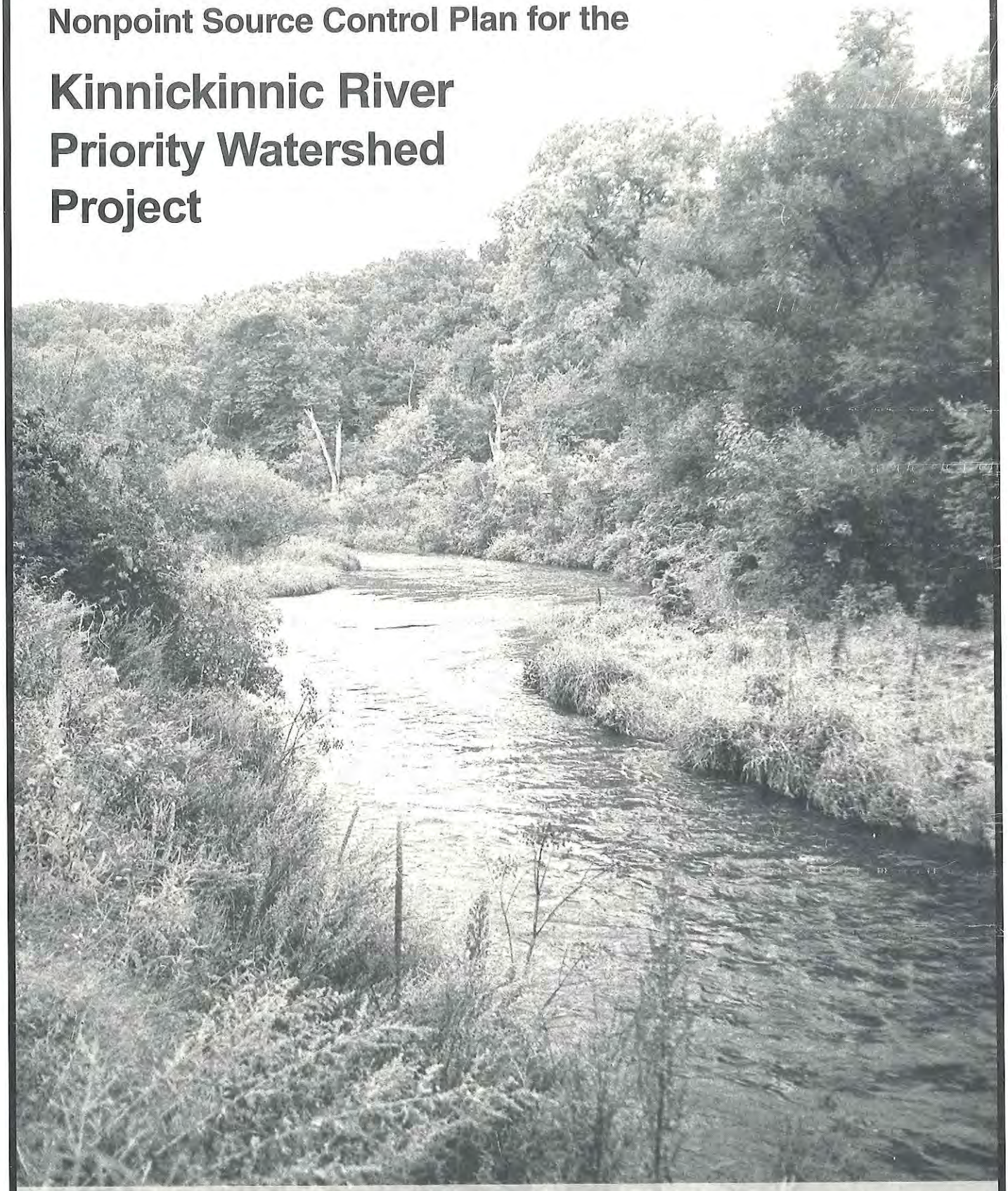
Nonpoint Source Control Plan for the

Kinnickinnic River Priority Watershed Project



This plan was prepared under the provisions of the Wisconsin Nonpoint Source Pollution Abatement Program by the Wisconsin Department of Natural Resources, the Department of Agriculture, Trade and Consumer Protection, and the St. Croix and Pierce County Land Conservation Departments.

Watershed Plan Organization Information

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Herbert F. Behnke
Betty Jo Nelsen
Mary Jane Nelson
Stephen D. Willett

St. Croix County
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Nonpoint Source Control Plan for the Kinnickinnic River Priority Watershed Project

The Wisconsin Nonpoint Source Water Pollution Abatement Program

April, 1999

This Plan Was Cooperatively Prepared By:

The Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade and Consumer Protection
and
St. Croix and Pierce County Land Conservation Departments

Publication WT-522

For copies of this document please contact:

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Nonpoint Source and Land Management Section
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Madison, WI 53707

The Department of Natural Resources acknowledges the Environmental Protection Agency's Region V Office for their involvement in the partial funding of this activity through Section 319 of the Water Quality Act.

Watershed Plan Credits

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Kinnickinnic River Priority Watershed Project
Mission Statement

"TO PRESERVE AND ENHANCE THE COLD WATER KINNICKINNIC WATERSHED ECOSYSTEM"

Kinnickinnic River Priority Watershed Steering Committee

Erling Lestrud, Chairman, Town of Hammond
Louie Campbell, Vice-Chair, Town of River Falls
John Afdahl, Town of Pleasant Valley
Leon Berenschot, St. Croix County Board of Supervisors
Dale Braun, University of Wisconsin - River Falls
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Sam Warp, Jr., Village of Hammond

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
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Eau Claire, WI 54702-4001
TELEPHONE 715-839-3700
FAX 715-839-6076/1605
TTY 715-839-2786

April 13, 1999

IN REPLY REFER TO:

Thomas Dorsey, Chair
St. Croix County Board of Supervisors
1101 Carmichael Road
Hudson, WI 54016

SUBJECT: Kinnickinnic River Priority Watershed Plan Approval

Dear Tom Mr. Dorsey,

I am pleased to approve the Kinnickinnic River Priority Watershed Management Plan prepared through the Wisconsin Nonpoint Source Abatement Program. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan was prepared in conjunction with the Department of Agriculture, Trade and Consumer Protection. The plan went before the Land and Water Conservation Board on April 13, 1999, and was approved at that time. I am also approving this plan as an amendment to the St. Croix River Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the St. Croix County Land Conservation Department staff who participated in preparing this plan. We look forward to assisting the LCD and other units of government in the watershed in the implementation of the Kinnickinnic River Priority Watershed plan.

Sincerely,

George

George E. Meyer
Secretary

Thank you for your hardwork in developing this excellent plan.

cc: Ben Brancel, DATCP
Robert Uphoff, LWCB
Charles Christenson, St. Croix County LCD
Arthur Jensen, St. Croix County LCC Chair
Keith Foye, DATCP
Jill Jonas, DNR, WT/2
Barb Kneer, DNR, CF/8
John Paddock, WCR
Karen Voss, WCR
Sue Porter, DATCP

RECEIVED
APR 15 1999
DNR - WT/2

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Tommy G. Thompson, Governor
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April 13, 1999

IN REPLY REFER TO:

Richard Wilhelm, Chair
Pierce County Board of Supervisors
414 West Main Street
Ellsworth, WI 54011

RECEIVED
APR 15 1999
DNR - WT/2

SUBJECT: Kinnickinnic River Priority Watershed Plan Approval

Richard

Dear Mr. Wilhelm,

I am pleased to approve the Kinnickinnic River Priority Watershed Management Plan prepared through the Wisconsin Runoff Management Program. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan was prepared in conjunction with the Department of Agriculture, Trade and Consumer Protection. The plan went before the Land and Water Conservation Board on April 13, 1999, and was approved at that time. I am also approving this plan as an amendment to the St. Croix River Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Pierce County Land Conservation Department staff who participated in preparing this plan. We look forward to assisting the LCD and other units of government in the watershed in the implementation of the Kinnickinnic River Priority Watershed plan.

Sincerely,

George

George E. Meyer
Secretary

Thank you for your hardwork in developing this excellent plan.

cc: Ben Brancel, DATCP
Robert Uphoff, LWCB
Ruth Stern, Pierce County LCD
Lloyd Yanisch, Pierce County LCC Chair
Keith Foye, DATCP
Jill Jonas, DNR, WT/2
Barb Kneer, DNR, CF/8
John Paddock, WCR
Karen Voss, WCR
Sue Porter, DATCP

RESOLUTION ADOPTING THE KINNICKINNIC NONPOINT SOURCE PRIORITY WATERSHED PLAN

RESOLUTION NO. 3 (99)
ST. CROIX COUNTY, WISCONSIN

WHEREAS, the Kinnickinnic Priority Watershed was designated by the Department of Natural Resources in 1996, under the Wisconsin Nonpoint Source Water Pollution Abatement Program; and

WHEREAS, the St. Croix County Land and Water Conservation Department, in cooperation with the Department of Natural Resources and the Department of Agriculture, Trade and Consumer Protection, conducted a detailed inventory of land use within the watershed in 1996 and 1997; and

WHEREAS, this inventory resulted in the development of a detailed nonpoint source control plan for the watershed; and

WHEREAS, a public informational meeting and an official public hearing was conducted on February 18, 1999; and

WHEREAS, pertinent public comments have been incorporated into the plan; and

WHEREAS, the County, before being able to receive cost sharing grants for landowners in the watershed, must first adopt the Kinnickinnic Nonpoint Source Priority Watershed Plan.

NOW, THEREFORE, BE IT RESOLVED, by the Board of Supervisors of the County of St. Croix, that the Kinnickinnic Nonpoint Source Priority Watershed Plan be and is hereby adopted and the implementation of the plan begin as soon as possible.

Dated this 16th day of March, 1999.

Offered by: LAND AND WATER CONSERVATION COMMITTEE

Negative	Affirmative
	Art Jensen
	Chris Bethke
	Lois J. Burri
	Leon Bruenschat
	Jim Lady

ADOPTED ON: 3-16-99

ATTEST: Sue E. Nelson
Sue E. Nelson
County Clerk

STATE OF WISCONSIN
COUNTY OF ST. CROIX

I, Sue E. Nelson, St. Croix County Clerk, DO HEREBY CERTIFY that the foregoing is a true and correct copy of Resolution 3 (99) adopted by the County Board of Supervisors at their meeting held March 16, 1999

Sue E. Nelson
Sue E. Nelson, St. Croix County Clerk

APR 27 1999

RESOLUTION NO. 98 – 42

RESOLUTION AUTHORIZING THE ADOPTION OF THE KINNICKINNIC PRIORITY WATERSHED PROJECT PLAN

WHEREAS, the Wisconsin Department of Natural Resources designated a priority watershed through the Wisconsin Nonpoint Source Pollution Abatement Program in 1995; and

WHEREAS, the Pierce County Board of Supervisors accepted this designation of the Kinnickinnic Watershed in 1996; and

WHEREAS, the staff of the Pierce County Land Conservation Department has cooperated with staff of the St.Croix County Land Conservation Department along with private citizens, state and federal agencies in order to complete A Nonpoint Source Control Plan for the Kinnickinnic Priority Watershed Project; and

WHEREAS, the watershed plan details actions and resources needed to address water quality problems in the Kinnicinnic River Watershed; and

WHEREAS, the watershed plan must be reviewed and approved by the Pierce County Board of Supervisors prior to receiving state cost-sharing and technical assistance funds for best management practice installation; and

WHEREAS, the Pierce County Land Conservation Committee has reviewed the Kinnickinnic Priority Watershed Plan and does recommend to the Pierce County Board of Supervisors that they do adopt the Kinnickinnic Priority Watershed Project Plan which has been distributed to the members in February of 1999.

