2005 Nebraska Surface Water Quality Monitoring Report

Nebraska Department of Environmental Quality
Water Quality Division
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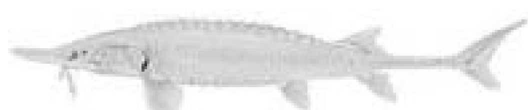


Preface

The Nebraska Department of Environmental Quality (NDEQ) has done a considerable amount of surface water quality monitoring over the years. In fact, more than a million analyses have been done for a myriad of parameters for a variety of purposes at hundreds of locations since the early 1970s. Data are routinely used to assess the stream or lake's suitability for human contact recreation or drinking water, make wastewater discharge permit decisions, monitor water bodies for compliance with water quality standards, develop watershed management plans, and numerous other purposes. Monitoring locations have been moved over the years to better assess the particular stream, lake, or watershed of concern. Some monitoring programs have a very focused and short-term goal. Other monitoring programs' purposes are long-term and more intent on probable trends rather than snap-shot pictures of the water body being assessed.

What are we finding?

Because more lakes are evaluated each year, we are finding a higher percentage that are not meeting their intended uses. However, bacteria problems at lakes have not increased since lake monitoring began in 1986. Stream and river sampling since 2001 at 26 crucially located sites shows water quality generally staying the same, neither degrading nor improving. In a statewide stream health study, conducted from 1997 – 2001, 65% of the 210 sites studied had either an excellent or good rating.

With the wide variety of parameters and purposes of NDEQ surface water quality monitoring programs, bringing the extensive data together for a comprehensive report has been a challenge. Another challenging aspect is the wide range of climatic and geologic conditions that exist from the western to the eastern part of the state. This report uses NDEQ's monitoring data in examples to highlight some of the programs NDEQ administers. The monitoring data are the backbone of many of the water quality programs and are vital to making everyday decisions in the agency. Highlighting the purposes and results of our monitoring programs is the intention of this report.

2005 Nebraska Surface Water Quality Monitoring Report

INTRODUCTION

This report summarizes water quality programs and information developed by the Nebraska Department of Environmental Quality (NDEQ) for surface water. More detailed information and data regarding surface water quality and the NDEQ's monitoring programs is available on-line (www.ndeq.state.ne.us) or by calling the Department (402/471-2186). Groundwater information is reported each year in the annual "Nebraska Groundwater Quality Monitoring Report", issued each December and available on-line on NDEQ's web site.

Watersheds

In order to more easily describe, monitor, and protect Nebraska's surface water bodies, the state has been divided into major watersheds or "basins". A watershed is the land area that naturally drains to a small stream or dry drainage, which in turn flows to a larger river, which in turn runs into a lake, reservoir or the ocean (Figure 1).

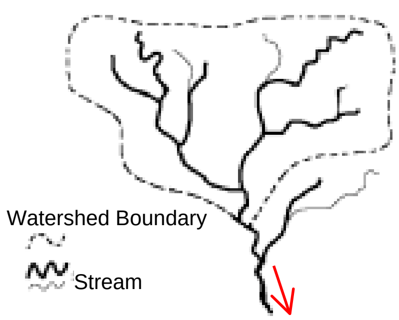


Figure 1. Watershed Schematic

Some monitoring programs are performed annually across the entire state and others are more intensive in targeted basins. Five major monitoring areas are shown, with the state's 13 primary basins outlined in Figure 2, along with the year they will be sampled more intensively.

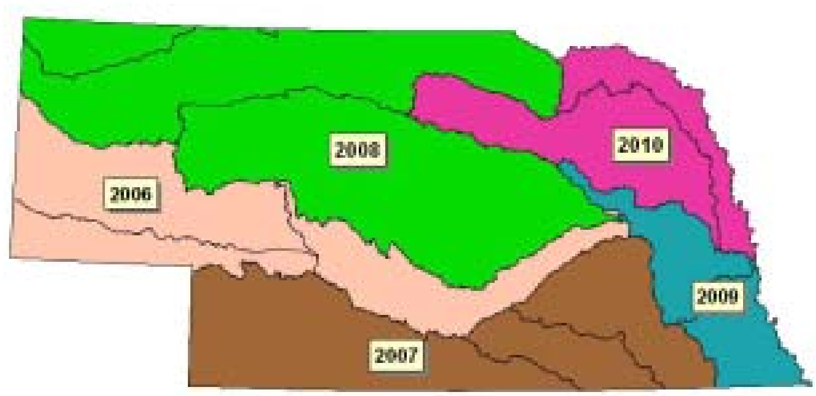


Figure 2. Five Year Basin Rotation Schedule

Nebraska's surface water resources are surprisingly extensive. Nebraska has approximately 24,000 miles of flowing rivers and streams, ranking 19th nationally in total stream miles. Nebraska's lakes total about 280,000 acres (about 430 square miles).

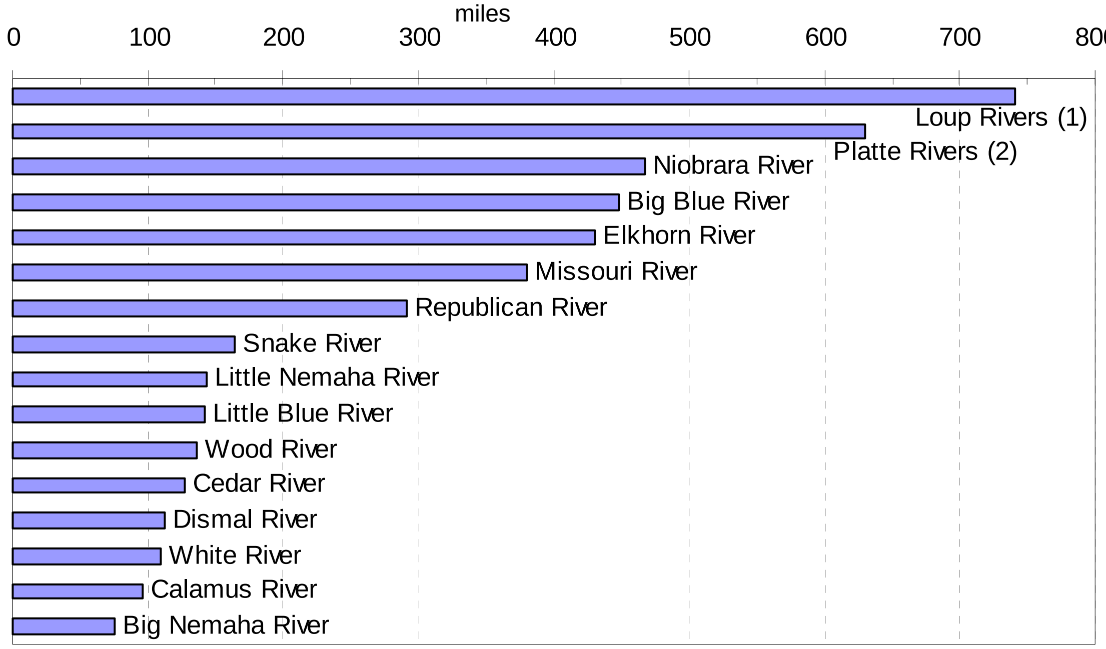


Figure 3. Nebraska Stream Miles.

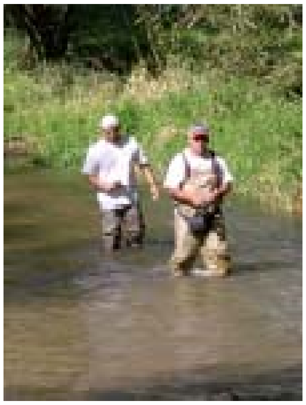
(1) Loup River includes the North, Middle, and South Loup Rivers
(2) Platte River includes the North, Middle, Lower and South Platte Rivers

Beneficial Uses

Nebraska's streams and lakes are used in many different ways and "beneficial uses" are assigned to them accordingly. The major beneficial uses for streams and lakes are as follows:

- Primary contact recreation
  - People swim, wade, water ski, canoe, fish, or play in the water.
- Public drinking water supply
  - Less than a dozen of Nebraska's communities rely wholly or partially on surface water as their public drinking water supply. Groundwater supplies the vast majority of community public water supply systems in Nebraska.
- Aquatic life (supporting fish, water plants, snails, etc.)
- Agricultural water supply (such as livestock watering, irrigation supply)
- Aesthetics (rivers, streams and lakes that look and smell good)

All lakes and streams automatically have agriculture, aquatic life, and aesthetics uses assigned to them. More detailed explanations of all the beneficial uses can be found in Appendix A. The maps in Figures 4 and 5 show the water bodies designated as recreation and drinking water supply, respectively.



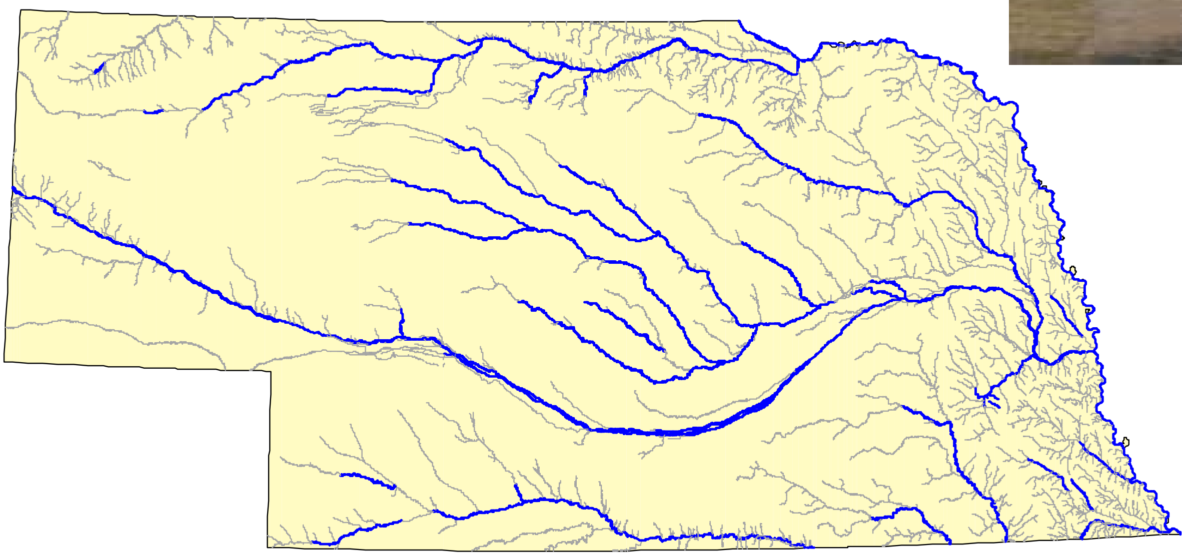


Figure 4. Primary Contact Recreation Streams in Bold.

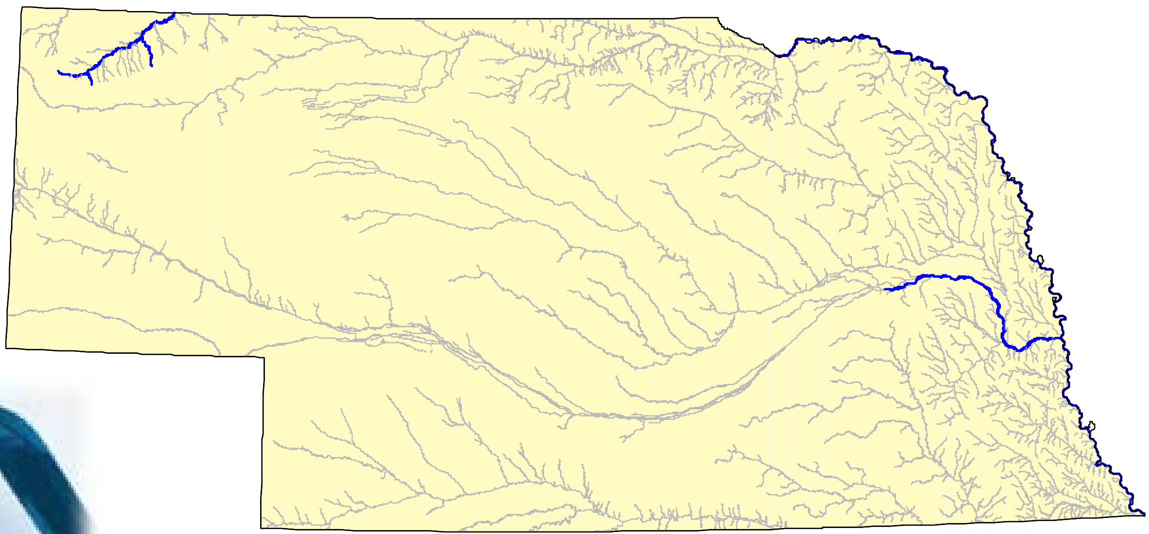


Figure 5. Streams Designated with Public Drinking Water Uses in Bold.

