwater Creeks	248,600	15.1	7	203	S
	8	Antelope - Cedar	148,800	18.7	7	99	S
	9,11	Neligh - Norfolk Tribs Corporation Gulch	107,800	22.0	7	55	S
	10	Tilden - Battle Creek Tribes	213,800	22.1	3	54	L
	12	North Fork (Upper)	142,400	17.9	1	121	I
	13	Dry Creek	79,200	18.2	7	113	S
	14	Willow Creek	146,100	18.1	7	116	S
	15	Yankton Slough	70,500	17.2	1	137	I
	16	North Fork (Lower)	112,800	21.3	3	66	L
	17,19	Stanton Tribs Butterfly - Leisy	130,300	25.8	3	11	I
	18	Union Creek	228,600	23.7	1	35	I
	20,21, 22	Humbug Creek Pilger Sand	77,300	24.6	1	25	I
	23	Rock Creek	27,300	23.2	1	37	I
	24,27	Fisher Creek Pebble Creek	189,200	25.1	1	20	I
	25,26	Plum Creek Cuming Creek	190,800	24.7	1	24	I
	28	East Fork Maple Creek	68,400	25.8	1	12	I
	29	Maple - Dry Creek	135,500	25.8	1	13	I
	30	Maple Creek (Lower)	62,100	19.8	1	90	I
	31	Bell Creek	159,100	22.5	1	47	I
	32	Rawhide Creek, etc.	100,100	20.0	1	89	I

Elkhorn Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
35d1	1	Logan Creek (Upper)	198,800	22.5	1	48	I
	2	South Logan Creek	150,200	26.1	1	8	I
	3	Logan Creek (Middle)	165,800	27.4	1	3	I
	4	Logan Creek (Lower)	158,300	23.7	1	33	I

Lower Platte Basin

35e	1	Upper Salt	109,100	23.0	1	41	I
	2	Lincoln Tribs	113,800	23.8	1	30	I
	3	Stevens - Camp	73,700	23.0	1	40	I
	4	Oak - Middle	230,800	21.7	1	61	I
	5	Little Salt - Jordan Creek	55,100	23.8	1	31	I
	6	Rock Creek	83,800	23.0	1	39	I
	7	Salt Creek (Lower)	61,800	23.3	1	36	I
	8,9, 10,11	Wahoo Creek (Upper) Cottonwood Sand Creek Swedeburg	171,300	27.6	1	2	I
12,13, 14	Silver Creek Clear Creek Wahoo Creek (Lower)	167,600	25.7	1	14	I	

Nemaha Basin

37	1,2,3	Little Nemaha (Upper) Brownell Ziegler	155,600	25.4	1	17	I
	4,6	South Branch Little Nemaha Spring (Johnson)	160,100	20.5	1	79	I
	5,8	Wilson Creek Rock (Nemaha - Otoe)	135,100	26.5	1	5	I
	7,9	Brock Auburn Tribs	117,100	25.5	1	15	I

Nemaha Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
38	1	Big Nemaha (Upper)	114,900	26.8	1	4	I
	2,3	Tecumseh Tribs Table Rock Tribs	193,900	25.5	1	16	I
	4	Long Branch	39,400	21.1	1	71	I
	5	North Fork (Lower)	35,900	24.5	1	27	I
	6,7,8, 9	Turkey Creek (Upper) Rock (Pawnee) West Branch Turkey Turkey Creek (Lower)	130,200	16.9	1	147	I
	11,12	South Fork (West) South Fork (Lower)	92,600	25.1	1	21	I
	13,14 16	Pony Creek Walnut Creek Big Nemaha (Lower)	55,400	24.8	1	23	I
	15	Muddy Creek	176,800	25.3	1	19	I

Republican Basin

41a	1	Chase - Dundy Sandhills	123,900	12.2	9	262	H
	2	Indian Creek	100,000	17.7	7	129	S
	3	Burntwood Creek	67,200	16.6	3	158	L
	4	Muddy Creek (Dundy Co.)	95,100	16.8	1	149	I
	5,6	Culbertson to Stratton Tribes (North) Culbertson to Stratton Tribes (South)	161,800	17.9	1	119	I
	7	Driftwood Creek	131,700	15.2	1	197	I
	8,10 16	Dry Creek (South) Sleepy Hollow - Bushy, etc. Creeks Silver Creek	139,800	15.8	1	182	I
	9	McCook Tribs	52,600	14.0	1	228	I
	11	Red Willow Creek (Upper)	272,000	17.9	1	122	I

Republican Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
41a	12	Red Willow Creek (Lower)	235,200	19.7	1	92	I
	13,14, 15	Coon Creek Dry Creek (Pilot) Cambridge to Bartly Tribs (North)	125,900	14.9	1	207	I
	17	Republican R. South Tribs (Furnas Co.)	111,300	22.0	1	56	I
	18	Deer Creek	126,800	15.2	1	198	I
	19	Muddy Creek (Frontier & Gosper Co.)	161,100	15.5	1	191	I
	20	Elk - Turkey etc. Creeks	205,800	20.3	1	81	I
	21	Orleans Tribs	250,000	21.1	1	72	I
	22	Turkey Creek	106,200	18.5	1	110	I
	23	Lost Creek - etc. Tribs	54,100	17.7	1	128	I
	24	Sacramento Tribs	76,600	11.2	1	277	I
	25	Center - etc. Tribs	99,100	16.5	1	163	I
	26	Thompson Creek	191,600	18.9	1	96	I
	27	Lohff - Oak - etc. Creeks	84,800	16.7	1	155	I
	28,29	Farmers - Indian - etc. Creeks Red Cloud Tribs	173,300	18.7	1	103	I
	30,32	Minnie Creek Superior Tribs	152,500	18.5	1	108	I
	31	Courtland Tribs	35,000	18.4	1	111	I
41a1	8,10	North Fork Republican River Buffalo Creek	96,700	13.0	9	249	H
	11	Rock - Spring Creeks	180,200	17.1	9	140	H
	12	Hay Canyon - etc. Tribs	26,300	16.5	1	164	I
41a1 (a)	8	Arikaree River	8,300	14.0	1	227	I

Republican Basin (cont.)