NOW, THEREFORE, BE IT RESOLVED by the Pierce County Board of Supervisors that they do hereby approve the Kinnicinnic Priority Watershed Nonpoint Source Plan and they do hereby authorize the implementation of the plan by Pierce County Land Conservation Department. Said plan shall be placed on file with the Pierce County Clerk which is incorporated herein and made a part hereof.

Dated this 23rd day of February, 1999.

PIERCE COUNTY BOARD OF SUPERVISORS

Richard E. Wilhelm

Richard Wilhelm, County Board Chairman

ATTESTED TO BY:

County Clerk

APPROVED AS TO FORM AND LEGALITY BY:

Karen J. Ebert

Corporation Counsel

I, Janis Feuerhelm as county clerk do hereby certify that the foregoing is a true and correct copy of the resolution adopted by the County of Pierce at the meeting held March 23, 1999

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List of Acronyms

ACP	Agricultural Conservation Program
BARNY	Barnyard nutrient analysis model
BIM-GEO	DNR Bureau of Information Management-Geographical Unit
BMP	Best Management Practice
CAC	Citizen Advisory Committee
CFSA	Consolidated Farm Services Agency (United States Department of Agriculture)
COD	Chemical Oxygen Demand
CRP	Federal Cropland Reserve Program
CSA	Cost share agreement
DATCP	Wisconsin Department of Agriculture, Trade, and Consumer Protection
DILHR	Department of Industry, Labor, and Human Relations
DNR	Wisconsin Department of Natural Resources
FFA	Future Farmers of America
FOCS	Field Offices Computing System
FPP	Wisconsin Farmland Protection Program
FSA	Food Security Act
GW	Groundwater
I&E	Information and Education
LCC	Land Conservation Committee
LCD	Land Conservation Department
LWCB	Land and Water Conservation Board
NPM	Nutrient and Pest Management
NRCS	Natural Resource Conservation Service
SHS	Wisconsin State Historical Society
SIP	Stewardship Incentive Program
SOS	Signs of Success monitoring program
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UWEX	University of Wisconsin-Extension
WGNHS	Wisconsin Geological and Natural History Survey
WINHUSLE	Sediment transfer model based on the Universal Soil Loss Equation
WPDES	Wisconsin Pollutant Discharge Elimination System [permit system]
WUWN	Wisconsin Unique Well Number assigned to well sample sites

Glossary

ACUTE TOXICITY:

Any poisonous effect produced by a single short-term exposure to a chemical that results in a rapid onset of severe symptoms.

ALGAE:

A group of microscopic, photosynthetic water plants. Algae give off oxygen during the day as a product of photosynthesis and consume oxygen during the night as a result of respiration. Therefore, algae effect the oxygen content of water. Nutrient-enriched water increases algae growth.

AMMONIA:

A form of nitrogen (NH_3) found in human and animal wastes. Ammonia can be toxic to aquatic life.

ANAEROBIC:

Without oxygen.

AREAWIDE WATER QUALITY MANAGEMENT PLANS (208 PLANS):

A plan to document water quality conditions in a drainage basin and make recommendations to protect and improve basin water quality. Each basin in Wisconsin must have a plan prepared for it, according to section 208 of the Clean Water Act.

ANTIDEGRADATION:

A policy stating that water quality will not be lowered below background levels unless justified by economic and social development considerations. Wisconsin's antidegradation policy is currently being revised to make it more specific and meet EPA guidelines.

AVAILABILITY:

The degree to which toxic substances or other pollutants are present in sediments or elsewhere in the ecosystem and are available to affect or be taken up by organisms. Some pollutants may be "bound up" or unavailable because they are attached to clay particles or are buried by sediment. Oxygen content, pH, temperature and other conditions in the water can affect availability.

BACTERIA:

Single-cell, microscopic organisms. Some can cause disease, but others are important in organic waste stabilization.

BASIN PLAN:

See "Areawide Water Quality Management Plan".

BENTHIC ORGANISMS (BENTHOS):

Organisms living in or on the bottom of a lake or stream.

BEST MANAGEMENT PRACTICE (BMP):

The most effective, practical measures to control nonpoint sources of pollutants that runoff from land surfaces.

BIOACCUMULATION:

The uptake and retention of substances by an organism from its surrounding medium and food. As chemicals move through the food chain, they tend to increase in concentration in organisms at the upper end of the food chain such as predator fish, or in people or birds that eat these fish.

BIOASSAY STUDY:

A test for pollutant toxicity. Tanks of fish or other organisms are exposed to varying doses of treatment plant effluent. Lethal doses of pollutants in the effluent are then determined.

BIOCHEMICAL OXYGEN DEMAND (BOD):

A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. BOD_5 is the biochemical oxygen demand measured in a five day test. The greater the degree of pollution, the higher the BOD_5.

BIODEGRADABLE:

Waste that can be broken down by bacteria into basic elements. Most organic wastes such as food remains and paper are biodegradable.

BIOLOGICAL USE CLASSIFICATION:

Description of fish species and other aquatic organisms which a stream system can support. A water body is *designated* as being in a biological use class based on the ability of a stream to provide suitable habitat and water quality conditions for fish and other aquatic life. See *Cold Water Communities (COLD), Warm Water Sport Fish Communities (WWSF), Warm Water Forage Fish Communities (WWFF), Limited Forage Fish Communities (LFF).*

BIOTA:

All living organisms that exist in an area.

BROOK TROUT CONDITIONS:

The complex set of biological and ecological factors that contribute to an environment suitable for sustaining naturally reproducing brook trout populations. Contributing factors include, but are not limited to stream flow, stream flow fluctuations, type of stream substrate, aquatic vegetation, macrophyte community, overhanging shoreline vegetation, presence of woody structure, and a host of stream temperature variables, including the percent of time stream temperatures are within the optimal range, temperature extremes, duration periods of time temperature is outside the optimal range. Brook trout conditions are characterized locally by the conditions that exist where brook trout populations thrive.

BROWN TROUT CONDITIONS:

The complex set of biological and ecological factors that contribute to an environment suitable for sustaining naturally reproducing brown trout populations. Contributing factors include, but are not limited to stream flow, stream flow fluctuations, type of stream substrate, aquatic vegetation, macrophyte community, overhanging shoreline vegetation, presence of woody structure, and a host of stream temperature variables, including the percent of time stream temperatures are within the optimal range, temperature extremes, duration periods of time temperature is outside the optimal range. Brown trout conditions are characterized locally by the conditions that exist where brown trout populations thrive.

BUFFER STRIPS:

Strips of grass or other erosion-resisting vegetation between disturbed areas and a stream or lake.

BULKHEAD LINES:

Legally established lines that indicate how far into a stream or lake an adjacent property owner has the right to fill. Many of these lines were established many years ago and allow substantial filling of the bed of the river and bay. Other environmental laws may limit filling to some degree.

CARCINOGENIC:

A chemical capable of causing cancer.

CATEGORICAL LIMITS:

All point source discharges are required to provide a basic level of treatment. For municipal wastewater treatment plants this is secondary treatment (30 mg/1 effluent limits for SS and BOD). For industry the level depends on the type of industry and the level of production. More stringent effluent limits are required, if necessary, to meet water quality standards.

CATEGORY:

See "Management Category".

CHLORINATION:

The application of chlorine to wastewater to disinfect it and kill bacteria and other organisms.

CHLORORGANIC COMPOUNDS (CHLORORGANICS):

A class of chemicals that contain chlorine, carbon and hydrocarbon. This generally refers to pesticides and herbicides that can be toxic. Examples include PCB's and pesticides such as DDT and dieldrin.

CHRONIC TOXICITY:

The effects of long-term exposure of organisms to concentrations of a toxic chemical that are not lethal, but are injurious or debilitating in one or more ways. An example of the effect of chronic toxicity is reduced reproductive success.

CLASS I TROUT STREAM:

High quality stream where trout populations are sustained by natural reproduction. See "Biological Use Classification".

CLASS II TROUT STREAM:

Trout stream with some natural reproduction but may need stocking to maintain a desirable trout fishery. See "Biological Use Classification".

CLASS III TROUT STREAM:

Trout stream with no natural reproduction and requires annual stocking of legal-size fish to provide sport fishing. See "Biological Use Classification".

CLEAN WATER ACT:

See "Public Law 92-500."

COLD WATER COMMUNITY (COLD):

Includes surface waters capable of supporting a community of coldwater fish and other aquatic life or serving as a spawning area for coldwater fish species. Within the COLD biological use classification, trout streams are further classified. See Class I, Class II and Class III.

CONSERVATION TILLAGE:

Planting row crops while only slightly disturbing the soil. In this way a protective layer of plant residue stays on the surface. Erosion rates decrease.

CONSUMPTION ADVISORY:

A health warning issued by DNR and DHFS that recommends people limit the fish they eat from some rivers and lakes based on the levels of toxic contaminants found in the fish.

CONTAMINANT:

Some material that has been added to water that is not normally present. This is different from a pollutant, which suggests there is too much of the material present.

CONVENTIONAL POLLUTANT:

Refers to suspended solids, fecal coliform, biochemical oxygen demand, and pH, as opposed to toxic pollutants

COST-EFFECTIVE:

A level of treatment or management with the greatest incremental benefit for the money spent.

CRITERIA:

See water quality standard criteria.

CRITICAL MANAGEMENT CATEGORY:

When a site is designated as "critical", it is an indication that controlling the source of pollution is essential for meeting water quality objectives for the project. Critical nonpoint sources contribute a significant amount of the pollutants impacting surface waters. These sources are eligible for funding and technical assistance through the priority watershed project. Landowners with critical sites are required, by law, to address those sites by reducing the nonpoint source pollutant load to an acceptable level.

DDT:

A chlorinated hydrocarbon insecticide that was banned because of its persistence in the environment.

DESIGNATION:

Identification of a waterbody as belonging to a specific use classification. See "Biological Use Classification".

DISSOLVED OXYGEN (DO):

Oxygen dissolved in water. Low levels of dissolved oxygen cause bad smelling water and threaten fish survival. Low levels of dissolved oxygen often result from inadequate wastewater treatment. The DNR considers 5 ppm DO necessary for fish and aquatic life.