MONITORING PROGRAMS

The NDEQ has several programs designed to monitor and assess the quality of the state's surface waters. The goal of these programs is to determine if the water quality of the streams and lakes is adequate to support the uses assigned to them and to help make management decisions. If water quality does not meet the prescribed standards or support the assigned beneficial uses, then that water body is "impaired". For example, is the water quality in Long Pine Creek in Brown County good enough for people to tube in the creek?

Impaired Water Bodies

Each spring of even numbered years, NDEQ issues a list of impaired streams and lakes. This list is called the 303(d) list, named after the section in the federal Clean Water Act dealing with impaired water bodies. Streams and lakes are considered impaired for particular parameters, such as

- Bacteria,
- Atrazine or dieldrin (pesticides),
- Dissolved oxygen,
- Nutrients,
- Selenium or mercury (metals),
- Sediment.

The 2004 list of impaired streams and lakes is presented in **Appendix B.**

Summary of Monitoring Programs

Thousands of water quality samples are taken each year for a myriad of parameters and a variety of specific purposes. NDEQ does much of this sampling, but the State's 23 Natural Resources Districts, the US Geological Survey, US Army Corps of Engineers, Nebraska Health and Human Services, and University of Nebraska – Lincoln have been doing more surface water quality work each year. Stream and lake water quality samples are analyzed for nutrients, bacteria, metals, common water constituents, pesticides, and physical characteristics. One monitoring program focuses on fish tissue sampling. Table 1 lists these parameters and Figure 6 shows sampling locations; more information about the different monitoring programs is in **Appendix C**

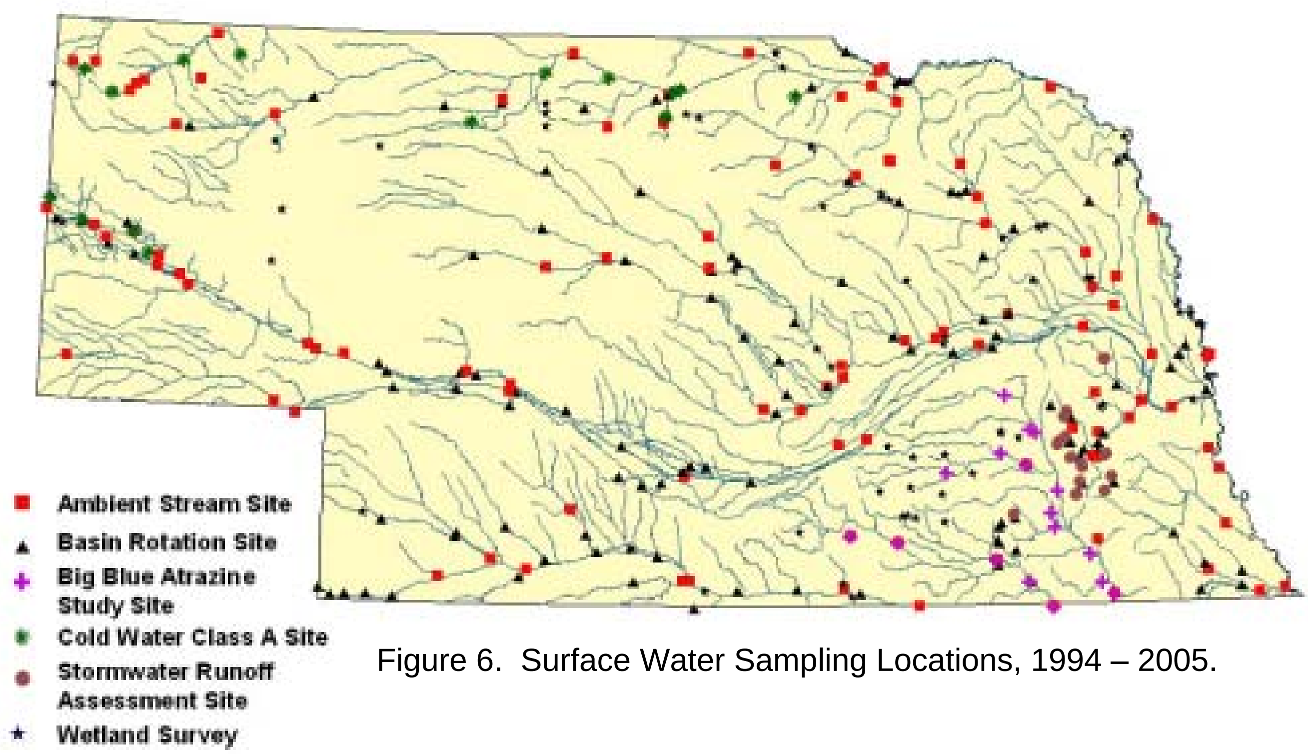


Figure 6. Surface Water Sampling Locations, 1994 – 2005.

Table 1. Summary of Monitoring Categories

Category	Analytes/Parameters
Nutrients	Nitrogen, phosphorus
Biological	E. Coli bacteria, chlorophyll, toxic algae, fish and aquatic insect communities
Metals	Lead, arsenic, selenium, chromium, magnesium, mercury, zinc, copper, cadmium, silver, nickel
Common constituents (major ions)	Alkalinity, chloride, calcium, sulfate, sodium, dissolved oxygen, total dissolved solids
Pesticides	Atrazine, alachlor, metalochlor, acetochlor, isoxaflutale
Physical characteristics (field measurements)	Temperature, pH, conductivity, turbidity, depth, discharge

SURFACE WATER QUALITY TRENDS

Cold-Water Streams and Dissolved Oxygen

Cold-water streams support natural trout fisheries, where trout spawn and live throughout the year. These streams are naturally cold due to groundwater seepage. An important water quality parameter for these streams is dissolved oxygen; without a proper dissolved oxygen level, trout and other cold-water fish species cannot survive.

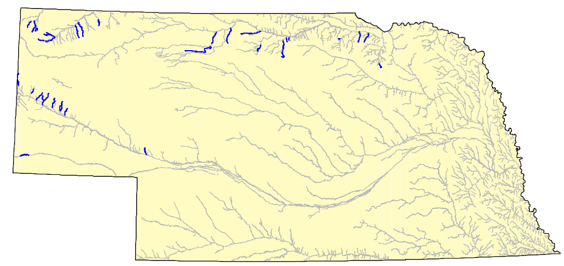


Figure 7. 41 Cold-Water Streams (~565 miles).

Over the past few years, public concerns about the health of cold-water streams have been centered on the potential impact from livestock operations. When discharge or runoff from livestock operations (from either the facility itself or the land where manure is spread) flows into streams, lower dissolved oxygen levels can result. If improperly applied, discharge and runoff water can contain high levels of nutrients (ammonia, other forms of nitrogen, carbon, and phosphorous), which uses the stream's dissolved oxygen as it breaks down. Figure 8, below, shows dissolved oxygen readings from Long Pine Creek in Brown County. The causes of the declining dissolved oxygen levels in Long Pine Creek have not been determined, but the health of this cold-water stream may be suffering.

State statute restricts the development of Concentrated Animal Feeding Operations (CAFOs) in cold-water stream watersheds. Federal and state rules require Nutrient Management Plans to help manage the application of manure on fields. Other regulations are in place to protect streams in Nebraska.

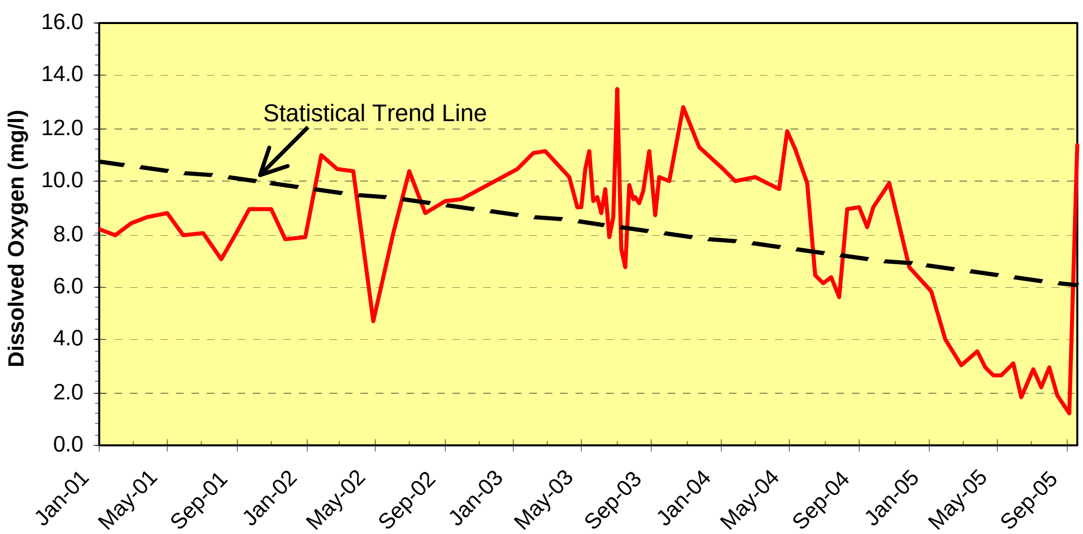


Figure 8. Dissolved Oxygen in Long Pine Creek, 2001 - 2005

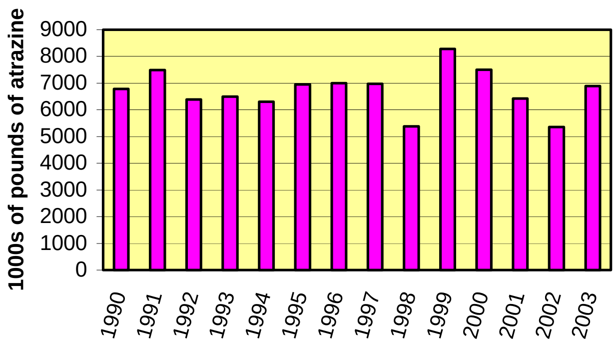


Figure 9. Atrazine Use in Nebraska, 1990 – 2003 (Nebraska Department of Agriculture)

Big Blue River and Atrazine

Atrazine, a commonly used herbicide, is of special concern in the Big Blue River Basin, because the river feeds Tuttle Creek Lake in Kansas. This lake serves as the drinking water supply for the City of Manhattan and other Kansas communities. The federal drinking water standard for atrazine is 3 ug/l (parts per billion), while the aquatic life standard is 12 ug/l.

NDEQ recently received a grant from EPA for "targeted watersheds" (see www.epa.gov/owow/watershed/initiative/ for more information) to work on atrazine issues in the Big Blue River watershed in both Nebraska and Kansas. Some activities to reduce runoff into the river include:

- Encouraging the use of and cost-share on buffer strips,
- Adoption of no-till cropping, and
- Providing technical assistance to farm operators in developing pesticide management plans.

While statewide atrazine use seems to be going down very slightly (Figure 9), this pesticide is still a problem in the Big Blue River. However, monitoring at Barneston, Nebraska, near the Kansas-Nebraska border, shows that high atrazine levels are generally detected during the spring runoff and high flow events (Figure 10).

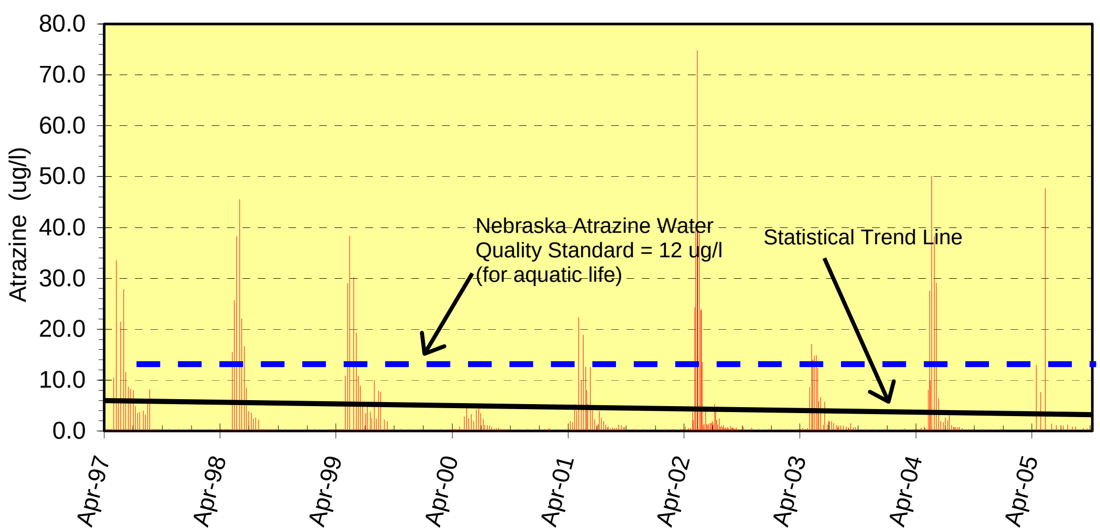


Figure 10. Atrazine Concentrations in the Big Blue River at Barneston, NE 1997 – 2005

Fish Tissue and Mercury

Fish tend to accumulate chemicals, such as metals or pesticides, in their tissues which can be harmful to humans if enough contaminated fish are eaten over a long period of time. As mentioned in the Monitoring Programs section, NDEQ samples fish tissue as part of the assessment of water quality. When fish tissue sampling results are received from the EPA lab, NDEQ assesses the data and, through the Nebraska Health and Human Services, issues a fish consumption advisory when unsafe levels are exceeded (for more information, see NDEQ's "Findings of the 2004 Regional Ambient Fish Tissue and Follow-Up Programs in Nebraska", December 2005).