<u>Basin No.</u>	<u>No.</u>	<u>Subwatershed</u>	<u>Acres</u>	<u>Score Nonpoint</u>	<u>Nitrates</u>	<u>Rank NP NO₃*</u>	
41a2	13	South Fork Republican River	3,900	13.1	1	247	I
41a3	1	Sand Creek	67,800	13.8	7	235	S
	4	Frenchman River (Enders Reservoir)	164,400	18.7	7	102	S
	5	Frenchman River (Wauneta Tribs)	102,600	16.3	9	170	H
	6	Frenchman River (Lower)	131,400	17.1	1	139	I
	7,8	Blackwood Creek (Upper) Blackwood Creek	287,600	16.5	3	162	L
41a3 (a)	1	Venango Tribs	38,100	11.2	7	278	S
	2	Spring Creek (Upper)	113,300	12.5	7	257	S
	3	Grant Tribs	147,400	10.2	7	283	S
	4	Stinking Water Creek (Upper)	231,000	11.9	7	267	S
	5	Spring - Stinking Water Creeks (Lower)	148,600	16.8	9	154	H
41a4	1	Medicine Creek (Sandhills)	230,200	11.5	5	275	M
	2	Medicine Creek (Upper)	219,100	20.1	1	88	I
	3	Medicine Creek (Lower)	152,700	21.9	1	57	I
	4	Medicine - Mitchell Creeks	83,500	20.8	1	74	I
41a5	6,7,8	Sappa Creek Sappa Creek (Lower) Stamford	139,300	24.2	1	28	I
41a5 (a)	6,7	Beaver Creek Beaver Creek (Lebanon)	139,900	20.9	1	73	I
	8	Beaver Creek (Beaver City)	129,400	22.9	1	42	I
41a6	4	Prairie Dog Creek (Lower)	40,300	21.2	1	70	I

Big Blue Basin

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
41c2	1,2	North Fork Kezan Creek	134,700	16.4	1	167	I
	3	North Branch (Upper)	181,800	16.8	1	149	I
	4,5	North Branch (Lower) West Ulysses	91,700	18.2	1	114	I
	6	Lincoln Creek (Upper)	116,700	19.7	1	91	I
	7	Lincoln Creek (Lower)	176,000	18.6	1	104	I
	8	Plum Creek (Seward)	58,000	14.9	1	209	I
	9	Seward - Milford Tribs	89,300	20.3	1	82	I
	10,11, 12,13	Crete - Wilbur - DeWitt Tribs Clatonia Soap Plymouth	150,000	21.8	1	59	I
	14	Cub	92,300	18.8	1	98	I
	15,16, 17	Little Indian Bear - Pierce - Cedar Mud	163,600	20.2	1	85	I
	18	Beatrice	74,100	17.7	1	127	I
	19	Big Indian	131,700	18.8	1	97	I
	20,21, 22	Wolf Plum Mission	124,900	20.2	1	87	I
41c	23	Horse Shoe	15,000	13.7	1	236	I
41c1	1	West Fork (Upper)	191,600	20.5	1	80	I
	2	School Creek	106,600	15.0	1	206	I
	3	West Fork (Middle)	196,200	23.1	1	38	I
	4	Beaver Creek	183,000	23.7	1	32	I
	5,6	West Fork (Lower) Dorchester	169,400	22.7	1	45	I

Big Blue Basin (cont.)

Basin No.	No.	Subwatershed	Acres	Score Nonpoint	Nitrates	Rank	
						NP	NO ₃ *
41c2	1	Upper Turkey Creek	155,900	20.6	1	78	I
	2	Lower Turkey Creek	139,000	24.5	1	26	I
	3,4	Swan Dry	164,500	20.2	1	86	I

Little Blue Basin

41c3	1	Little Blue (Upper)	233,100	19.4	1	95	I
	2	Cottonwood - Scott Creeks	98,800	18.7	1	101	I
	3,4	Thirty Two Mile Creek Pawnee Creek	147,800	16.9	1	147	I
	5	Acnw Tribs	199,500	21.5	1	62	I
	6	Angus - Hebron Tribs	144,300	18.7	1	100	I
	7	Spring Creek	115,200	17.7	1	130	I
	8	Dry (Thayer)	80,900	15.7	1	185	I
	9	Big Sandy (Upper)	212,300	19.5	1	93	I
	10	Big Sandy (Lower)	195,700	20.6	1	77	I
	11	Little Sandy	67,300	16.0	1	180	I
	12,13, 14	Bowman Springs Buckley Rose	129,700	22.2	1	52	I
	15,16	Fairbury Tribs Little Blue (Hollenberg)	97,600	22.1	1	53	I

* The following scale was used to rank and determine significance of the score under nitrates:

- 10 > H = High potential for nitrate contamination of groundwater
- 8 > S = Significant potential for nitrate contamination of groundwater
- 6 > M = Medium potential for nitrate contamination of groundwater
- 4 > L = Low potential for nitrate contamination of groundwater
- 2 > I = Insignificant potential for nitrate contamination of groundwater