DRAINAGE AREA:

An area of land defined by the surrounding topography, and that drains to a lake or stream. Drainage areas can be defined on a scale ranging from very small to very large. For the purposes of this plan, drainage areas are areas of land within the Kinnickinnic River Watershed that drain to a tributary or stream segment of the Kinnickinnic River. See "Watershed".

DREDGING:

Removal of sediment from the bottom of water bodies.

ECOSYSTEM:

The interacting system of biological community and its nonliving surroundings.

EFFECTIVE IMPERVIOUSNESS:

See IMPERVIOUSNESS.

EFFLUENT:

Solid, liquid or gas wastes (byproducts) that are disposed on land, in water or in air. Effluent generally means wastewater discharges.

EFFLUENT LIMITS:

The DNR issues WPDES permits establishing the maximum amount of pollutant to be discharged to a receiving stream. Limits depend on the pollutant and the water quality standards that apply for the receiving waters.

ELIGIBLE MANAGEMENT CATEGORY:

Nonpoint source pollution sites designated as "eligible" are eligible for technical and cost-share assistance. Landowners with eligible sites are not required by law to reduce nonpoint source pollutant loads from these sites.

ENVIRONMENTAL PROTECTION AGENCY (USEPA):

The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air and solid waste pollution control to state agencies.

ENVIRONMENTAL QUALITY INCENTIVE PROGRAM (EQIP):

A federal cost-sharing program to help landowners install measures to conserve soil and water resources. Funds are targeted to priority areas to achieve the maximum environmental benefit per dollar spent. EQIP is administered by NRCS.

ENVIRONMENTAL REPAIR FUND:

A fund established by the Wisconsin Legislature to deal with abandoned landfills.

EROSION:

The wearing away of the land surface by wind or water.

EUTROPHIC:

Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

EUTROPHICATION:

The process of nutrient enrichment of a lake loading to increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

FACILITY PLAN:

A preliminary planning and engineering document that identifies alternative solutions to a community's wastewater treatment problems.

FECAL COLIFORM:

A group of bacteria used to indicate the presence of other bacteria that cause disease. The

number of coliform is particularly important when water is used for drinking and swimming.

FISHABLE AND SWIMMABLE:
Refers to the water quality goal set for the nation's surface waters by Congress in the Clean Water Act. All waters were to meet this goal by 1984.

FOOD CHAIN:
A sequence of organisms where each uses the next as a food source.

GOALS:
See "Water Quality Goals".

GREEN STRIPS:
See buffer strip.

GROUNDWATER:
Underground water-bearing areas generally within the boundaries of a watershed, which fill internal passageways of porous geologic formations (aquifers) with water that flows in response to gravity and pressure. Often used as the source of water for communities and industries.

HABITAT:
The place or type of site where a plant or animal naturally lives and grows.

HAZARDOUS WASTE:
Waste that has been found to be fatal to humans or animals in low doses, or is otherwise capable of causing or significantly contributing to an increase in serious irreversible, or incapacitating reversible, illness.

HEAVY METALS:
Metals present in municipal and industrial wastes that pose long-term environmental hazards if not properly disposed. Heavy metals can contaminate ground and surface waters, fish and other food stuffs. The metals of most concern are: arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium and zinc (see also separate listings of these metals for their health effects).

HERBICIDE:
A type of pesticide that is specifically designed to kill plants and can also be toxic to other organisms.

HYDROCARBONS:
Any chemical of a large family of chemicals containing carbon and hydrogen in various combinations.

IMPERVIOUS:

A surface that is incapable of being penetrated. Impervious surfaces include roads, roof tops, sidewalks, etc. One-half acre lots may be 20-25% covered with impervious surfaces. *Effective imperviousness* refers to a calculated percent imperviousness for an area. It may be lower than the actual percent of land covered with impervious surface, due to best management practices that increase the ability of the land to absorb water. Best management practices may include grassed waterways, porous pavement, etc.

INELIGIBLE MANAGEMENT CATEGORY:

Sites which do not contribute significant amounts of pollutants are not eligible for funding or technical assistance through the priority watershed project. Other DNR programs, such as wildlife and fisheries management, may assist county project staff to control these sources as part of the implementation of the integrated resource management plan for this watershed. Other local, state, or federal programs may also be applicable to these lands.

LANDFILL:

A conventional sanitary landfill is "where solid waste is disposed on land by utilizing the principles of engineering to confine the solid waste to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth or other approved material as required." Hazardous wastes frequently require various types of pretreatment before they are disposed of, i.e., neutralization, chemical fixation, or encapsulation. Neutralizing and disposing of wastes should be considered a last resort. Repurifying and reusing waste materials or recycling them for another use may be less costly.

LEACHATE:

The contaminated liquid which seeps from a pile or cell of solid materials and which contains water, dissolved and decomposing solids. Leachate may enter the groundwater and contaminate drinking water supplies.

LOAD:

The total amount of materials or pollutants reaching a given locale.

MACROPHYTE:

A rooted aquatic plant.

MANAGEMENT CATEGORY:

Defines which nonpoint sources are eligible for financial and technical cost share assistance. The management categories are based on the amount of pollution generated by a site. During the watershed inventory, sites or areas were identified and designated as either critical, eligible or ineligible for financial assistance for control of pollutants. See "Critical Management Category", "Eligible Management Category" and "Ineligible Management Category".

MASS BALANCE:

A study that examines all parts of the ecosystem to determine the amount of toxic or other pollutant present, its sources, and the processes by which the chemical moves through the ecosystem.

MESOTROPHIC:

Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrophic.")

MILLIGRAMS PER LITER (mg/l):

A measure of the concentration of substance in water. For most pollution measurement this is the equivalent of "parts per million".

MITIGATION:

The effort to lessen the damages caused, by modifying a project, providing alternatives, compensating for losses or replacing lost values.

NONPOINT SOURCE POLLUTION (NPS):

Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff, which can best be controlled by proper land management.

NPS:

See nonpoint source pollution.

NRCS:

Natural Resource Conservation Service.

OBJECTIVES:

The amount of control of control or reduction needed of nonpoint sources of pollution in order to reach water quality goals. Objectives are often numeric (percent reduction of a pollutant), but can also be qualitative.

OLIGOTROPHIC:

Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

OUTFALL:

The mouth of a sewer, drain, or pipe where effluent from a wastewater treatment plant is discharged.

OUTSTANDING RESOURCE WATER (ORW):

Rivers, streams or lakes that have been designated as due to valuable fisheries, hydrologically or geologically unique features, outstanding recreational opportunities or

unique environmental settings that are not affected significantly by human activities. In designated ORW waters, effluent from all new permitted discharges must be of a quality equal to or better than the water receiving the discharge. A listing of these designated waters occurs in NR 102, Wisconsin Administrative Code.

PATHOGEN:

Any infective agent capable of producing disease. It may be a virus, bacterium, protozoan, etc.

PESTICIDE:

Any chemical agent used to control specific organisms, such as insecticides, herbicides, fungicides, etc.

PH:

A measure of acidity or alkalinity, measured on a scale of 0 to 14 with 7 being neutral and 0 being most acid, and 14 being most alkaline.

PHOSPHORUS:

A nutrient that, when reaching lakes in excess amounts, can lead to overfertile conditions and algae blooms.

PLANKTON:

Tiny plants and animals that live in water.

POINT SOURCES:

Sources of pollution that have discrete discharges, usually from a pipe or outfall.

POLLUTION:

The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects.

POLYCHLORINATED BIPHENYLS(PCBs):

A group of 209 compounds, PCBs have been manufactured since 1929 for such common uses as electrical insulation and heating/cooling equipment, because they resist wear and chemical breakdown. Although banned in 1979 because of their toxicity, they have been detected on air, land and water. Recent surveys found PCBs in every section of the country, even those remote from PCB manufacturers.

PRIORITY POLLUTANT:

A list of toxic chemicals identified by the federal government because of their potential impact in the environment and human health. Major dischargers are required to monitor all or some of these chemicals when their WPDES permits are reissued.

PRIORITY WATERSHED:

A drainage area selected to receive Wisconsin Fund money to help pay the cost of controlling nonpoint source pollution. Because money is limited, only watersheds where problems are critical, control is practical, and cooperation is likely are selected for funding.

PRODUCTIVITY:

A measure of the amount of living matter which is supported by an environment over a specific period of time. Often described in terms of algae production for a lake.

PUBLIC LAW 92-500 (CLEAN WATER ACT):

The federal law that sets national policy for improving and protecting the quality of the nation's waters. The law set a timetable for the cleanup of the nation's waters and stated that they are to be fishable and swimmable. This also required all dischargers of pollutants to obtain a permit and meet the conditions of the permit. To accomplish this pollution cleanup, billions of dollars have been made available to help communities pay the cost of building sewage treatment facilities. Amendments in the Clean Water Act were made in 1977 by passage of Public Law 95-217, and in 1987.

PUBLIC PARTICIPATION:

The active involvement of interested and affected citizens in governmental decision-making.

RECYCLING:

The process that transforms waste materials into new products.

RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA):

This federal law amends the Solid Waste Disposal Act of 1965 and expands on the Resource Recovery Act of 1970 to provide a program that regulates hazardous wastes, to eliminate open dumping and to promote solid waste management programs.

RETRO-FIT:

The placement of an urban structural practice in an existing urban area, which may involve rerouting existing storm sewers and/or relocating existing buildings or other structures.

RIPARIAN:

Belonging or relating to the bank of a lake, river or stream.

RIPRAP:

Broken rock, cobbles, or boulders placed on the bank of a stream to protect it against erosion.

RULE:

Refers to Wisconsin administrative rules. See Wisconsin Administrative Code.

RUNOFF:

Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to streams. Runoff can collect pollutants from air or land and carry them to receiving waters.

SECONDARY IMPACTS:

The indirect effects that an action can have on the health of the ecosystem or the economy.

SEDIMENT:

Soil particles suspended in and carried by water as a result of erosion.

SEPTIC SYSTEM:

Sewage treatment and disposal for homes not connected to sewer lines. Usually the system includes a tank and drain field. Solids settle to the bottom of the tank. Liquid percolates through the drain field.

SLUDGE:

A byproduct of wastewater treatment; waste solids suspended in water.

SOLID WASTE:

Unwanted or discharged material with insufficient liquid to be free flowing.

STANDARDS:

See water quality standards.

STORM SEWERS:

A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

SUPERFUND:

A federal program that provides for cleanup of major hazardous landfills and land disposal areas.

SUSPENDED SOLIDS (SS):

Small particles of solid pollutants suspended in water.

SYNERGISM:

The total effect is greater than the sum of the individual effects. For example, the characteristic property of a mixture of toxicants that exhibits a greater-than-additive cumulative toxic effect.

TOTAL MAXIMUM DAILY LOADS (TMDLs):

The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

TOXIC:

An adjective that describes a substance which is poisonous, or can kill or injure a person or plants and animals upon direct contact or long-term exposure. (Also, see toxic substance.)