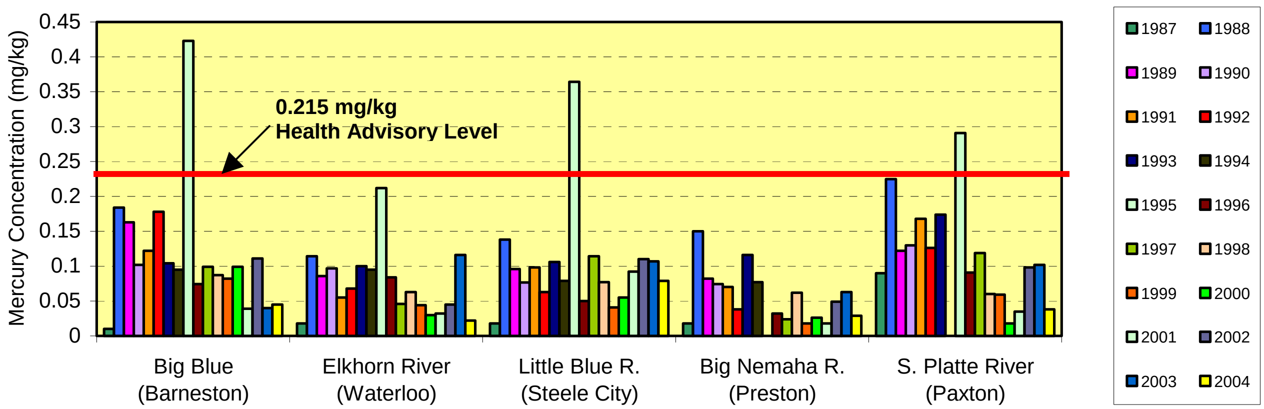


Figure 11. Mercury Concentrations in Fish Tissue at Five Sites, 1987 – 2004 (each bar represents a year)

Republican River, Selenium, and Chloride

Selenium is a heavy metal found naturally in some geologic sediments, such as shale. The Republican River flows through both the Pierre and Niobrara shales in southern Nebraska, and the river picks up selenium from the shale. Some water is lost by evaporation which concentrates dissolved constituents. Additionally, when surface water is diverted for irrigation uses and excess water is returned to the river, the water often dissolves additional metals from soils, concentrates them, and returns them to the river. Chloride comes from sediments (chloride can also come from the break down of fecal material) and is concentrated in irrigation return flow in the same manner as heavy metals, such as selenium. Since selenium data are more scattered and scarce, chloride monitoring information is used here to show similar trends. Figure 12 shows chloride concentrations in the Republican River at Orleans, in Harlan County (note that the public drinking water and aquatic life water quality limits for chloride are above 230 mg/l).

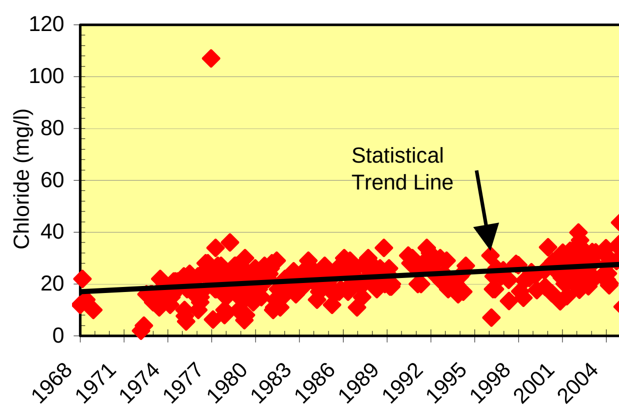


Figure 12. Chloride Concentrations in the Republican River at Orleans, 1968 - 2004

Nitrogen and the Lower Platte River

Nitrogen is most commonly found in streams and lakes in the nitrate and/or nitrite form (NO_3-N and NO_2-N, respectively). Because the Cities of Lincoln and Omaha (combined population of about half the state's population) rely on groundwater under the direct influence of the Platte River (also called "induced recharge"), the amount of nitrate in the river is of great importance. This part of the Platte River receives drainage from nearly two-thirds of the entire state, so the potential for higher nitrates is great.

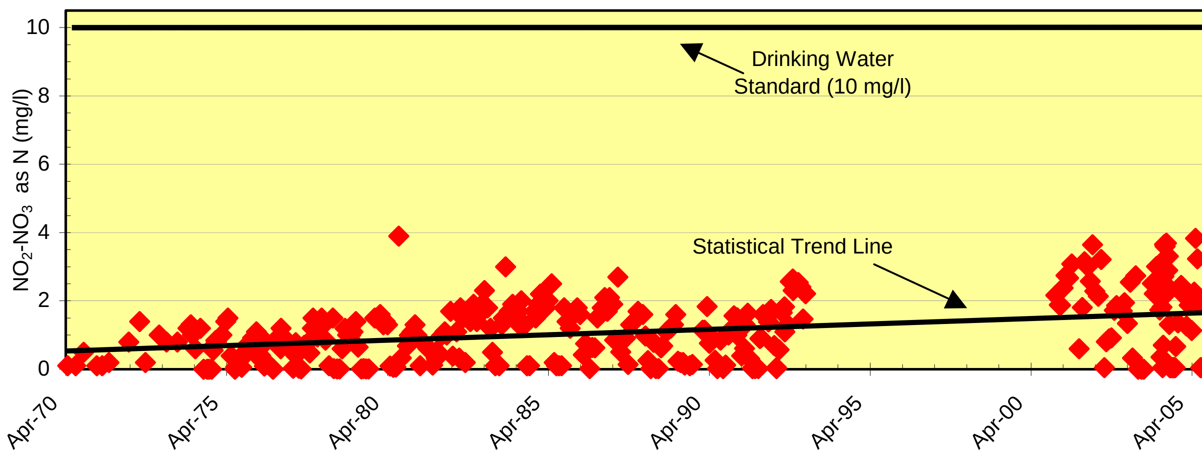


Figure 13. Nitrite + Nitrate as Nitrogen in the Platte River at Louisville, 1969 – 2005.

Niobrara River and Bacteria

The Niobrara River, like many streams and lakes in Nebraska, is used heavily in the summer months for recreation. Canoeing, tubing, and wading are common in and all along the river. In order to protect the heath of the people using the river this way, bacteria is sampled in the Niobrara River and many other rivers, streams, and lakes across the state and analyzed (and reported) by NDEQ. Sources of bacteria in water bodies can be discharges from municipal wastewater plants, other domestic wastewater discharges, runoff from livestock operations or manure application, or even wildlife walking in the water.

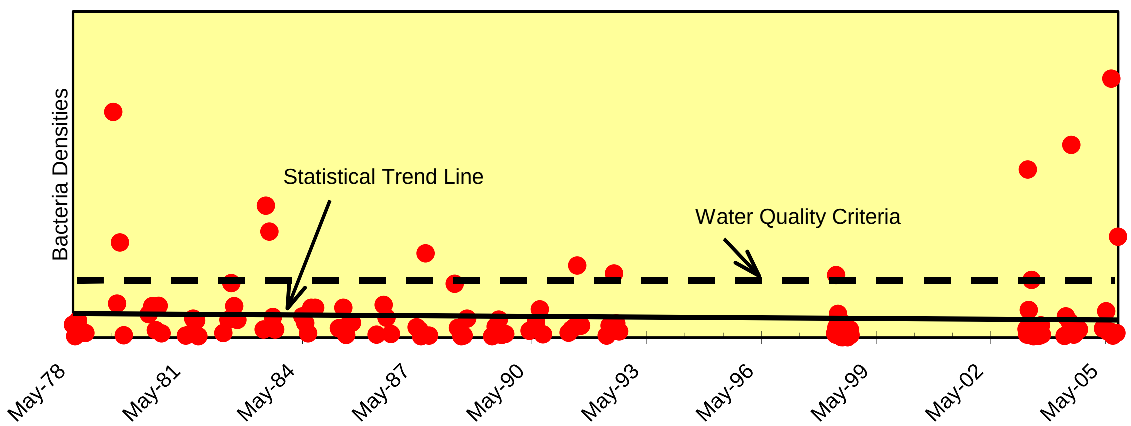


Figure 14. Bacteria Densities in the Niobrara River near Sparks, 1978 - 2005

NDEQ issues results of weekly beach bacteria monitoring during summer months. Find this information at **www.deq.state.ne.us**

Statewide Stream Health

From 1997 through 2001, sampling and analysis of 210 sites across the state was done to gauge stream health. Besides water quality analysis, the insects and fish were surveyed and counted to determine if their habitat was sound and if they were in good condition. For example, when stream bottoms are muddy and clogged with silt, fish and other aquatic life will have a hard time reproducing and maintaining a viable population. A "healthy" stream (the 65% that fit into the excellent and good categories in Figure 15) will have four to five times the number of species (large diversity) than the streams rated poor. Sites rated poor will be placed on the 303(d) list of impaired streams (see page 4 for explanation).

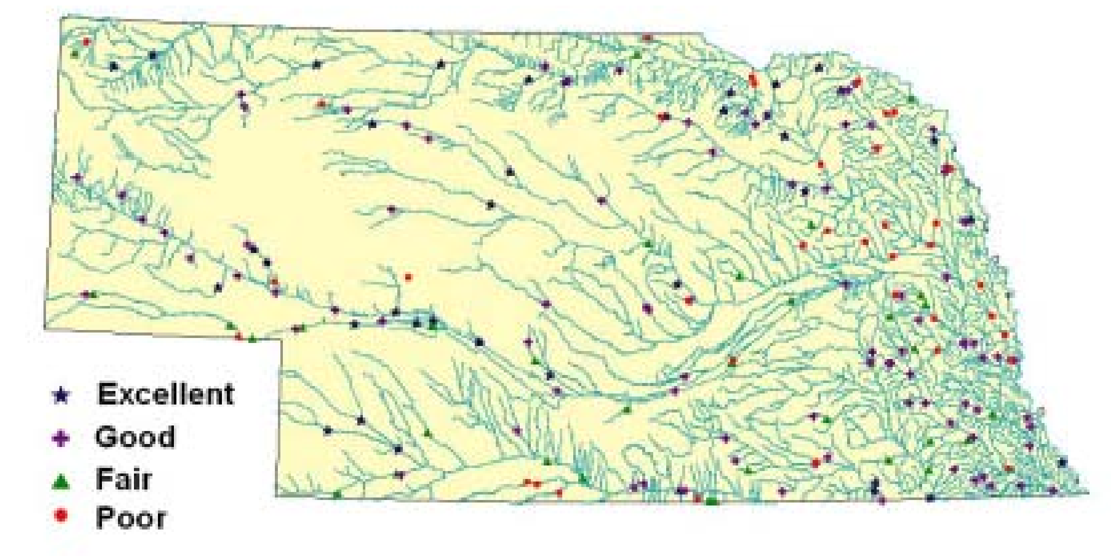


Figure 15. Biological Health of Nebraska Streams

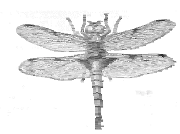


Table 2. Rating of Biological Health of Streams

Rating	Number of Streams
Excellent	40
Good	97
Fair	35
Poor	38

Sediment: Impact to Lakes and Reservoirs

Natural lakes are formed when natural processes like glaciers, earthquakes, and volcanoes dam up a stream or drainage. In Nebraska, natural lakes are most commonly found in the Sandhills. Reservoirs are man-made bodies of water, built to provide flood control, irrigation, public water supply, or recreation. Sediment, carried by rivers from runoff that fill the reservoirs, is one of the most serious impacts to reservoir water quality. Excessive sedimentation can decrease water clarity, increase amounts of nutrients, and cause accelerated filling in of the reservoir.

A simple way to determine if a reservoir is suffering from excessive sedimentation is to measure its total volume loss over time. If a reservoir has lost 25% of its total volume since it was built, it is considered to be impaired. Some reservoirs are targeted for rehabilitation, even before they have lost a quarter of their original volume.

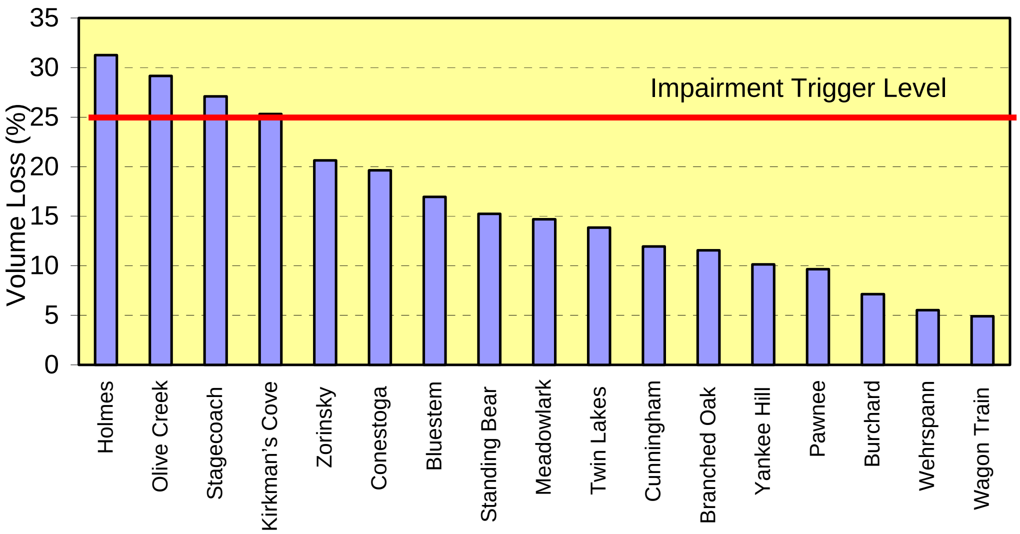


Figure 16. Reservoir Volume Loss, Since Construction – 2001

The photo to the right shows how sediment built up in Pawnee Reservoir, making use of a boat ramp impossible.

Maskenthine Reservoir (Stanton Co.), Nutrients, and Algae

Nutrients, such as phosphorus and nitrogen, are integral parts of fertilizer and livestock and human waste. When fertilizer or animal waste (human and/or livestock) runoff into streams and reservoirs, a chain-reaction can occur. An increased nutrient content (or "load") may cause algae to grow excessively, called an algal bloom. Algal blooms can be unsightly and reduce the clarity of the water. Algae eventually die and consume oxygen as they break down. Lack of oxygen causes a direct impact to the fish and aquatic life, leading to a fish kill in some cases. All lakes and man-made reservoirs will show an increase of nutrients over time, although this process is much slower in natural lakes. Maskenthine Reservoir in Stanton County is a good example of this chain-reaction and the interaction between nutrients, algae growth (indicated by chlorophyll levels), and water clarity (Figures 17, 18, and 19 below).

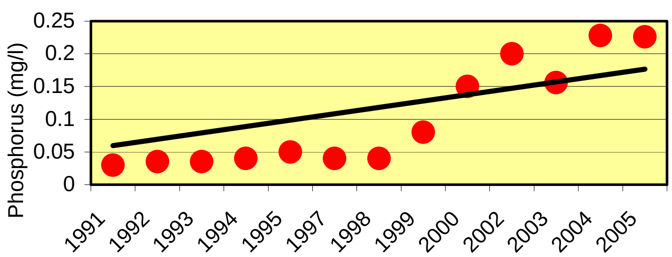


Figure 17. Annual Median Phosphorus, Maskenthine Reservoir

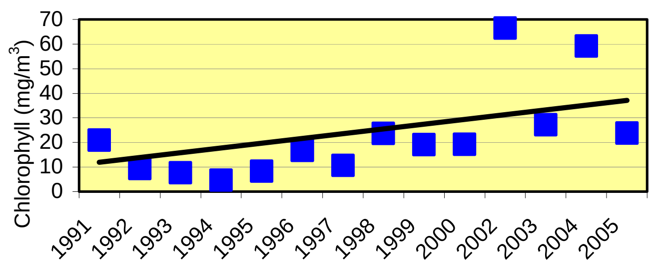


Figure 18. Annual Median Chlorophyll, Maskenthine Reservoir

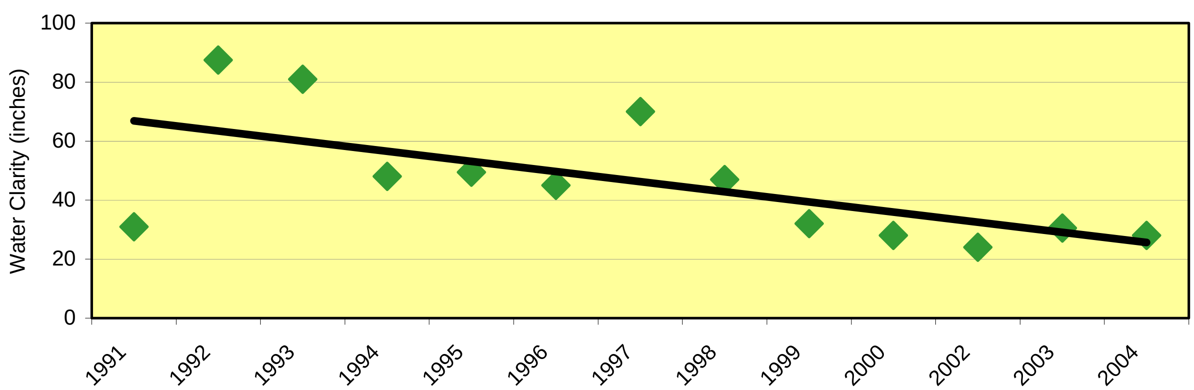


Figure 19. Annual Median Water Clarity, Maskenthine Reservoir

Toxic Algae

One particular type of algae, commonly known as "blue-green algae", has been noticed more in Nebraska lakes and reservoirs in recent years. When this algae dies and breaks down, it releases a toxin called microcystin. In 2004, dogs swimming in sandpits near Omaha died from the effects of microcystin. NDEQ began extensive sampling of lakes and reservoirs across the state, and, with coordination between Nebraska Health and Human Services and the Nebraska Game and Parks Commission, posted Health Alerts at 13 lakes. Nine of the 13 had chronic toxic algae problems, which remained a problem throughout most of the recreation season.

Table 3. Summary of Toxic Algae Sampling

Year	Number of samples	Number of Public Lakes*	Number of Private Lakes*
2004	748	35	72
2005	880	33	51
Total	**1628**		

*Nearly the same lakes were sampled in both 2004 and 2005.

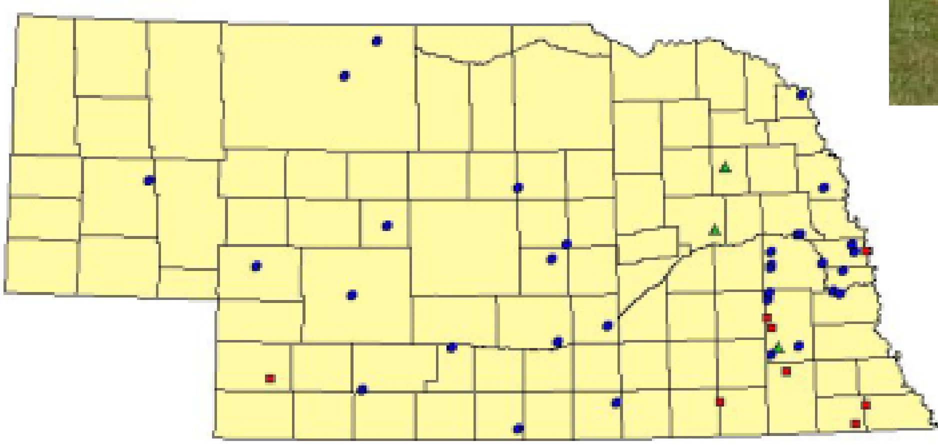


Figure 20. Toxic Algae Public Lake Sampling Locations, 2004 – 2005
● Monitored, no high levels of toxin
▲ Occasional high levels of toxin
■ Persistent high levels of toxin

What causes blue-green algae to grow?

We are learning more all the time about this particular type of algae, but there is some evidence to indicate that a specific ratio of nitrogen (N) to phosphorus (P) in the lake water can give a growth advantage to blue-green algae. The drought may have caused less runoff into lakes, which in turn, changed the N-P ratio. These algae can also float to the top of the lake surface during low light situations, thereby gaining an advantage over other types of algae.

Bacteria at Beaches and in Lakes

Bacteria problems are more common in Nebraska streams than in lakes and reservoirs. Three primary reasons for this are: 1) bacteria enter streams and rivers through surface runoff and once these streams and rivers feed into reservoirs, dilution lowers the overall bacteria concentration; 2) ultraviolet light from the sun has enough time to cause bacteria to die in lakes and reservoirs (retention time); and 3) Nebraska does not allow direct waste water discharges into reservoirs.

Many more people use lakes for recreation (i.e. swimming, skiing, windsailing, wading) than streams, so monitoring the bacteria levels at lake and reservoir beaches to protect human health is a very important activity. NDEQ samples bacteria levels during the recreation season (May through September and publishes the results weekly on the internet (www.deq.state.ne.us). If monitoring indicates problem bacteria levels, a lake or reservoir may be considered "impaired" and placed on the 303(d) list of impaired water bodies (2004 list found in Appendix B.) Bacteria problems in Nebraska lakes and reservoirs have not increased since monitoring began in 1986 (Figure 21).

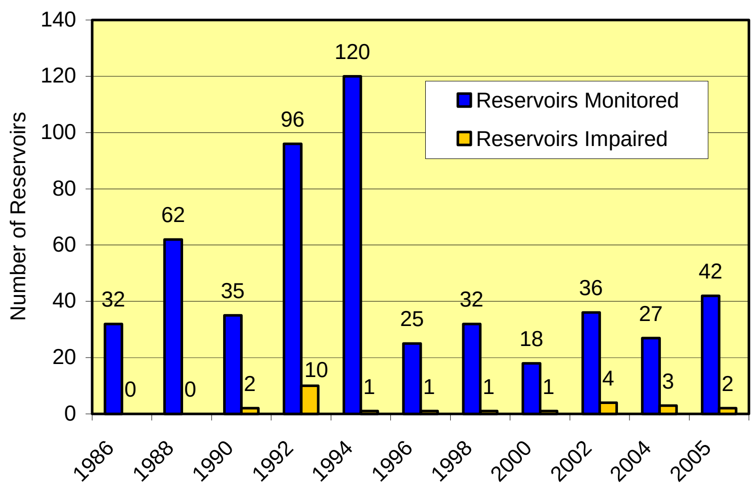


Figure 21. Monitored and Bacteria Impaired Reservoirs, 1986 - 2005

WATER QUALITY PROGRAMS

NDEQ manages many programs aimed at directly or indirectly protecting and improving the surface water quality of the State. Both federal and state programs put controls or limits on the amount of contaminants that can be discharged into a stream, for example. Other programs are aimed at reducing runoff in both rural and urban locales; runoff that may carry sediments, nutrients, pesticides, or other pollutants.

NPDES

National Pollutant Discharge Elimination System, or NPDES, is a federal Clean Water Act permit program that limits the amount of pollutants or contaminants that can be discharged from a "point source". Typical point sources include municipal wastewater treatment facilities, industrial waste discharge outlets, and runoff from construction sites larger than one acre.

As an example of how NPDES permits work, when new ammonia limits were anticipated in the mid 1990s, the City of Grand Island constructed a better wastewater treatment facility (WWTF) to meet the discharge limits. It is important to reduce the amount of ammonia being discharged into the rivers of Nebraska, since ammonia can reduce the amount of oxygen available to fish and other aquatic life. Ammonia at high levels is actually toxic to fish and at lower levels can also limit growth of fish and other aquatic life. The graph in Figure 22 shows the rapid improvement in the quality of effluent (discharged wastewater) after the new ammonia limits were instituted.