TOXIC SUBSTANCE:

A chemical or mixture of chemicals which, through sufficient exposure, or ingestion, inhalation of assimilation by an organism, either directly from the environment or indirectly by ingestion through the food chain, will, on the basis of available information cause death, disease, behavioral or immunologic abnormalities, cancer, genetic mutations, or development of physiological malfunctions, including malfunctions in reproduction or physical deformations, in organisms or their offspring.

TOXICITY:

The degree of danger posed by a toxic substance to animal or plant life. Also see acute toxicity, chronic toxicity and additivity.

TROPHIC STATUS:

The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration. (See also "Oligotrophic," "Mesotrophic," "Eutrophic..")

TURBIDITY:

Lack of water clarity. Turbidity is usually closely related to the amount of suspended solids in water.

UNIVERSITY OF WISCONSIN-EXTENSION (UWEX):

A special outreach and education branch of the state university system.

USE CLASSIFICATION:

See "Biological Use Classification".

VARIANCE:

Government permission for a delay or exception in the application of a given law, ordinance or regulation. Also, see water quality standard variance.

VOLATILE:

Any substance that evaporates at a low temperature.

WASTEWATER:

Water that has become contaminated as a byproduct of some human activity. Wastewater includes sewage, washwater and the water-borne wastes of industrial processes.

WASTE:

Unwanted materials left over from manufacturing processes, refuse from places of human habitation or animal habitation.

WASTEWATER TREATMENT PLANT:

A facility for purifying wastewater. Modern wastewater treatment plants are capable of removing 95% of organic pollutants.

WATER QUALITY CRITERIA:

A measure of the physical, chemical or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

WATER QUALITY GOALS:

A) Description of the desired biological use category, in relation to the existing biological use category for a water body. See "Water Quality Goals - Enhancement", "Water Quality Goals - Protection" and "Water Quality Goals - Restoration".

B) General description of efforts needed to protect, enhance or restore a water body. For example, efforts needed may be to reduce sediment loading or improve stream hydrology. The intensity of efforts needed, if known, may be identified as high, or medium.

WATER QUALITY GOALS - ENHANCEMENT:

Refers to an *improvement* in the overall condition of a stream or lake *within* its given biological use category. For example, if a stream supports a warmwater fishery whose diversity could be enhanced, the goal focuses on changing those water quality conditions which keep it from achieving its full biological potential. See "Biological Use Category".

WATER QUALITY GOALS - PROTECTION:

Refers to *maintaining* the present biological uses supported by a stream or the reservoir. For example, if a stream supports a healthy cold water fishery, the goal seeks to maintain those uses. See "Biological Use Category".

WATER QUALITY GOALS - RESTORATION:

Refers to *upgrading* the existing capability of the resource to support a higher category of biological use. An example would be a stream which historically supported healthy populations of warmwater game fish, but no longer does. This goal seeks to improve conditions allowing viable populations of forage and warmwater game fish species to become reestablished. See "Biological Use Category".

WATER QUALITY STANDARDS:

The legal basis and determination of the use of a water body and the water quality criteria, physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

WATER QUALITY STANDARD VARIANCE:

When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

WATER RESOURCE GOALS:

See "Water Quality Goals".

WATERSHED:

The land area that drains into a lake or river. Watersheds can be defined on scales ranging from very small to very large, such as the Mississippi River drainage basin. For management purposes the state of Wisconsin has 333 identified watersheds.

WETLANDS:

Areas that are inundates or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs and similar areas.

WISCONSIN ADMINISTRATIVE CODE:

The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

WISCONSIN FUND:

A state program that helps pay the cost of reducing water pollution. Funding for the program comes from general revenues and bonds and is based on a percentage of the state's taxable property value. The Wisconsin Fund includes these programs:

Point Source Water Pollution Abatement Grant Program - Provides grants for 60% of the cost of constructing wastewater treatment facilities. Most of this program's money goes for treatment plant construction, but three percent of this fund is available for repair or replacement of private, on-site sewer systems.

Nonpoint Source Water Pollution Abatement Grant Program - Funds to share the cost of reducing water pollution. Nonspecified sources are available in selected priority watersheds.

Solid Waste Grant Program - Communities planning for solid waste disposal sites are eligible for grant money. $500,000 will be available each year to help with planning costs.

WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT GRANT PROGRAM:

A state cost-share program established by the State Legislature in 1978 to help pay the costs of controlling nonpoint source pollution. Also known as the nonpoint source element of the Wisconsin Fund or the Priority Watershed Program.

WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES):

A permit system to monitor and control the point source dischargers of wastewater in Wisconsin. Dischargers are required to have a discharge permit and meet the conditions it specifies.

PROJECT SUMMARY

This summary describes the Wisconsin Nonpoint Source (NPS) Water Pollution Abatement Program, including the development of the Kinnickinnic River Priority Watershed Project Plan. It also describes the Kinnickinnic River Watershed, sources of nonpoint pollution, management goals and objectives, eligibility criteria, the scope and impact of critical sites, and estimated project costs. This summary is organized in the following manner:

- Summary of the Wisconsin NPS Pollution Abatement Program, including the planning and implementation phases.
- Description of the Kinnickinnic River Watershed
- Sources of Nonpoint Pollution
- Management Goals and Objectives
- Eligibility Criteria and Critical Sites
- Estimated Project Costs

Summary of the Wisconsin Nonpoint Source Water Pollution Abatement Program

The State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1978. The goal of the Program is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural *nonpoint sources*.

Pollutants from *nonpoint sources* are carried to surface water or groundwater through rainfall runoff or seepage, and snowmelt. Sources of nonpoint pollution include: (1) runoff and erosion from established urban areas and rapidly developing areas, (2) eroding agricultural lands, (3) eroding streambanks, (4) runoff from livestock wastes and (5) agricultural practices.

The Department of Natural Resources (DNR) administers the program in cooperation with the Department of Agriculture, Trade and Consumer Protection (DATCP). Wisconsin is divided into 333 discrete drainage areas called watersheds. These watersheds are assessed for water quality concerns as part of a comprehensive basin planning program. Watersheds with a potential high degree of water quality impairment from nonpoint sources of pollution become eligible for consideration as a priority watershed project. Designation as a priority watershed project enables, special financial support to local governments and private landowners in the watershed to reduce nonpoint source pollution.

Watershed Planning
Plans are prepared through the cooperative efforts of the DNR, DATCP, County Land Conservation Departments, local units of government and a Citizen Advisory Committee (referred to as "Steering Committee" for the Kinnickinnic River Priority Watershed Project).

The project manager and other local staff funded by the priority watershed program, and Steering Committee members, along with DATCP and DNR staff, evaluate the conditions of surface water and groundwater, and inventory the types of land use and nonpoint sources of pollution throughout the watershed. The priority watershed plan assesses nonpoint and other sources of water pollution and identifies best management practices (BMPs) needed to control pollutants to meet specific water resource objectives. The plan guides implementation of these practices (BMPs) in an effort to improve water quality. The watershed plan is the basis for the DNR to enter into cost-share and local assistance grants with agencies responsible for project implementation.

Project Implementation
During implementation, the DNR supports local staff and other resources necessary for plan implementation, through grants with local units of government. These staff contact landowners eligible for best management practices (BMPs) identified in the plan. Landowners may sign cost-share agreements that identify BMPs, costs, cost-share amounts and schedules for installation. In urban areas, similar processes are used. Funding is also available to support planning activities that will provide water quality protection. Examples include stormwater management and well head protection planning, and construction site erosion control ordinance development.

There are also many existing state, federal and local resource management programs and local resource protection groups which provide benefits for water quality and/or fish and wildlife resources in the Kinnickinnic River Watershed. Watershed staff coordinate efforts with these groups and programs to provide for the best possible management of land and water resources in the watershed. This comprehensive approach will facilitate cost-effectiveness in meeting the various goals of participating programs.

Description of the Kinnickinnic River Watershed

The Kinnickinnic River Watershed project encompasses 174 square miles, and is located in St. Croix and Pierce Counties within the St. Croix River Basin (Map S-1).

Gently rolling agricultural land comprises most (78 percent) of the watershed (Table S-1). Dairy farming and cash cropping are the primary enterprises, with the average farm size being 205 acres. Woodlands, wetlands and natural areas cover 17 percent of the watershed. Public lands include the Kinnickinnic River State Park, the Kinnickinnic River Streambank Protection Area, three Federal Waterfowl Production Areas and the Casey Lake Wildlife Area.

Urban land uses cover five percent of the watershed. Incorporated areas include the cities of Prescott and River Falls, and the villages of Hammond and Roberts. About 25,300 people live in the Kinnickinnic River Watershed, with approximately 70 percent in cities or villages. Towns and villages have a growth rate over the last decade of about 20 percent. Regional trends suggest that the watershed's population will continue to expand rapidly. St. Croix County Townships in the watershed are Hammond, Warren, Kinnickinnic, Troy, Baldwin, Erin Prairie, Emerald and Hudson. Pierce County Townships are River Falls and Clifton.

The Kinnickinnic River is a high quality, COLD Class I trout fishery that originates in agricultural lands in St. Croix County, flows through the City of River Falls and eventually drains to the St. Croix River. In rural areas of the watershed, the river is primarily impacted by agricultural runoff, flashy streamflow and sedimentation. As the stream flows through River Falls, it is also thermally impacted by urban stormwater runoff and two shallow impoundments (known locally as Lake George and Lake Louise).