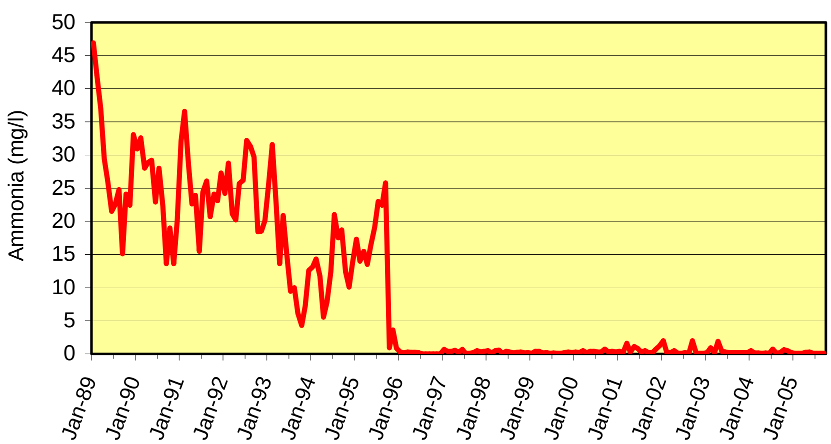


Figure 22. Ammonia in WWTF Effluent at Grand Island

Table 4. Grand Island Ammonia Discharge Limits

Season	Monthly Average	Daily Maximum
Spring	1.6 mg/l	8.7 mg/l
Summer	1.2 mg/l	6.3 mg/l
Winter	3.3 mg/l	17.5 mg/l

State Revolving Funds

The State Revolving Funds, or SRF, are two loan and grant funding programs meant to help local governments upgrade or develop new wastewater treatment facilities (the Clean Water SRF) or drinking water systems (the Drinking Water SRF). The Clean Water SRF program started in 1989 and has provided over $220 million to 146 municipalities for new sewers, new or upgraded treatment plants, storm water collection systems, etc.

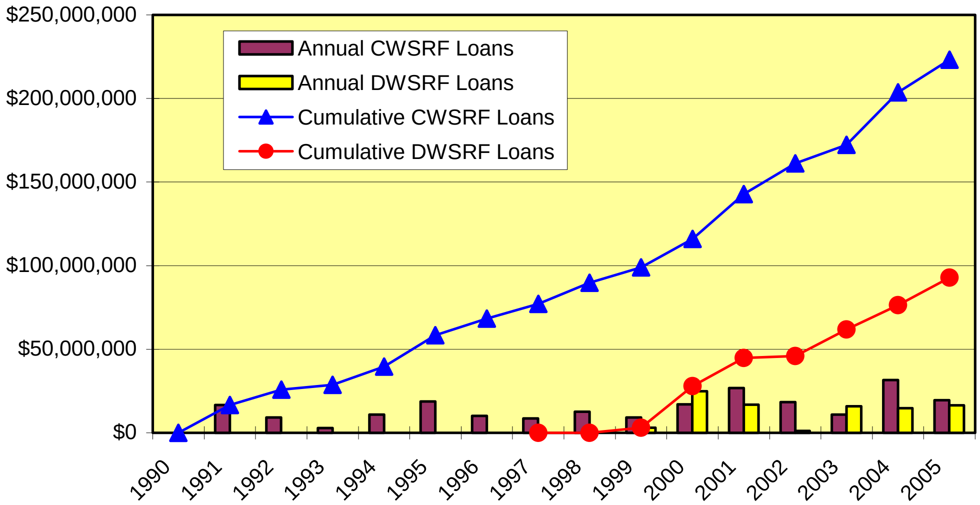


Figure 23. SRF Program Summary, 1989 - 2005

Eighty-nine local governments have received nearly $93 million for drinking water system improvements, including new wells, new or upgraded water storage and transmission pipe, and land around new wells (to protect the water quality) from the Drinking Water SRF, which began in 1997. Nebraska Health and Human Services sets priorities and works with NDEQ to identify projects for funding from the Drinking Water SRF.

The Clean Water SRF program, and to a certain extent, the Drinking Water SRF program, have made possible the improvement of effluent being discharged to Nebraska's rivers and stream so that the beneficial uses are protected. Limiting ammonia, disinfecting the discharge from bacteria problems, and other water quality improvements all add up to better quality surface water for Nebraskans to enjoy.

Wastewater facility at West Point, Nebraska.

CLEAR, Help for Small Community Lakes

CLEAR stands for Community Lake Enhancement and Restoration, and is focused on restoring small community lakes that have become filled with sediment, trash, or choked with weeds. Often these small lakes were once the focus of a town's park or school and gradually, over time, became uninviting. Many of these lakes were no longer able to support healthy aquatic life. Using federal Clean Water Act Section 319 and Nebraska Environmental Trust funding, NDEQ has partnered with 24 communities since the mid 1990s to restore these valuable resources across the state. Figure 25, below, shows the effects the restoration projects have had.

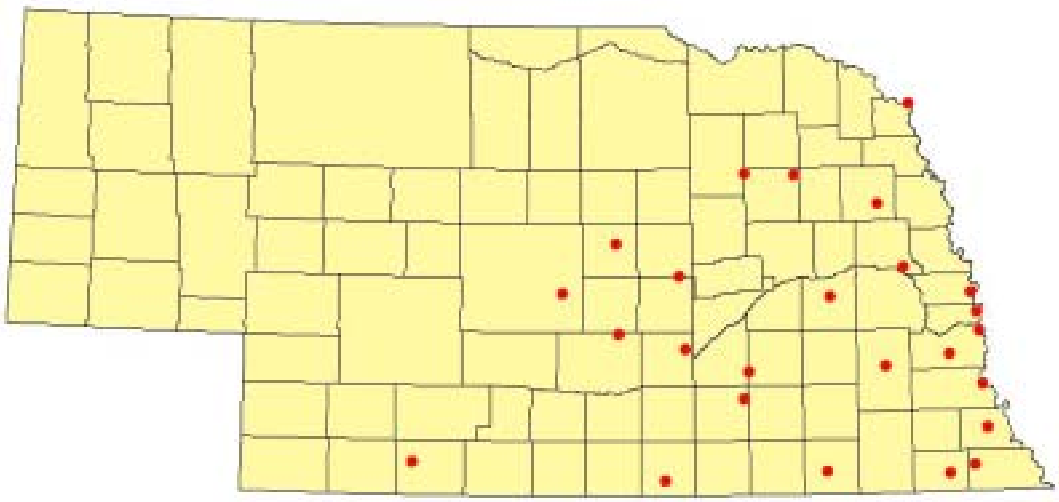


Figure 24. CLEAR Project Locations

Table 5. Average Percent Improvement in CLEAR Projects

Lake Characteristic	Average Percent Improvement
Water Clarity	679%
Chlorophyll	532%
Nitrogen	442%
Phosphorous	900%

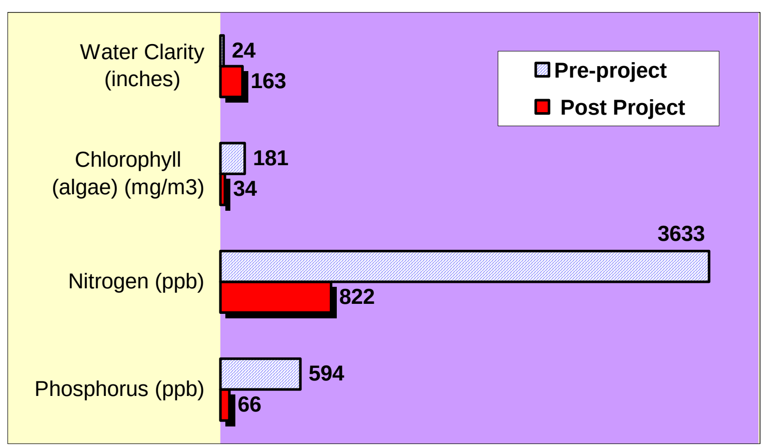


Figure 25. Average Water Quality Improvements in Small Community Lakes

Holmes Lake – Community Participation and Lake Improvement

The US Army Corps of Engineers built Holmes Lake, in the eastern part of the City of Lincoln in 1962, primarily for flood protection. This lake provides a recreation opportunity for many thousands of people each year. Fishing, sailing, golf, jogging, softball, picnicking, and 4th of July fireworks all happen at this 112-acre lake. Over the years, sedimentation and urban runoff threatened the quality of the lake's water, it's aquatic life, and even the recreational value. The lake was placed on the 303(d) list of impaired waters. In 2001, a partnership was developed, made up of more than a dozen groups or organizations to consider options. Four community meetings were held and over $5.5 million from mainly NDEQ (Clean Water Act Section 319 funds), Nebraska Game and Parks, Lincoln Parks and Recreation, and Nebraska Environmental Trust was spent to restore and improve this highly used recreational lake and park. The project, which was completed in 2005, should result in better water quality and improved aquatic habitat.

The Community Based Planning Process has been used in more than 20 reservoir and watershed projects across the state since the mid-90s (including Wagon Train Lake, Lancaster County, shown below). The Holmes Lake experience is one example of these successes. This process is a locally driven approach to solving water quality problems. Technical experts and watershed stakeholders develop local solutions to local problems in both urban and rural settings. By involving local stakeholders in the development of goals, applicable management actions, and specific cost-share/incentive programs, the potential for success is much greater.

Nonpoint Source Pollution Management

"Nonpoint source" pollution is described as contamination or pollution coming from a widespread source or multiple sources that cannot be pinpointed. When related to water pollution, nonpoint source pollution is caused by contaminants carried into water bodies by run-off water from agricultural lands, construction sites, business and industrial facilities, residential properties, streets and roads, and other land uses. Primary nonpoint source pollution concerns in Nebraska include sediment, nutrients, pesticides, and bacteria. Secondary concerns include oils, litter, and toxic chemicals. A "point source" of pollution is typically from a discharge pipe or specific spill or leak that causes an environmental impact.

Since 1990, NDEQ has provided nearly $25 million to projects across the state. The projects have been aimed at preventing nonpoint source pollution or restoring waters of the state that have been impaired by nonpoint source pollution.

The NDEQ receives funds from the U.S. Environmental Protection Agency under Section 319 of the federal Clean Water Act to conduct a nonpoint source pollution management program in Nebraska. The Nebraska program addresses both ground and surface water quality through monitoring, special studies, outreach and financial assistance for watershed or area projects. Several sub-programs have been created to target assistance funds for watershed and groundwater area protection, wellhead protection, urban run-off management, information and education, and lake renovation and protection. Assistance funds are used primarily to install best management practices to prevent targeted contaminants from washing off the land. Projects are selected through a request for proposals, usually done in the fall each year. Impaired waters, watersheds targeted for improvement, and new reservoirs to be built are prioritized for consideration under the nonpoint source management program. Project sponsors are highly encouraged to develop partnerships to leverage funding and technical expertise in completing their project.

The photo to the left illustrates a best management practice typically supported by Section 319 projects. Grass planted in waterways (buffer strips) that lead to streams will help to stop sediment and agricultural chemicals from contaminating surface water.

CONCLUSIONS

Lakes and Reservoirs

Each even numbered year, water quality data are assessed to determine if the lakes are meeting their intended uses. These uses always include aquatic life, aesthetic, and recreation (human contact) uses, and occasionally include a public water supply use. Figure 26 below shows the percentage of lakes and reservoirs assessed each even year that met their intended uses (the 2004 list of impaired water bodies is in Appendix B). This graph shows that fewer Nebraska lakes are meeting their uses each year, but several points should be kept in mind:

- Many of the same lakes are assessed each year, but different lakes are always added in or removed from assessment, depending on the amount of data available that year.
- Water quality standards occasionally change or new standards are adopted.
- Assessment methods may change as better lab methods or sampling techniques develop.
- Short-term climatic differences (dry years versus wet years).