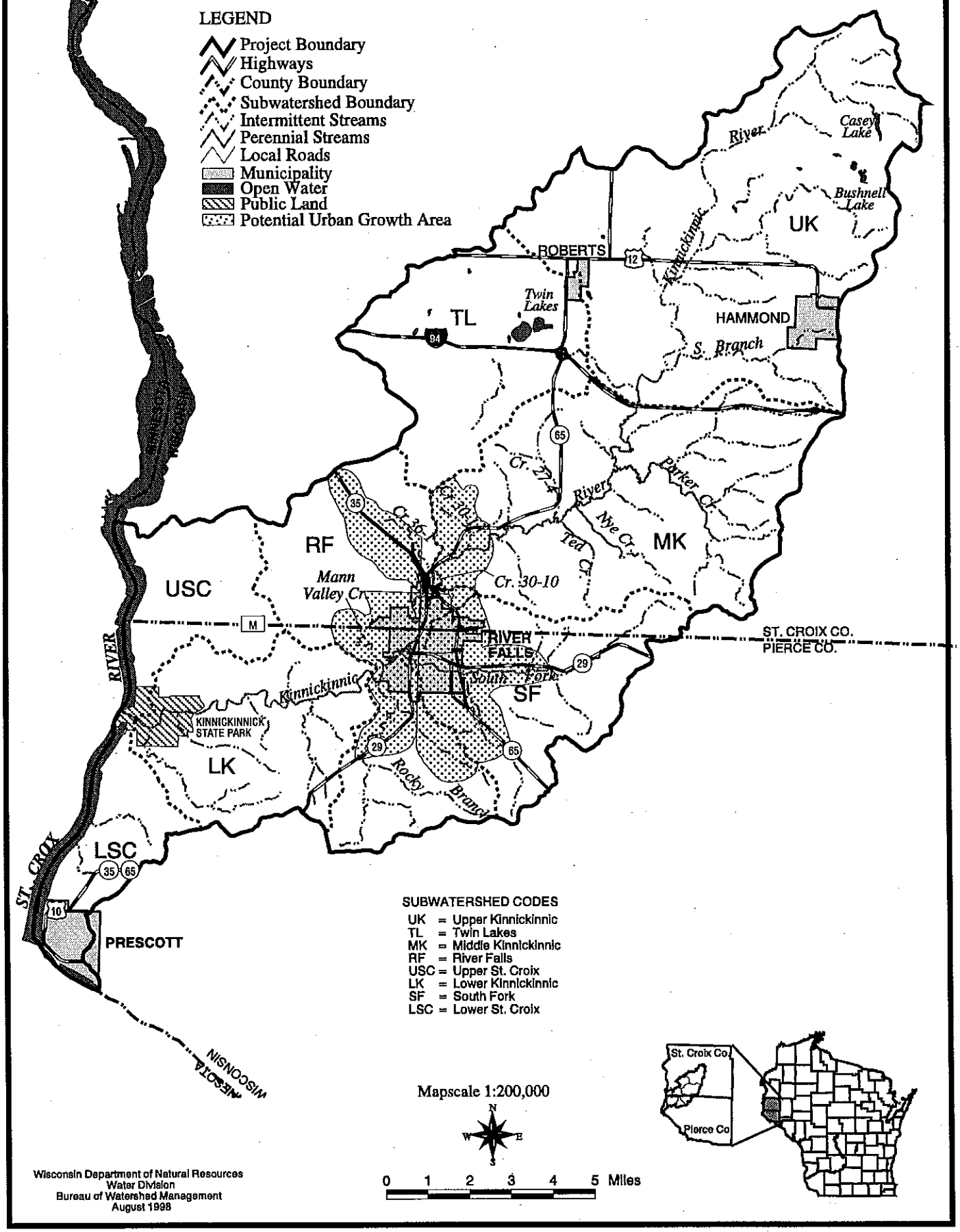
The Kinnickinnic River, excepting the reach within the City of River Falls has been designated as an **Outstanding Resource Water** by the State of Wisconsin. Numerous perennial streams in the watershed support coldwater fish communities. The Kinnickinnic River Watershed has 6 Class I (50 miles) and 18 Class II (38 miles) trout streams and one stream reach that supports a warmwater sport fishery. The Kinnickinnic River (23 miles) is the longest perennial stream in the watershed. Other primary streams in the watershed are the St. Croix River, Parker Creek, South Fork of the Kinnickinnic River and Rocky Branch. Brook and brown trout dominate the coldwater fishery in this watershed.

Table S-1. Summary of Land Uses in the Kinnickinnic River Watershed

Land Uses	Acres	Percent
Agricultural	84,036	78%
Pasture	*8,220*	
Cropland	*72,956*	
Farmstead	*2,860*	
Woodland	12,650	12%
Urban	5,391	5%
Wetland	3,092	3%
Natural Area	2,632	2%
TOTAL	107,801	100%

Source: St. Croix Co. LCD (based on WINHUSLE inventory).
Urban acres based on information obtained from cities and villages for SLAMM modeling.

Map S-1. Kinnickinnic River Subwatersheds and Tributaries



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
August 1998

Sources of Nonpoint Pollution

The St. Croix and Pierce County Land and Water Conservation Department (LWCD) staff conducted inventories to estimate pollutant loads from barnyards, agricultural lands, streambanks, and dry runs in the watershed. Urban land use inventories were conducted by local units of government and DNR staff, to estimate urban pollutant loads. Inventory results are summarized below.

Barnyard Runoff Inventory

- Ninety-nine barnyards or other confined livestock areas were inventoried, and are a source of 235,222 pounds per year of combined oxygen demand (COD). "COD" is a measure of the oxygen demanded by organisms that decompose organic pollutants in barnyard runoff.
- Of these barnyards, two were identified as "critical", with annual loads of greater than 20,000 pounds of COD. Control of COD from these critical barnyards will achieve 37 percent of the pollutant load reduction goal for barnyards.

Cropland Nutrient and Pesticide Application Inventory

- There are approximately 73,000 acres of cropland, managed by 405 operators, including 94 dairy farms and 311 farms without animals.
- Due to differences of scientific opinion, there was no determination available for phosphorus loading estimates from fields where winterspreading of manure takes place. However, some studies have estimated that 30 to 40 percent of the total cropland phosphorus loading comes from runoff of field-spread manure. The remainder would come from phosphorus tied up in the eroding soils.

Upland Sediment

- An estimated 73,000 acres of cropland deliver 16,800 tons per year of soil to lakes, wetlands and streams in the watershed. An additional 1,650 tons per year are delivered from farmsteads, pastures and woodlots. Uplands are the source of 85 percent of the sediment delivered to surface waters.
- There are an estimated 997 "critical" acres of cropland that deliver 1,226 tons per year of sediment. Control of sediments from critical acres will achieve a 22 percent control of the reduction goal of 4,200 tons per year.

Streambank Erosion

- Approximately 82 miles of inventoried streams deliver an estimated 600 tons of sediment annually into streams. Streambank erosion contributes three percent of the total annual sediment load to surface waters in the Kinnickinnic River Watershed. Significant erosion had occurred and/or aquatic habitat and water quality were degraded along approximately seven miles of streambank.
- There are 10 critical streambank sites, eroding at greater than 10 tons per year, that deliver an estimated 105 tons of sediment annually to streams. Control of sediments from critical stream sites will achieve a 29 percent control of the reduction goal of 356 tons per year.

Dry Run Erosion

- Approximately 57 miles of inventoried dry runs deliver an estimated 988 tons of sediment annually to streams. Dry run erosion contributes five percent of the total annual sediment load to surface waters.
- Four critical dry run segments are estimated to deliver 50 tons per year of sediment. Control of critical dry run segments will control 18 percent of the sediment reduction goal from dry runs.

Wetlands Inventory

- Approximately 4,200 acres of wetlands were inventoried, utilizing Natural Resources Conservation Service maps, air photos and DNR wetland inventory maps. About 1,300 wetland acres (31 percent) have been disturbed by draining, farming or other human uses.

Groundwater Pollutant Inventory

- A total of 166 private well samples were analyzed for nitrates, and 126 well samples were analyzed for atrazine. About 82 percent of wells sampled for nitrates tested at or above the Preventive Action Limit (PAL) of 2.0 mg/l. About 29 percent of wells sampled for atrazine tested at or above the PAL of 0.3 ppb. Concentrations of a substance exceeding the PAL indicate potential groundwater contamination problems, and efforts to control contamination are recommended. An additional 44 percent of the wells sampled had detectable levels of atrazine, but were below the PAL.
- About 25 percent of wells sampled for nitrates tested above the Enforcement Standard (ES) for environmental health of 10.0 mg/l. About 2% of wells sampled for atrazine tested above the ES of 3.0 ppb. Concentrations of substance exceeding the ES indicate a need to take action to reduce the concentration of the pollutant.
- No pattern of groundwater contamination can be linked to specific sources based on this survey. However, the levels of contamination found indicate that groundwater in the watershed is susceptible to contamination, and efforts to protect drinking water should be undertaken.

Total Suspended Solids (TSS) and Toxic Pollutants in Urban Areas

- Current land uses were inventoried for four urban communities in the watershed, the Villages of Hammond and Roberts, and the Cities of Prescott and River Falls. Land uses included low- and medium-density residential, commercial, industrial, and open space. TSS loads were calculated for River Falls, using a model known as "P-8". Regression equations calibrated for the area were then used to estimates pollutant loads for total Kjeldahl nitrogen, copper, lead and zinc. Pollutant loads were also estimated based on projected land use changes.
- For the other communities, TSS loads were estimated using the Source Loading and Management Model (SLAMM). The regression equations used for the City of River Falls were then applied to estimate loads for the other toxic pollutants listed above.
- Urban land uses are estimated to contribute 622 tons per year of sediment to surface waters, or five percent of the total annual sediment load in the watershed.

Construction Site Erosion

- Erosion from new construction sites is estimated to deliver about 720 tons of sediment annually to surface waters within the watershed. This source contributes three percent of the total annual sediment load to surface waters.
- Over 50 percent of this sediment load is coming from developing areas in and around the City of River Falls.

Thermal Pollution

- Maximum, minimum and mean stream temperatures were monitored continuously at sites above, within and below the City of River Falls during 1996 and 1997. The impoundments, Lake George and Lake Louise, were shown to have an overall constant warming effect of about 3^0 C. (5^0 F.) on downstream water temperatures during base flow. The impoundments were also shown to have significant impacts on stream flow during trash rack cleaning operations.

- Storm events monitored showed an increase in stream temperatures below stormwater outfalls. The thermal impact of stormwater is affected by numerous factors, including initial stream water temperature and flow, air temperature, ambient land surface temperatures, and the length, timing and duration of the storm.

Management Goals and Objectives

Overall project goals are to:

- protect and enhance the water quality in the streams and lakes in the Kinnickinnic River Watershed,
- protect, enhance and restore wetlands within the watershed
- protect and enhance the groundwater resources from nonpoint source pollutants, especially through protection of sinkholes and wellhead protection planning, and
- protect and enhance the thermal regimes in the Kinnickinnic River and its tributaries, to protect and enhance the cold water ecosystems.

Specific pollutant reduction objectives are described below. These reduction objectives are based upon inventory results, and an analysis of the potential for cost effectively controlling pollutant sources using available BMPs.

Sediment Reduction Objectives

The overall objective is to reduce sediment loads delivered to the Kinnickinnic River and its tributaries by 30 percent annually. To meet this objective, the sediment reductions shown in Table S-2 are needed.

Table S-2. Sediment Reduction Objectives for the Kinnickinnic River Watershed

Source	Inventoried Sediment Load (T/yr)	Percent of Total	Planned Percent Reduction	Planned Sediment Load (T/yr)
Cropland	16,824	78%	25%	12,618
Streambank	600	3%	60%	240
Dry Runs	988	5%	30%	593
Urban Runoff*	1,223	5%	35%	795
Construction Sites	720	3%	70%	216
Total	20,355	100%	30%	14,462

Source: St. Croix Co. LCD (based on WINHUSLE inventory).
*Estimated future load. Source: DNR (based on SLAMM modeling and River Falls Water Management Plan)

Nutrient Reduction Objective

The nutrient reduction objective is to achieve a 30 percent reduction in the current annual phosphorus load leaving the Kinnickinnic River Watershed and reaching the St. Croix River. In order to achieve this objective, the following nutrient reduction will be needed:

- Reduce Combined Oxygen Demand (COD) from barnyards by 35 percent, or 82,330 pounds annually.
- Reduce by 25 percent the delivery of phosphorus to streams from eroding croplands. This reduction will be achieved by reaching the sediment reduction objective.
- Reduce excess application of nutrients to croplands by entering 60 percent of croplands into nutrient and pesticide management planning.

Groundwater Protection Objective

The groundwater protection objective is to prevent an increase or expansion of areas impacted by nitrates and atrazine, and to prevent contamination of community water supplies. To meet this objective, the following are needed:

- Reduce excess application of nutrients to croplands by entering 60 percent of croplands into nutrient and pesticide management planning.
- Increase buffers around sensitive areas such as sinkholes and intermittent waterways.
- The Village of Roberts and City of River Falls should write Wellhead Protection Plans to protect the investment they have in their community wells. The City of Prescott should implement their wellhead protection plan, as anticipated in mid-1999. The Village of Hammond should continue with wellhead protection plan development and approval, as anticipated, in late 1998 or early 1999.

Wetland Habitat Restoration Objective

- The goal for wetland restoration is at least 10 percent (425 acres) of wetlands inventoried. The focus will be on restoration of wetlands that drain to the Kinnickinnic River or its tributaries, particularly those associated with springs.

Thermal Pollution Control Objective

- Maintain thermal regimes of the Kinnickinnic River and its tributaries that are at least as good as existing conditions. To achieve this goal, best management practices should be utilized during land development so that the "effective" impervious cover is no greater than 15 percent.
- Maximize infiltration of stormwater, with highest priority placed on designing site development to minimize impervious surfaces and on-site infiltration. More costly practices such as infiltration basins and detention ponds designed to minimize thermal pollution may also be considered where warranted.
- The plan may be amended to reflect the outcome of ongoing thermal monitoring and modeling studies.

Total Suspended Solids (TSS) and Toxic Pollutants in Urban Areas Reduction Objectives

The stormwater runoff pollutant control objective is to reduce by 35 percent, the TSS load to lakes and streams that would occur by 2017, if the current level of stormwater runoff control effectiveness is applied to new development. This goal can be achieved by a combination of retrofitting developed drainage areas with stormwater controls, and planning new development to maximize infiltration of runoff on-site. The following reductions will be needed:

- A 60 percent reduction in the *potential* future loads that are estimated will come from currently undeveloped areas by 2017. Many low-cost and very effective on-site measures to maximize infiltration can be applied to new development during the planning phase. To meet this goal, it will be necessary to maintain an *effective* imperviousness of no more than 15 percent. Appendix B, as discussed in Chapter Three of this plan, identifies stream protection strategies that can be used to meet this objective.

- A 10 percent reduction in runoff pollutant loads from developed urban areas. To meet this objective, constructing new detention ponds or infiltration areas, or enhancing the effectiveness of existing ones may be feasible. In many cases, there is no available land, or costs are too prohibitive for this approach. The City of River Falls Water Management Plan assesses stormwater control alternatives for drainage areas, and will be utilized in meeting this objective.

Project Implementation Strategy

The eight designated subwatersheds of the Kinnickinnic watershed have varying mixes of urban, rural and growth areas. Each subwatershed, or drainage areas *within* a subwatershed can be characterized as "Rural", "Urban" or "Growth", based on the amount of impervious land draining to a delineated stream segment. Current and planned land uses, in combination with identified pollutant management priorities, can be used to develop suitable arrays of Best Management Practices (BMPs), and a management strategy can be developed and implemented for each subwatershed or drainage area.

Rural drainage areas currently have less than 15 percent imperviousness, and imperviousness is not projected to increase by an additional 10 percent within the next twenty years. Rural drainage areas will primarily implement rural BMPs throughout the life of the watershed project. Areas where surface and groundwater impacts are greatest will benefit most from rural BMP's.

Urban drainage areas currently have greater than 15 percent imperviousness and imperviousness is not projected to increase by an additional 10 percent within the next twenty years. Urban drainage areas may need "retrofitting", utilizing urban BMPs, based on the cost effectiveness of the project. These practices include ordinance development and implementation, wellhead protection, "housekeeping" practices (such as street sweeping and reduction in urban fertilizer, herbicide and pesticide use), and in some cases structural practices to control stormwater pollution.

Growth drainage areas:

(a) currently are rural (less than 15 percent imperviousness), and imperviousness is projected to increase by an additional 10 percent within the next twenty years, or
(b) currently are urban (more than 15 percent imperviousness) and imperviousness is projected to increase by an additional 10 percent within the next twenty years.

Thus, growth areas can be designated whether the land use is currently rural or urban. Impacts in these areas are likely to include increased stormwater runoff, reduced groundwater recharge, increased thermal pollution from runoff flowing over hot impervious surfaces, and increased pollutants carried in runoff. Growth areas may utilize a combination of rural and urban BMPs. Management in these areas will require some unique approaches, and should be targeted for coordination among local governing units. Growth strategies should minimize increases in runoff and thermal pollution, and increase groundwater recharge while at the same time ensuring groundwater protection.

Information and Education

The Information and Education Program objective is to support improving and protecting water resources in the Kinnickinnic River Watershed through outreach and educational activities. Information and education is seen as part of an approach to obtain positive change through:

- increased awareness, knowledge, and skills;
- providing technical and financial assistance; and,
- regulations.

Those who live, work, and recreate in the Kinnickinnic River Watershed will not request project assistance, follow project recommendations, or willingly submit to regulations unless they first are aware of the problems and understand how to apply the solutions. An informed and educated public is required for the project to be successful.

Specific audiences and educational topics have been identified within the Kinnickinnic River Watershed. Annual information and education implementation plans will be developed by the project manager and Steering Committee. Plans will chart out what activities are to be done, when they are going to done, who will do them, and at what cost to the project. An "eight-step outreach approach" has been designed to assure successful planning and implementation of educational activities.

A "Kinni Karetakers" program will promote involvement of individuals and groups in activities that improve and protect the rivers, streams and groundwater found in the Kinnickinnic River Watershed. It includes resource materials, suggested activities and participation incentives for schools, youth groups and adults.

Integrated Resource Management

There are many existing state, federal and local resource management programs and local resource protection groups which provide benefits for water quality and/or fish and wildlife resources in the Kinnickinnic River Watershed. Watershed staff and the Steering Committee plan to coordinate the efforts of these programs to provide the best possible management of land and water resources in the watershed. This comprehensive approach will facilitate consideration of the various goals and objectives for all these programs.

The Kinnickinnic River Watershed Project will be coordinated with the conservation features of the Wisconsin Farmland Preservation Program (FPP) administered by the Department of Agriculture, Trade and Consumer Protection (DATCP), and the Federal Food Security Act (FSA) administered by the Farm Service Agency (FSA) and the Natural Resource Conservation Service (NRCS). Federal programs available which may have water quality implications include the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP), the Wetland Reserve Program (WRP), the Wildlife Habitat Incentives Program (WHIP), and the Environmental Quality Incentive Program (EQIP). These programs generally involve cost-sharing to landowners for beneficial land management practices. Project staff plan to utilize these and other funding sources, as they become available, to accomplish project goals.

Additionally, many local groups and organizations have an interest in the Kinnickinnic River Priority Watershed Project. Project staff and the Steering Committee will seek assistance, when appropriate, from these groups during implementation. Area groups and organizations include Mainstreet Groups, Boy and Girl Scouts, Future Farmers of America, UW-Extension Master Gardeners, Trout Unlimited, Ducks Unlimited, Kinnickinnic River Land Trust, Pheasants Forever, Wisconsin Waterfowl Foundation, Whitetail Unlimited, Sportsmen's Alliance, Rod and Gun Clubs, Citizens for Responsible Zoning and Landowner Rights, Inc., Environmental Clubs in schools, Elementary and Secondary Schools, University of Wisconsin-River Falls, University of Wisconsin-Extension, Town and County Boards, City and Village Councils and private individuals.

Best Management Practice Eligibility Criteria and Critical Sites

Barnyard Runoff

The goal for barnyard runoff is to reduce the annual COD load of 235,222 pounds by 35 percent. Barnyard sites contributing a COD load greater than 20,000 pounds annually will be designated as **"critical"** sites for control. Those landowners with an animal lot designated as a critical site for control will be required to install clean water diversion practices and control COD down to 10,000 pounds annually. Installation of these low-cost, required, practices will reduce the current annual load by 13 percent, and will achieve a 37 percent control of the annual reduction goal of 82,328 pounds of COD.

Barnyard sites that contribute between 2,000 pounds and 20,000 pounds of COD annually, will be considered **eligible** for cost-sharing. There are approximately 26 landowners with animal lots in this category. Voluntary participation by eligible livestock operations will be the most expedient and cost effective method of controlling the manure runoff and will be essential for attaining the COD reduction goal. Landowners in this voluntary category are eligible for cost sharing on clean water diversion practices. Installation of these low-cost, practices will reduce the current annual load of COD by 22 percent, and will achieve a 63 percent control of the annual reduction goal of 82,328 pounds of COD. These reduction amounts are based on an estimated 75 percent participation rate of eligible sites.

Barnyard sites that contribute less than 2000 pounds of COD annually **will not be eligible** for cost sharing. There are approximately 71 landowners with animal lots in this category.

Those landowners installing low cost clean water diversions or roof gutters will be encouraged to develop an nutrient and pest management plan. All nutrient and pest management plans will be developed with a certified crop consultant, or farmer-developed and approved by knowledgeable county conservation staff.

Table S-3. Barnyard Runoff Pollutant Reduction Objective is 35% (82,328 pounds/year of COD).

Management Category	Eligibility Criteria (lbs/yr of COD)	Number of barnyards	Amount Controlled (lbs/yr of COD)	% of Total COD Annual Load	% of COD Annual Reduction Objective
Critical	>20,000	2	30,499	13%	37%
Eligible	>2,000, ≤ 20,000	26	51,829	22%	63%
Not Eligible	≤ 2,000	71	0	65%	0
Control Totals			82,328	35%	100%

Source: St. Croix County LCD (BARNY modeling)

Cropland Nutrient and Pesticide Application

All 73,000 acres of cropland in the Kinnickinnic River Watershed will be **eligible** for cost sharing for development of nutrient and pest management plans. County manure storage ordinances require Nutrient Management Planning on farms where manure storage facilities are installed.

It is a goal of the Kinnickinnic River Priority Watershed Project to implement Nutrient and Pest Management Planning as a practice on all farms which participate in agricultural cost-shared practices.