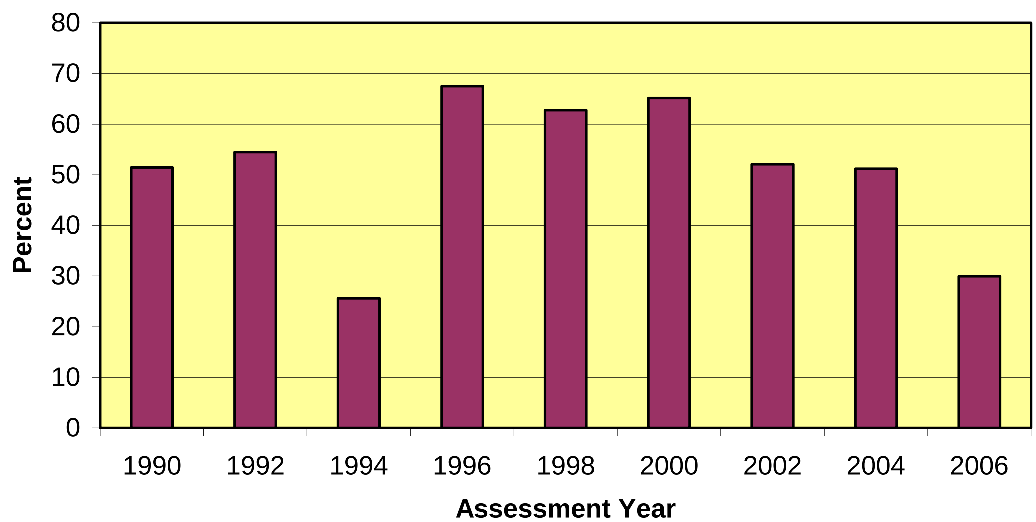


Figure 26. Percentage of Lakes Fully Meeting Their Uses, 1990 – 2006.

Streams and Rivers

The information shown on page 11 (Statewide Stream Health) shows one way of determining how healthy Nebraska's streams are by taking a 'snap-shot' in time. Another method of showing the long-term water quality of Nebraska's water bodies is through the use of trends. The ambient stream network, as explained in the text and Appendix C, covers 98 sites across the state. Samples for many parameters are taken routinely throughout the year. Using data collected from 26 specific ambient stream sites since 2001, some trends can be shown (Figure 27). These 26 sites represent two crucial locations in each of Nebraska's 13 major watersheds. This graph does not tell us whether an individual site is improving or degrading. We can conclude that, in general, most of our strategically located sampling locations are not showing an improvement or degradation over the four years of comparison; however, most sites are remaining the same in terms of key water quality parameters.

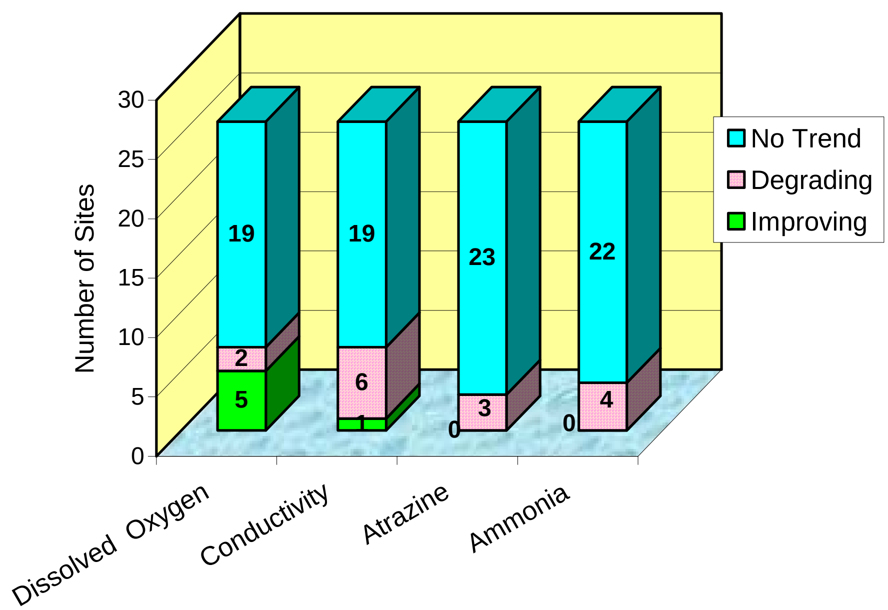
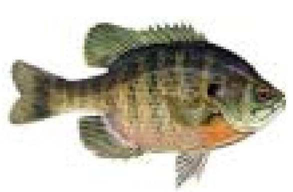


Figure 27. Trends in Key Water Quality Parameters at 26 Stream Sites, 2001 – 2005.

Summary

NDEQ has been monitoring the state's surface water resources for many years. In many parts of Nebraska, we can state that overall water quality is getting better, but in other regions water quality may be degrading. Broad "water quality of Nebraska" statements are difficult to make because of the variety of pollutants and contaminants, the climatic differences across the state, population differences, a variety of land use practices, and the wide spectrum of geologic conditions that shape the state's streams and lakes.



For example, the level of the pesticide atrazine in the Big Blue River at Barneston meets the water quality standard, except during spring months and/or when rainfall causes runoff and high flow events (page 7 and Figure 10). Other examples of atrazine in streams can be found that are similar. However, these examples do not tell us about the water quality of the whole state; rather, they tell us that atrazine can be a concern during high flow events in rivers. This information helps us develop management plans and find the right partners to approach the specific problem.

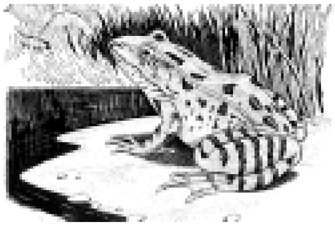
Another good example of what our monitoring shows is the drop in ammonia levels in the effluent from the Grand Island wastewater treatment facility (page 16 and Figure 22). Ammonia can be lethal to aquatic life, so reducing the levels being discharged has improved the water quality in the immediate vicinity of the WWTF. Monitoring is showing that our NPDES permit program is doing a good job.

Rather than asking, "Is the surface water quality of Nebraska improving", a series of other questions should be considered and answered:

- **Are we monitoring the right parameters?**
  - Yes. NDEQ chooses parameters to monitor based on land use practices, discharge types and properties, natural conditions, and potential pollutants that could be harmful to human, animal, and aquatic life.
- **Do we have enough monitoring locations and are they in the correct locations?**
  - Yes, although there can always be more locations that would benefit our monitoring program. As it is, a representative and statistically valid network of monitoring locations tell us the health of Nebraska's lakes and streams.
- **Do we monitor on a schedule that will give us a complete picture?**
  - Yes, NDEQ has fine-tuned the monitoring schedule to best assess the seasonal health and seasonal uses of Nebraska surface water resources.
- **Are we using our monitoring data to develop management tools to address problems that are found?**
  - Yes, the recent award of $900,000 federal grant for a targeted watershed project in the Big Blue River basin is a prime example of NDEQ's monitoring and assessment leading to more partnerships, opportunities, and programs to address a specific problem (page 7).

- Other examples include using Clean Water Act Section 319 funds to restore and improve impaired watersheds (watersheds associated with lakes or streams that are considered "impaired" and are on the 303(d) list of impaired water bodies). Examples are given on pages 18 and 19 of this report.

With continued monitoring, assessment of monitoring data, study of trends and statistics, and work with local, state, and national partners, NDEQ will continue to have the information available to allow the Department to focus programs and projects to maintain, protect, revitalize, and improve the state's valuable water resources.



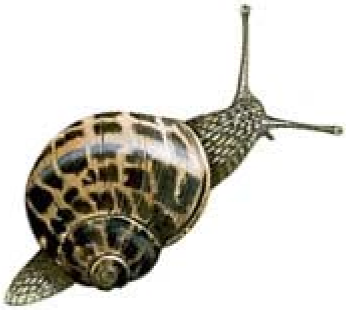


Photo Credits

Front Cover	Platte River near Alma; Marty Link, NDEQ
Page ii	Snow; Kara Gall, MRNRD
Page v	Irrigation near Mitchell; Kay Grote, NPNRD
Page v	Construction on the Antelope Valley flood control project, Lincoln; Mike Mascoe, LPSNRD
Page 2	Platte River near Grand Island; Ken Bazata, NDEQ
Page 2	People fishing at Wagon Train Lake; Mike Mascoe, LPSNRD
Page 3	Trout fishermen, Nine Mile Creek; Kay Grote, NPNRD
Page 4	Stream sampling at Long Branch Creek; Jane Kuhl, NNRD
Page 4	Lake sampling at Wirth Lake; Jane Kuhl, NNRD
Page 6	High school students measuring flow, Nine Mile Creek; Kay Grote, NPNRD
Page 9	Platte River; Emmett Egr, PMRNRD
Page 9	Platte River near Elm Creek; Marty Link, NDEQ
Page 13	Lake near entrance to Halsey National Forest; Rachel Weatherly, UNWNRD
Page 14	Toxic algae warning sign at Pawnee Lake; Dave Bubb, NDEQ
Page 14	Dead fish with toxic algae at a sandpit near Shelton; Dave Bubb, NDEQ
Page 15	Crystal Lake; Jeanne Dryburgh, NARD
Page 16	North Platte River at Scotts Bluff; Kay Grote, NPNRD
Page 17	West Point WWTF; Ron Smaus, NDEQ
Page 18	Grand “re-opening” at Ord City Lake; Paul Brakhage, NDEQ
Page 19	Ski-Doo Race, Holmes Park August 2001; Ken Dewey, UNL
Page 19	Wagon Train Lake; Mike Mascoe, LPSNRD
Page 20	Holmes Lake, Lincoln; Paul Brakhage, NDEQ.
Page 22	Heron at Wagon Train Lake; Mike Mascoe, LPSNRD
Page 23	Turtle; Hayden Kaderly, Lincoln
Page 23	Nebraska Sunset; Dale Link, Ravenna
Page 24	South Loup River; Dale Link, Ravenna
Page A-1	Elkhorn River; Emmett Egr, PMRNRD
Page A-2	Moon Lake Marsh, Ft. Robinson; Terry Hickman, NDEQ
Page C-1	“Cloudy water”; Terry Maret, formerly NDEQ

Applicable NDEQ Rules and Regulations
(available to view or download from www.deq.state.ne.us)

T117 – Nebraska Surface Water Quality Standards
T119 – Rules And Regulations Pertaining To The Issuance Of Permits Under The National Pollutant Discharge Elimination System
T123 - Rules And Regulations For Design, Operation And Maintenance Of Wastewater Treatment Works
T130 - Livestock Waste Control Regulations
T131 - Rules And Regulations For The Wastewater Treatment Facilities And Drinking Water Construction Assistance Programs
T197 - Rules And Regulations For Certification Of Wastewater Treatment Operators In Nebraska

Acronyms and Abbreviations Used in This Report

CLEAR	Community Lake Enhancement and Restoration
CPNRD	Central Platte NRD
EPA	Environmental Protection Agency
LBBNRD	Lower Big Blue NRD
LBNRD	Little Blue NRD
LCNRD	Lewis & Clark NRD
LENRD	Lower Elkhorn NRD
LLNRD	Lower Loup NRD
LNNRD	Lower Niobrara NRD
LPNNRD	Lower Platte North NRD
LPSNRD	Lower Platte South NRD
LRNRD	Lower Republican NRD
MNNRD	Middle Niobrara NRD
MRNRD	Middle Republican NRD
NDEQ	Nebraska Department of Environmental Quality
NNRD	Nemaha NRD
NPDES	National Pollutant Discharge and Elimination System
NPNRD	North Platte NRD
NRD	Natural Resources District
PMRNRD	Papio Missouri River NRD
SPNRD	South Platte NRD
SRF	State Revolving Fund (either Clean Water or Drinking Water)
TBNRD	Tri Basin NRD
TMDL	Total Maximum Daily Load
TPNRD	Twin Platte NRD
UBBNRD	Upper Big Blue NRD
UENRD	Upper Elkhorn NRD
ULNRD	Upper Loup NRD
UNL	University of Nebraska – Lincoln
UNWNRD	Upper Niobrara-White NRD
URNRD	Upper Republican NRD
USGS	United States Geological Survey
WWTF	Wastewater Treatment Facility

Appendix A
Definitions

Beneficial Use:

Any use of surface waters where water quality can affect the use. Beneficial uses include agricultural, industrial, and public water supplies; support and propagation of fish, and other aquatic life; recreation in and on the water; and aesthetics.

The uses define the water quality goals of a water body desired by society.

They provide the basis for classifying water bodies and determining the level of water quality that should be protected or set as a goal.

The following are beneficial uses:

Aesthetics:

Water quality should provide that the water is pleasing to visual and olfactory senses.

Agricultural Water Supply:

Water is used for either irrigation or livestock watering

Agricultural Water Supply Class A:

Water quality should be suitable for irrigation or livestock watering without treatment.

Agricultural Water Supply Class B:

Naturally occurring constituents that affect water quality limit its suitability for irrigation or livestock watering.

Aquatic Life:

Water quality should support the protection and propagation of fish and other aquatic life. In other words, organisms that live in and on the water should not be adversely affected by its water quality.

Coldwater Aquatic Life Class A:

Water quality should support a self-sustaining, naturally reproducing trout fishery and other coldwater life forms year-round.

Coldwater Aquatic Life Class B:

Water quality should support a year-round trout fishery, but there is no suitable habitat for trout spawning. Trout will be present due to fish stocking activities.