Cropland Sediment

The goal for cropland sediment is to reduce the annual sediment load of 16,824 tons by 25 percent. Fields with sediment loss exceeding "T", and delivering greater than 0.9 tons/acre/year of sediment are **critical sites**, and must be reduced to below "T". There are an estimated 997 "critical" acres of cropland, delivering an estimated 1226 tons per year, at an average rate of 1.2 tons/acre/year. Landowners with land designated as "critical" will be required to install practices and control sediment delivery down to 0.3 tons/acre/year. If all critical acres are reduced to 0.3 tons/acre/year, 930 tons would be controlled, achieving a 22 percent control of the annual reduction goal of 4,206 tons, and a seven percent reduction of the total cropland sediment load.

Fields delivering sediment at a rate greater than or equal to 0.2 tons/acre/year **eligible**. About 49,712 acres of eligible cropland deliver an estimated 14,500 tons/year of sediment at an average rate of 0.3 tons/acre/year. If 75 percent of eligible acres are reduced to a delivery rate 0.20 tons/acre/year, about 3,276 tons would be controlled. Control of sediments from eligible fields will achieve a 75 percent control of the reduction goal of 4,206 tons/year, and an 20 percent reduction of the total cropland sediment load.

Table S-4. Cropland Sediment Reduction Objective is 25% (16,800 tons per year)

Management Category	Eligibility Criteria	Number of Acres	Amount Controlled (tons/yr of sediment)	% of Total Annual Sediment Load	% of Sediment Annual Reduction Objective
Critical	>"T" and >0.9 T/ac/yr	997	930	5%	22%
Eligible	≥ 0.2 T/ac/yr	49,712	3,276	20%	78%
Not Eligible	<0.2 T/ac/yr	22,247	0	75%	0
Control Totals			4,206	25%	100%

Source: St. Croix Co. LCD (based on WINHUSLE inventory).

Gully Erosion

A field inventory of gully erosion was not done because gullies often are temporary and are difficult to identify during an inventory. During runoff events, the gullies erode and aggrade; but after the runoff has dissipated, they may appear no different than the surrounding land.

When working with landowners, LWCD staff will attempt to highlight areas susceptible to gully erosion and examine options for prevention and/or treatment. Any active gully site that is determined by county LWCD staff to be cost-effective will be eligible for structural practices in order to stabilize the area. Soil erosion that occurs from gully activity on cropland will mainly be controlled through the installation of structural practices such as grassed waterways and/or grade stabilization structures. In some instances, other Best Management Practices such as no-till residue management or contour strips may alleviate the need for such structural practices.

Streambank Erosion

Streambank sites eroding at greater than 10 tons of sediment annually, and caused by animal access or landowner management practices are designated as **"critical".** There are 10 critical sites, all in the Middle Kinnickinnic Subwatershed. These sites deliver 105 tons of sediment annually to streams, and account for 18 percent of the 600 ton annual load.

Streambank sites eroding at five tons or more per year are designated **"eligible".** There are 18 eligible sites that deliver 358 tons/year to streams. If 70 percent of eligible sites are treated, 251 tons/year of sediment from eligible sites can be controlled. This is 42 percent of the 600 ton annual load.

Sites that erode at less than five tons per year are designated **"ineligible"** for cost sharing. However, if a landowner has an eligible site, other eroding sites on the property may be cost shared if the county LWCD staff determines that control is cost effective.

Table S-5. Streambank Erosion Reduction Objective is 60% (363 tons/year).

Management Category	Eligibility Criteria	Number of Sites	Amount Controlled (tons/yr of sediment)	% of Total Annual Sediment Load	% of Sediment Annual Reduction Objective
Critical	>10 T/site/yr and animal access	10	105	18%	29%
Eligible	≥ 5 T/site/yr	17	251	42%	71%
Not Eligible	< 5 T/site/yr				
Control Totals			356	60%	100%

Source: St. Croix Co. LCD .

Dry Run Erosion

Dry runs that are cropped or pastured, and at least 1700 feet or more in length will be designated **"critical".** Critical sites must be stabilized with permanent vegetative cover, using BMPs such as grassed waterways, critical area stabilization, wetland restoration, or in some cases, easements.

Any cropped or pastured dry runs are considered **"eligible"** for practices that establish permanent vegetative cover.

Table S-6. Dry Run Erosion Reduction Objective is 30% (285 tons/year).

Management Category	Eligibility Criteria	Number of Miles	Amount Controlled (tons/yr of sediment)	% of Total Annual Sediment Load	% of Sediment Annual Reduction Objective
Critical	≥1700 ft long and cropped or pastured	1.6 (4 sites)	50	5%	18%
Eligible	All cropped or pastured dry runs	31.7	235	24%	82%
Control Totals			285	30%	100%

Source: St. Croix Co. LCD.

Total Suspended Solids (TSS) and Toxic Pollutants in Urban Areas

Priority for cost-share funding will be given to cost-effective non-structural and structural activities such as:

- Planning for new development that maximize infiltration, including minimizing roadways, rooftops, driveways and parking areas; protecting sensitive areas; and establishing buffer corridors
- Implementing urban best management practices, such as street sweeping, regulating pet wastes, leaf and grass clipping collection
- Educational efforts, such as storm drain stenciling
- Stormwater management planning and ordinance development
- On-site low-cost infiltration techniques and devices such as directing downspouts to vegetated areas; crown driveways to direct drainage to grass; perimeter infiltration for parking lots; grassed swales along roadways

Where more control than can be obtained with on-site infiltration is needed, retention ponds or infiltration basins may be appropriate. The needed capacity for these structures should be minimized by making maximum use of on-site infiltration options. Where detention ponds are necessary, special design considerations should be incorporated to minimize thermal pollution impact. Feasibility studies may be needed to select site specific infiltration and wet detention practices consistent with this watershed plan.

The City of River Falls Water Management Plan (1995) will facilitate implementation, and will be referred to in determining stormwater management priorities and cost effectiveness. In 1998, River Falls adopted a stormwater utility for the purposes of water quantity and water quality control. A stormwater utility allows for a self-sustaining method of financing stormwater control. An annual revenue of approximately $180,000 is anticipated. This could provide for treatment of between 10 and 25 impervious acres annually.

Construction Site Erosion

It is highly recommended that local governmental units either together or independently, apply for a Local Assistance Grant through the Priority Watershed program to hire a municipal engineer to review construction site erosion control plans and enforce a construction site erosion control ordinance. Communities are eligible to receive financial support for construction site erosion control ordinance preparation and implementation.

Thermal Pollution

Many of the activities eligible for cost-sharing to control stormwater pollutants will also help to minimize thermal pollutants. A thermal modeling study is underway, and when it is complete, it can be used to identify cost effective thermal management strategies.

Project Implementation Costs

Project implementation is scheduled to begin in April 1999, and continue for a period of 10 years. During the first five years of implementation, cost-share agreements with eligible landowners may be signed. Voluntary participation will be emphasized throughout the project. Sites determined as critical will be a priority. Other sites will be targeted for pollution control based on identified priorities and ongoing inventory information. Practices listed on any cost-sharing agreement must be installed before the end of the implementation phase. The implementation phase of this project is scheduled to conclude in 2009.

Table S-7. State Share of Total Project Costs at 75 percent Landowner Participation

Item	Rural Costs		Urban and Developing Area Costs	
	State Share	Local Share[1]	State Share	Local Share[1]
Cost-Share Funds: Practices	$1,498,989	$642,541	$1,686,915	$4,293,609
Cost-Share Funds: Easements	$100,000	$0	$0	$0
Local Assistance Staff Support	$1,255,000	$418,333	$160,000	$310,000
Information and Education Direct	$30,000	$0	*	*
Other Direct (travel, supplies, etc.)	$5,000	$0	*	*
Engineering Assistance	$10,000	$0	*	*
Professional Services	$10,000	$0	*	*
TOTAL	$2,908,989	$1,060,874	$1,846,915	$4,603,609
TOTAL STATE SHARE	$4,755,904			
TOTAL PROJECT COSTS	$10,420,387			

* Included with staffing

Source: DNR, DATCP, and St. Croix and Pierce County Land Conservation Departments

[1] Local share is paid by the landowner or as in-kind contributions from the local unit of government.

Project Evaluation and Monitoring

The evaluation plan for the Kinnickinnic River Priority Watershed includes:

- Administrative review - The administrative review will focus on the progress of St. Croix and Pierce Counties and other units of government in implementing the watershed plan. The project will be evaluated with respect to accomplishments, financial expenditures, and staff time spent on project activities.

- Pollution reduction evaluation - The St. Croix and Pierce County LWCDs will track the reductions in nonpoint source pollutant loads that result from changes in land use practices. These pollutant load reductions should be reported annually to the DNR and DATCP.

- Water resource monitoring - The *Kinnickinnic River Priority Watershed Surface Water Resources Appraisal Report* (DNR, 1998) describes in detail the methods used and data collected in order to evaluate the current (baseline) water resource conditions in the Kinnickinnic River Watershed. Partners of the watershed project should commit to collecting data necessary to allow for a periodic comparison of water resource conditions to baseline conditions. Assuming limited resources, monitoring efforts should be focused on sites where land use changes, including best management practices, are likely to impact water quality conditions.

Information on the first two components should be collected by the St. Croix and Pierce County Land and Water Conservation Departments (LWCDs) and reported on a regular basis to the DNR and the DATCP. The project staff and the DNR generally meet early in the year throughout the implementation phase to review and evaluate the accomplishments of the preceding year.

CHAPTER ONE
Purpose, Legal Status and General Description

This chapter describes the Wisconsin Nonpoint Source (NPS) Water Pollution Abatement Program, including the legal status of the Kinnickinnic River Priority Watershed Project Plan, a summary of the planning and implementation phases of the Project, and the Plan approval process. It also includes a map of the watershed land use and location information for the Kinnickinnic Watershed. This section is organized in the following manner:

- History of the Wisconsin NPS Pollution Abatement Program
- Legal status of the Kinnickinnic River Priority Watershed Project
- Priority Watershed Project Planning and Implementation Phases
- Kinnickinnic River Watershed location and land use information

History of the Wisconsin Nonpoint Source Water Pollution Abatement Program

The State Legislature created the Wisconsin Nonpoint Source Water Pollution Abatement Program in 1978. The goal of the Program is to improve and protect the water quality of streams, lakes, wetlands, and groundwater by reducing pollutants from urban and rural nonpoint sources.

Pollutants from nonpoint sources are carried to surface water or groundwater through rainfall runoff or seepage, and snowmelt. Sources of nonpoint pollution include: (1) runoff and erosion from established urban areas and rapidly developing areas, (2) eroding agricultural lands, (3) eroding streambanks, (4) runoff from livestock wastes and (5) agricultural practices.

The Department of Natural Resources (DNR) administers the program in cooperation with the Department of Agriculture, Trade and Consumer Protection (DATCP). Wisconsin is divided into 333 discrete hydrologic units called watersheds. These watersheds are assessed for water quality concerns as part of a comprehensive basin planning program. Watersheds with a potential high degree of water quality impairment from nonpoint sources of pollution become eligible for consideration as a priority watershed project. Currently, there are 130 eligible watersheds. Of these, 86 have been in the nonpoint source program; 24 are completed and 62 are

active. Designation as a priority watershed project enables, special financial support to local governments and private landowners in the watershed to reduce nonpoint source pollution.