Industrial Water Supply:

Water is used for cooling water, hydroelectric power generation or nonfood processing.

Primary Contact Recreation:

Water quality should be suitable for activities in and on the water such as swimming, skiing, canoeing, wading, and scuba diving.

These are activities where the body comes into prolonged or intimate contact with the water.

Public Drinking Water Supply:

Water quality should be suitable for use by community water supply systems as a source for drinking water after the water is put through a treatment process.

Warmwater Aquatic Life Class A:

Water quality should support a year-round warmwater fishery that consists of larger species including game fish along with smaller forage fish.

Warmwater Aquatic Life Class B:

This use is restricted to smaller streams where size and habitat limitations only allow for a warmwater forage fishery such as minnows to exist. Water quality should support this limited fishery.

State Resource Waters (not a beneficial use, but a classification):

These are waters that have special significance by being either of very high quality or having unique features that have been recognized by society.

State Resource Water Class A:

These waters have been given special designations by being included in State or National Parks, wildlife refuges, or wild and scenic river systems. Their existing water quality characteristics may not be degraded.

State Resource Water Class B:

These waters have exceptionally high water quality – much higher than needed to support the designated uses. Their existing high water quality is to be protected and can only be lowered after a very involved public process and a finding that the lowered water quality would be in the public's interest.

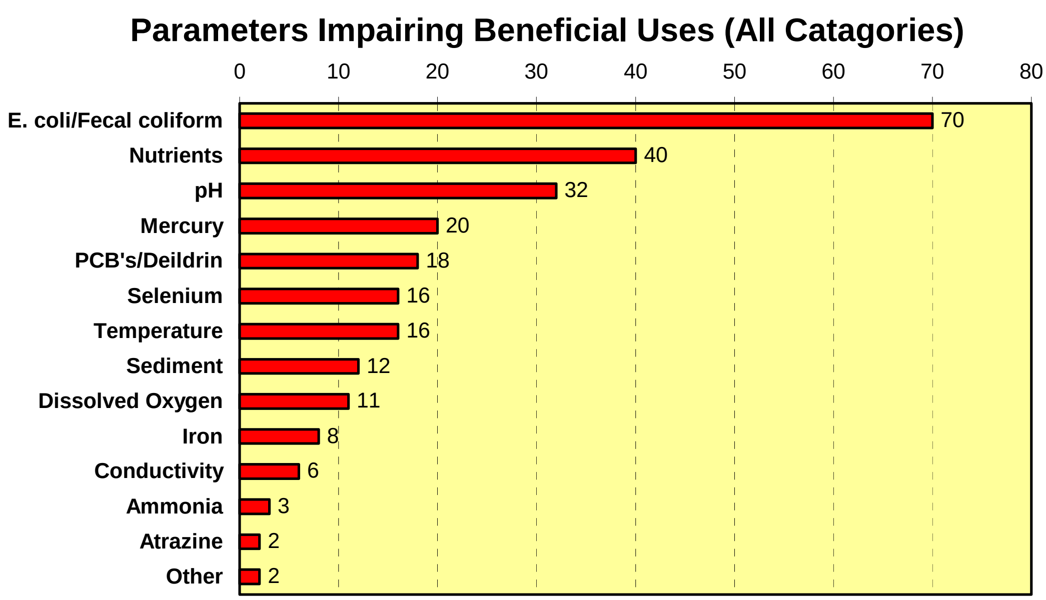
Appendix B
2004 303(d) List of Impaired Streams (Category 5 Only) *

Segment	Name	E. coli/ Fecal coliform	Selenium	PCBs/ Deildrin	Mercury	Nutrients	Sediment	Dissolved Oxygen	Atrazine	pH	Temper-ature	Other
Big Blue Basin												
BB1-10000	Big Blue River	x	x									
BB2-10000	Big Blue River	x										
BB3-10000	West Fork Big Blue River	x	x	x								
BB4-20800	Lincoln Creek		x									
BB4-40000	Big Blue River							x				
BB1-L0060	Rockford Lake				x	x						
BB1-L0080	Cub Creek Lake 12a					x						
BB1-L0090	Clatonia Lake					x						
BB2-L0020	Swan Creek Lake 5a								x	x		
Elkhorn Basin												
EL1-10000	Elkhorn River	x	x	x								
EL1-10900	Maple Creek		x									
EL1-20000	Elkhorn River	x										
EL1-20100	Pebble Creek		x									
EL2-10000	Logan Creek		x	x								
EL2-20000	Logan Creek		x									
EL3-20000	North Fork Elkhorn River		x									
EL4-10000	Elkhorn River	x										
EL4-20000	Elkhorn River	x										
EL4-30000	Elkhorn River	x			x							
EL4-40000	Elkhorn River									x		
EL1-L0070	Pilger Reservoir									x		
EL1-L0080	Maskenthine Reservoir				x	x				x		
EL1-L0140	Dead Timber Lake					x						
EL3-L0010	Willow Creek Lake									x		
EL4-L0090	Overton Lake					x						
Little Blue Basin												
LB1-10000	Little Blue River	x										
LB2-10000	Little Blue River	x										
LB2-L0030	Alexandria Lake No 3									x		
LB2-L0040	Bruning Dam Lake					x						
LB2-L0050	Liberty Cove Lake				x					x		
LB2-L0080	Prairie Lake									x		
Loup Basin												
LO1-10000	Loup River	x										
LO1-30000	Loup River	x										
LO1-30300	Cedar River	x										
LO2-10000	North Loup River	x										
LO2-11400	Calamus River	x										
LO2-30000	North Loup River	x									x	
LO2-40000	North Loup River	x									x	
LO3-10000	Middle Loup River	x										
LO3-30000	Middle Loup River	x										
LO3-50300	Dismal River	x										
LO4-10000	South Loup River	x										
LO4-20000	South Loup River	x										
LO3-10900	Alkali Lake											

Segment	Name	E. coli/ Fecal coliform	Selenium	PCBs/ Deildrin	Mercury	Nutrients	Sediment	Dissolved Oxygen	Atrazine	pH	Temper-ature	Other
Lower Platte Basin												
LP1-10000	Platte River	x	x									
LP1-11600	Pawnee Creek											Carbon Tet
LP1-20000	Platte River	x		x								
LP1-20700	Shell Creek		x									
LP1-21800	Loup River Canal	x		x								
LP2-10000	Salt Creek	x		x								Iron
LP2-10100	Wahoo Creek		x									
LP2-20000	Salt Creek	x		x								Iron
LP2-20300	Little Salt Creek		x									
LP2-20400	Dead Man's Run	x										
LP2-20500	Oak Creek	x										
LP2-20900	Antelope Creek	x										
LP2-21100	Middle Creek								x			
LP2-21500	Beal Slough									x		
LP1-L0300	Fremont Lake No 2									x		
LP1-L0310	Fremont Lake No 3					x						
LP1-L0320	Fremont Lake No 5									x		
LP1-L0440	Lake North					x				x		
LP2-L0050	Stagecoach Lake					x						
LP2-L0060	Oak Lake							x				Salinity
LP2-L0110	Bluestem Lake	x				x	x					
LP2-L0130	Conestoga Lake					x	x					
LP2-L0140	Olive Creek Lake					x				x		
LP2-L0220	Meadowlark Lake					x		x				
LP2-L0240	East Twin Lake						x					
LP2-L0260	West Twin Lake					x	x					
LP2-L0270	Czechland Lake				x					x		
Middle Platte Basin												
MP2-10000	Middle Platte River	x									x	
MP2-30000	Middle Platte River	x										
MP2-L0410	Blue Hole East Lake					x				x		
MP2-L0500	Phillips Lake				x							
MP2-L0520	Johnson Lake	x				x						
MP2-L0540	Elwood Reservoir				x							
MP2-L0580	Cozad Lake					x						
Missouri Tributaries Basin												
MT1-10000	Missouri River	x		x								
MT1-10100	Papillion Creek			x								
MT1-10120	Big Papillion Creek	x										
MT1-10250	West Papillion Creek			x								
MT1-12100	Omaha Creek			x								
MT1-L0030	Wehrspann Lake				x							
MT1-L0050	Zorinsky Lake				x							
MT1-L0090	Carter Lake	x		x		x				x		
MT1-L0100	Standing Bear Lake				x							
MT1-L0120	Glenn Cunningham Lake						x					
MT1-L0200	Crystal Lake				x							
MT-ND	Candlewood Lake					x	x					
Nemaha Basin												
NE1-10000	Missouri River	x		x								
NE2-11900	South Fork Big Nemaha River	x										

Segment	Name	E. coli/ Fecal coliform	Selenium	PCBs/ Deildrin	Mercury	Nutrients	Sediment	Dissolved Oxygen	Atrazine	pH	Temper-ature	Other
NE2-12100	South Fork Big Nemaha River	x										
NE2-12330	Long Branch Creek	x										
NE2-12500	North Fork Big Nemaha River	x										
NE2-L0090	Iron Horse Trail Lake				x	x	x					
NE2-L0120	Burchard Lake									x		
Niobrara Basin												
NI2-10000	Niobrara River	x										
NI3-10000	Niobrara River	x										
NI3-12300	Long Pine Creek	x										
NI3-13000	Plum Creek	x										
NI3-13100	Plum Creek	x										
NI3-21900	Minnechaduza	x									x	
NI3-22400	Snake River											
NI3-22500	Snake River	x										
NI4-10000	Niobrara River	x										
NI3-L0300	West Long Lake					x				x		
NI3-L0370	Round Lake					x				x		Conductivity
NI4-L0010	Cottonwood Lake				x							
NI4-L0020	Shell Lake				x							
NI4-L0080	Box Butte Reservoir				x							
NI4-L0090	Kilpatrick Lake					x				x		
North Platte Basin												
NP1-10000	North Platte River				x							
NP1-20000	North Platte RIver	x										
NP2-10000	North Platte River				x							
NP3-10000	North Platte River			x							x	
NP1-L0300	Lake Ogallala					x		x				
NP2-L0300	Border Lake					x				x		Conductivity
NP3-L0060	Lake Minatare					x						
NP3-L0080	Cochran Lake					x				x		
Republican River Basin												
RE1-10000	Republican River	x										
RE1-20000	Republican River	x										
RE1-50000	Republican River	x										
RE2-10000	Republican River	x										
RE2-10300	Prairie Dog Creek							x				
RE2-10610	Beaver Creek							x				
RE3-10000	Republican River	x	x									
RE3-20300	Frenchman Creek	x									x	
RE2-L0010	Harlan Co Reservoir					x						
RE3-L0060	Hugh Butler Lake							x				
RE3-L0060	Wellfleet Lake					x						
RE3-L0090	Swanson Reservoir					x						
RE3-L0110	Champion Mill Pond					x						
South Platte Basin												
SP1-10000	South Platte River	x										
SP1-10500	Outlet Canal			x								
SP1-10600	Outlet Canal			x								
SP1-20000	South Platte River		x									
SP1-70000	South Platte River									x		
SP1-90000	South Platte River		x									
SP1-L0030	Birdwood Lake				x							
SP1-L0040	East Hershey Lake				x							

Segment	Name	E. coli/ Fecal coliform	Selenium	PCBs/ Deildrin	Mercury	Nutrients	Sediment	Dissolved Oxygen	Atrazine	pH	Temper-ature	Other
SP1-L0080	Sutherland Reservoir			x								
SP1-L0100	Goldeneye Pond											Conductivity
SP2-L0030	Oliver Reservoir				x	x						
White River-Hat Creek Basin												
WH1-20000	White River	x										
WH1-L0060	Whitney Reservoir					x						
WH2-L0030	Meng Lake									x		Conductivity
Total		**59**	**16**	**17**	**20**	**34**	**7**	**7**	**2**	**24**	**6**	**8**



*Every two years the Department is required to evaluate quality and report on the status of water bodies in the state. The report format integrates sections 303(d) and 305(b) of the Clean Water Act and must be submitted to EPA for review and approval. The report and final assessments are broken into categories for the purpose of quality and quantity of data available, if the waterbody is meeting the assigned uses and the Department's past or future actions on those water bodies deemed impaired. The five water body categories in the report are:

- *Category 1* – All uses supported
- *Category 2* – At least one use supported and data lacking for other use assessments
- *Category 3* – Data lacking to determine if any uses are supported
- *Category 4* – At least one use is impaired but Total Maximum Daily Load (TMDL) assessment not needed
    - –TMDL completed, other program will address impairment (NPDES) or natural condition
- *Category 5* – At least one use is impaired and a TMDL is needed

Appendix C
Surface Water Quality Monitoring Programs

The physical, chemical, and biological quality of surface waters in Nebraska can fluctuate significantly in conjunction with stream flows, storms, and nonpoint source runoff. Streams in the Sand Hills region of Nebraska are primarily fed by groundwater and therefore have relatively stable flows and fewer fluctuations in water quality conditions. However, streams in other areas of the state are subject to extreme fluctuations in stream flows as a result of high intensity, short duration rainstorms, and significant changes in water quality conditions often occur. In order to efficiently and effectively collect representative water quality samples in surface waters throughout the state, the NDEQ uses a variety of monitoring approaches including:

- Long-term fixed station monitoring,
- Rotating basin monitoring,
- Probabilistic sample design monitoring,
- Detailed watershed assessments,
- Investigative monitoring, and
- Special studies.

These monitoring approaches have been incorporated into the surface water monitoring programs described in Tables 1 and 2 and the following text.

(Both photos below show water clarity and monitoring techniques; 1) Very cloudy water prevents us from seeing all of the hand; 2) A secchi disk is used to measure water clarity.)

Table 1. Summary of the number of sites, frequency of sampling, and parameters measured for each of NDEQ's surface water quality monitoring programs.

Monitoring Program	Number of Sites	Bacteriological	Biological	Field Measurements	Habitat	Major Ions	Metals	Nutrients	Pesticides	Others
Ambient Lakes	25		M1	M1		M1		M1		
Ambient Streams	98		A	B, M2		B, M2	Q	B, M2	B, M2	B, M2
Basin Rotation	50-90	W1		W1		W1		W1	W1	W1
Citizen Complaints/Fish Kills	30-50	V	V	V	V	V	V	V	V	V
Fish Tissue	40		A				A			A
Joint State Atrazine	27								M2, R, W1	
Lake Biological	3		A							
Lake Inlet Streams	10-15							R	R	R
Lake Sedimentation	5-10									A
Pre- and Post-Project Lakes	10-15		M1	M1		M1		M1		
Stream Biological	45		A	A	A					
Toxic Algae	60-80		A, V, W2							
Toxic Algae Remote Sensing	8		M1	M1				M1		M1

Codes -- Frequency of Monitoring

A – Annually
B – Biweekly, April through September
M1 – Monthly, May through September
M2 – Monthly, October through March
Q – Quarterly
R – Runoff Events
V – Variable (As Needed)
W1 – Weekly, April through September
W2 – Weekly, May through September

Table 2. Summary of Analyses and Parameters for the Surface Water Monitoring Programs.

Category	Analyses/Parameters
Nutrients	Dissolved Orthophosphorus (Lakes Only); Nitrate-Nitrite Nitrogen, Total Kjeldahl Nitrogen, Total Nitrogen, Total Phosphorus; Total Ammonia (Streams Only),
Bacteriological	Escherichia Coli (E. Coli)
Biological	Blue-Green Algae and Microcystin Toxins (Toxic Algae Only); Chlorophyll a (Lakes Only); Fish and Aquatic Insects (Stream Biological Only); Juvenile Trout (Ambient Stream Only); Microcystin (Fish Tissue Only); Phytoplankton, Zooplankton, and Benthic Aquatic Insects (Lake Biological Only)
Habitat	Various Stream and Riparian Habitat Measurements (Stream Biological Only)
Metals	Dissolved: Arsenic, Cadium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Zinc (Ambient Stream Only); Methyl Mercury (Fish Tissue Only); Total Selenium
Major Ions	Alkalinity (Lakes Only); Dissolved: Calcium, Magnesium, Sodium; Chloride
Pesticides	Acetochlor, Alachlor, Atrazine, Isoxaflutale (i.e. Balance) (Ambient Lakes, Ambient Streams, and Basin Rotation Only), Metalochor
Field Measurements	Conductivity, Depth (Lakes Only), Discharge (Streams Only), Dissolved Oxygen, pH, Turbidity, Temperature, Transparency (Lakes Only)
Others	Dieldrin and PCBs (Fish Tissue Only); Global Positioning System Locations and Lake Depth Measurements (Lake Sedimentation Only), Priority Pollutants as needed (Citizen Complaints/Fish Kills Only), Total Suspected Solids (Ambient Streams, Basin Rotation, Lake Inlet Streams Only), Remote Sensing Overflight Photographs (Toxic Algae Remote Sensing Only)

Ambient Lakes Monitoring Program

A long-term fixed-station monitoring network of 25 lakes is sampled monthly from May through September each year to document existing lake water quality conditions and long-term trends. Samples are collected for parameters such as nutrients, sediment, pesticides, heavy metals, dissolved oxygen, pH, temperature, conductivity, and water clarity.

Ambient Streams Monitoring Program

The Ambient Streams Monitoring Program is a long-term fixed-station monitoring program composed of 98 stream sites across the state. This program includes representative mainstem and tributary stream sites in all 13 river basins and utilizes ecoregion and land use considerations in the selection of stream sites. In addition, this network samples fish communities annually in some coldwater streams to document existing or potential Coldwater Class A stream designations (streams capable of supporting a self-sustaining trout populations). The primary monitoring objectives are to provide information on the status and trends of water quality for streams in each of the state's river basins, and to link assessments of status and trends to natural and human factors that affect water quality.

This program was initiated in 1972, and has undergone numerous changes over the years. In 1990, the network was reduced from 66 sites to 21 sites, and in 1993, the program was discontinued and monitoring funds were used to implement the Basin Rotation Monitoring Program. In 2000, when new state and EPA funds became available, the Ambient Streams Monitoring Program was re-established as a 42-site network. In 2002, the network was expanded to 93 sites, and in 2003, the network added an additional 5 sites to attain its current total of 98 sites. Fifty-eight of the 98 sites provide coverage for the largest stream segments in the state. The remaining 40 sites are located on medium and small perennial stream segments. Water samples are collected monthly and analyzed for traditional chemical and physical parameters. Metals analyses are conducted on a quarterly basis.

Table 3. Historical Ambient Stream Sampling Sites

1972 – 1989	66 sites
1990 – 1993	21 sites
1994 – 1999	0 sites
2000 – 2001	42 sites
2002	95 sties
2003 – present	98 sites

Both the Ambient Stream and Lake Monitoring Programs are designed for trend analysis and long-term analysis of stream and lake health.

Basin Rotation Monitoring Program

This program uses a rotating basin monitoring strategy, which focuses water quality sampling in two to three major river basins each year so that over a five-year cycle, all 13 river basins in the state are intensively monitored. The 13 major river basins in Nebraska are: Big Blue, Elkhorn, Little Blue, Loup, Lower Platte, Middle Platte, Missouri Tributaries, Nemaha, Niobrara, North Platte, Republican, South Platte, and White River-Hat Creek. A total of approximately 50-90 stream and lake sites are sampled each year from April through September. Monitoring objectives are to identify water quality problems in streams and lakes, identify the pollutant(s) of concern and their sources, and estimate pollutant loadings. Flow is measured in streams at the time of sampling to calculate pollutant loadings. Where stream gaging stations are not available, channel surveys are conducted to develop flow-rating curves and estimate stream flows at the time of sampling based on stream depth. Sampling is conducted for parameters such as bacteria, pesticides, nutrients, sediment, and other traditional parameters.

Recreation-designated stream segments and swimming beaches at lakes are targeted for weekly bacteria monitoring from May through September to assess the suitability of water quality for primary contact recreational activities such as swimming, rafting, tubing, and canoeing. Weekly updates about the suitability of water quality for swimming are reported on the NDEQ website (www.deq.state.ne.us). Monthly samples are also collected and analyzed for routine lake parameters from May through September at the deep-water sites of approximately 10 lakes each year.

Fish Tissue Monitoring Program

This program collects approximately 40 fish tissue samples each year for analysis of toxic pollutants in streams and lakes, including five long-term fixed stream sites and 14 new stream or lake basin rotation sites each year. The remaining samples are collected to verify existing fish consumption advisories. These data are used to assess toxic pollutant trends, identify problem areas, and annually assess and prepare a report on the suitability of fish for human consumption. Fish consumption advisories are currently issued for 19 stream or canal segments and 22 lakes. The primary contaminants of concern in Nebraska fish are PCBs, mercury and dieldrin.

Citizen Complaint and Fish Kill Investigations
Fish kill and citizen complaint investigations are conducted, as needed, to document existing water quality conditions, surface water quality standards violations, and identify pollution sources and responsible parties. About 30-50 investigations of fish kills or citizen complaints are conducted annually.

Stream Biological Monitoring Program
The Stream Biological Monitoring Program uses a unique probability-based (randomized) sample design that allows water quality status and trend assessments to be made with a known level of statistical confidence. Monitoring is conducted for fish, aquatic insects, and physical habitat at about 40 wadeable stream sites each year (approximately 7 to 20 sites per basin per year). Additional funds are available in 2006 to expand the number of sites to 45. Sampling is conducted in conjunction with the rotating basin monitoring strategy. These assessment procedures allow for the quantification of water quality conditions over large geographic areas such as a river basin or across the entire state. A stream biological report was recently completed for data collected from 1997 to 2001.

Joint State Atrazine Monitoring Program
The Joint State Atrazine Monitoring Program is a special study involving a cooperative effort between Nebraska and Kansas's governmental agencies, agricultural organizations, universities, and the Syngenta Corporation (formerly Novartis Corporation) to determine atrazine concentrations and loadings in the Big and Little Blue River Basins in Nebraska and Kansas. Beginning in 1997, weekly grab samples were collected each year from April through September at 22 stream sites in Nebraska and Kansas. In addition, spring and summer runoff samples were collected from nine sites during all significant rainfall events using automatic sampling equipment. Monthly grab samples were collected at the 22 sites from October through March. In 2002 and 2003, the number of sites was expanded from 22 to 27 sites and alachlor, metolachlor, and acetochlor were added to the parameter list. In 2004, the number of monitoring sites was reduced to 21 and the number of runoff sites was reduced to 6. All remaining program funds were expended in 2004 and no monitoring was conducted in 2005. Monitoring will resume in 2006 or 2007 with funds from an EPA Targeted Watershed Grant.

Lake Inlet Stream Monitoring Program
The Lake Inlet Stream Monitoring Program conducts detailed watershed assessments during the spring, summer, and fall at approximately 10-15 inlet streams of selected lakes during significant runoff events. The primary use of this data is to calculate annual loadings of nutrients, sediment, and pesticides to lakes.

Lake Sedimentation Monitoring Program
Sediment volume surveys are detailed watershed assessments conducted at about 5-10 lakes or lake sediment basins each year to estimate sedimentation rates and to determine if excessive sedimentation is occurring. Global Positioning System technology is used to provide the "exact" geographic locations on a lake or lake sediment basin where depth measurements are collected. This information is used to produce detailed topography maps, and to estimate lake or lake sediment basin volume for a given surface elevation. In most cases, an initial survey is needed to establish baseline conditions. Once baseline information is obtained, follow-up surveys are conducted approximately every five years on lakes and every two years on lake sediment basins. Surveys on lake sediment basins are also used to evaluate sediment-trapping efficiencies.

Pre-Project and Post-Project Lake Monitoring Program
This program conducts detailed watershed assessments in lake watersheds where water quality improvement projects are being planned (pre-project), or where projects have been implemented (post-project). Water quality data collected from these lakes are used for determining baseline water quality conditions and documenting project-related improvements in water quality due to the implementation of best management practices. Three or more years of pre-implementation (pre-project) and post-implementation (post-project) data are usually collected. Approximately 10-15 pre-project or post-project lake watersheds are monitored each year.

Toxic Algae Monitoring Program
This program monitors the levels of microcystin toxins produced by blue-green algae blooms at approximately 60-80 lakes each year from May through September. Especially targeted are high public use lakes with designated swimming beaches. Toxin data are used to identify waters that pose significant health risks to animals and humans, and to issue or update weekly Health Alerts. A long-term fixed station network of 15 lake sites is sampled weekly throughout the recreation season, and other lakes are sampled, as needed, based on citizen complaints and the severity of the toxin problems encountered.

Toxic Algae Remote Sensing Monitoring Program
The Toxic Algae Remote Sensing Program is a special study investigating the use of remote sensing technologies to identify and quantity concentrations of blue-green algae at eight stations located on sandpit lakes near the Platte River. In 2005, remote sensing was conducted using aircraft spectral imagery or field radiometry from boats in association with chemical, physical, and biological sampling of the sandpit lakes. This information will be used to develop predictive models for identifying lakes with blue-green algae problems and to develop a toxic algae alert system. It will be continued in 2006.

The false color air photo below shows Fremont State Lakes and the relative chlorophyll-a concentrations on August 30th, 2005. Chlorophyll-a concentrations can be predictive of blue green algae and the associated toxins.