Legal Status of the Nonpoint Source Control Plan

Priority Watershed Plans are prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 281.20 and 281.65 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. Plans are prepared through the cooperative efforts of the DNR, DATCP, County Land Conservation Departments, local units of government and a Citizen Advisory Committee (referred to as "Steering Committee" for the Kinnickinnic River Priority Watershed Project).

The watershed plan is the basis for the DNR to enter into cost-share and local assistance grants with agencies responsible for project implementation. The plan will be used as a guide to implement measures to achieve desired water quality conditions. If a discrepancy occurs between this plan and the statutes or the administrative rules, or if statutes or rules change during implementation, the statutes and rules will supersede the plan. This watershed plan does not in any way preclude the use by local, state or federal governments of normal regulatory procedures developed to protect the environment. All local, state and federal permit procedures must be followed. In addition, this plan does not preclude the DNR from using its authority under chapters 281, 283, 285, 289, 291, 292, 293, 295 and 299 of the state statutes to regulate significant nonpoint pollution sources in the project area.

Plan Adoption and Amendment Process

This plan is subject to the amendment process under NR 120.08(4) for substantive changes. The DNR makes a determination with the local sponsors, if a proposed change will require a formal plan amendment.

Relationship of the Nonpoint Source Control Plan to the Stormwater Discharge Permit Program

Wisconsin's Pollution Discharge Elimination System (WPDES) Storm Water Permit Program is administered by DNR's Bureau of Wastewater Management under Sec. 283 of the Wisconsin Statutes and Ch. NR 216 Wis. Admin. Code. The WPDES permit program applies to certain classes of dischargers statewide as identified in NR 216. Some activities regulated by the WPDES program are similar to activities identified in the watershed plan. Priority Watershed Project implementation grants may be used to fund some permit activities, including construction site erosion control ordinance development, storm water ordinance development and stormwater management plans. Practices to control erosion and stormwater runoff from *new development* are not eligible for cost sharing.

Priority Watershed Project Planning and Implementation Phases

A priority watershed project is guided by a plan prepared cooperatively by the DNR, DATCP and local units of government, with input from a local citizen's advisory committee. For the Kinnickinnic River Priority Watershed, this advisory committee is identified as the Steering Committee. The project manager and other local staff funded by the priority watershed program, and Steering Committee members, along with DATCP and DNR staff, evaluate the conditions of surface water and groundwater, and inventory the types of land use and nonpoint sources of pollution throughout the watershed. The priority watershed plan assesses nonpoint and other sources of water pollution and identifies best management practices (BMPs) needed to control pollutants to meet specific water resource objectives. The plan guides implementation of these practices in an effort to improve water quality. The Priority Watershed Plan approval process is illustrated in Figure 1-1.

Upon approval by state and local authorities, local units of government may implement the plan. Water quality improvement is achieved through implementation of nonpoint source control best management practices (BMPs) and the adoption of ordinances. Landowners, land renters, counties, cities, villages, towns, sanitary districts, lake districts, and regional planning commissions are eligible to participate.

Technical assistance may be provided to aid in the design of BMPs. State level cost-share assistance is available to help offset the cost of installing these practices. Eligible landowners and local units of government are contacted by the local staff funded by the Priority Watershed Program, to determine their interest in installing the BMPs identified in the plan. Signed cost-share agreements list the practices, costs, cost-share amounts and a schedule to install management practices. Municipal governments are also assisted in developing and installing BMPs to reduce urban pollutants.

Informational and educational activities are developed by the project manager with assistance from the Steering Committee, to encourage participation.

The DNR and DATCP review the progress of the counties and other implementing units of government, and provide assistance throughout the ten-year project. The DNR monitors improvements in water quality resulting from control of nonpoint sources in the watershed.

Summary of the Planning Phase

The planning phase of the Kinnickinnic River project began in 1995. The following information gathering and evaluation activities were completed during this stage:

- Determine the conditions and uses of groundwater, streams and lakes.
- Inventory types of land uses and severity of nonpoint sources affecting groundwater, streams and lakes.

- Evaluate the types and severity of other factors which may be affecting water quality. Examples include discharges from municipal wastewater treatment plants and natural or endemic stream conditions.

- Determine nonpoint source controls and other measures necessary to improve and/or protect water quality.

- Prepare and gain approval of a program for local implementation so that plan recommendations will be carried out.

Summary of the Implementation Phase

The implementation phase of the Kinnickinnic River Priority Watershed Project begins following acceptance of the plan by the DNR, the state Land and Water Conservation Board (LWCB), and the Board of Supervisors for St. Croix and Pierce Counties. Public review during plan development occurred primarily through the efforts of the Kinnickinnic River Watershed Citizen Steering Committee (see Figure 1-1).

During the implementation phase:

- DNR enters into local assistance agreements with local units of government that have implementation responsibilities identified in the plan. These agreements provide funds necessary to maintain the resources and staff required for plan implementation.

- In the rural portions of the watershed, the St. Croix and Pierce County LCDs contact eligible landowners to determine their interest in installing best management practices identified in the plan.

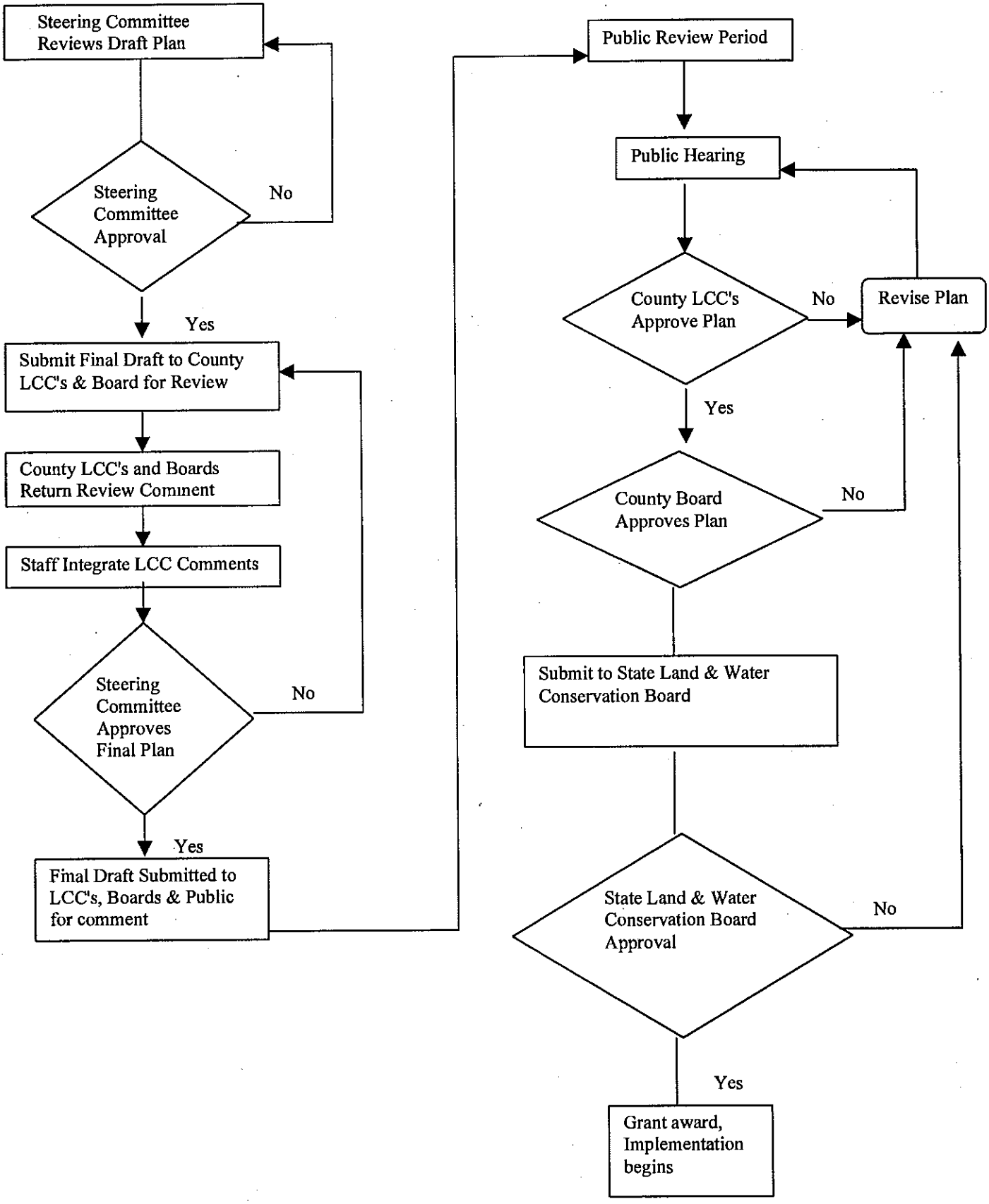
- In the urban portions of the watershed, the DNR or its designee contacts local units of government to discuss in detail the actions needed for implementing the plan recommendations.

- In rural areas, the landowner signs a cost-share agreement with the county that outlines the practices, costs, cost-share amounts and a schedule for installation of management practices. Practices are scheduled for installation after an agreement is signed. Practices must be maintained for at least 10 years. Easements purchased by the county must be for a period of at least 20 years, and easements purchased by the DNR will be perpetual.

  In urban areas, similar processes are used. In some cases, the local units of government and the DNR sign agreements for urban practices. In other cases the agreements will be between local units of government and private landowners.

PRIORITY WATERSHED PLAN APPROVAL PROCESS

FIGURE 1-1



Location and Land Use Information

The Kinnickinnic River Watershed is a 174-square-mile drainage area located in St. Croix and Pierce counties, approximately 20 miles east of the Twin Cities in Minnesota (DNR, 1994a) (map S-1). Gently rolling agricultural land comprises most of the watershed . The rapidly growing city of River Falls straddles the Kinnickinnic River on the St. Croix and Pierce County border. The Kinnickinnic River Watershed is at the mouth of the St. Croix River Basin.

Civil Divisions

Incorporated areas in the watershed include the cities of Prescott and River Falls and the villages of Hammond and Roberts. St. Croix County Townships in the watershed are Hammond, Warren, Kinnickinnic, Troy, Baldwin, Erin Prairie, Emerald and Hudson. Pierce County Townships are River Falls and Clifton. Public land within the watershed includes the Kinnickinnic River State Park, Kinnickinnic River Streambank Protection Area, three federal Waterfowl Production Areas and the Casey Lake Wildlife Area. Map S-1 shows civil divisions.

Population Size and Distribution

About 25,300 people live in the Kinnickinnic River Watershed, with approximately 70% in cities or villages. Towns and villages have a growth rate over the past decade of about 20 percent. Regional trends suggest that the watershed's population will expand rapidly.

Land Uses

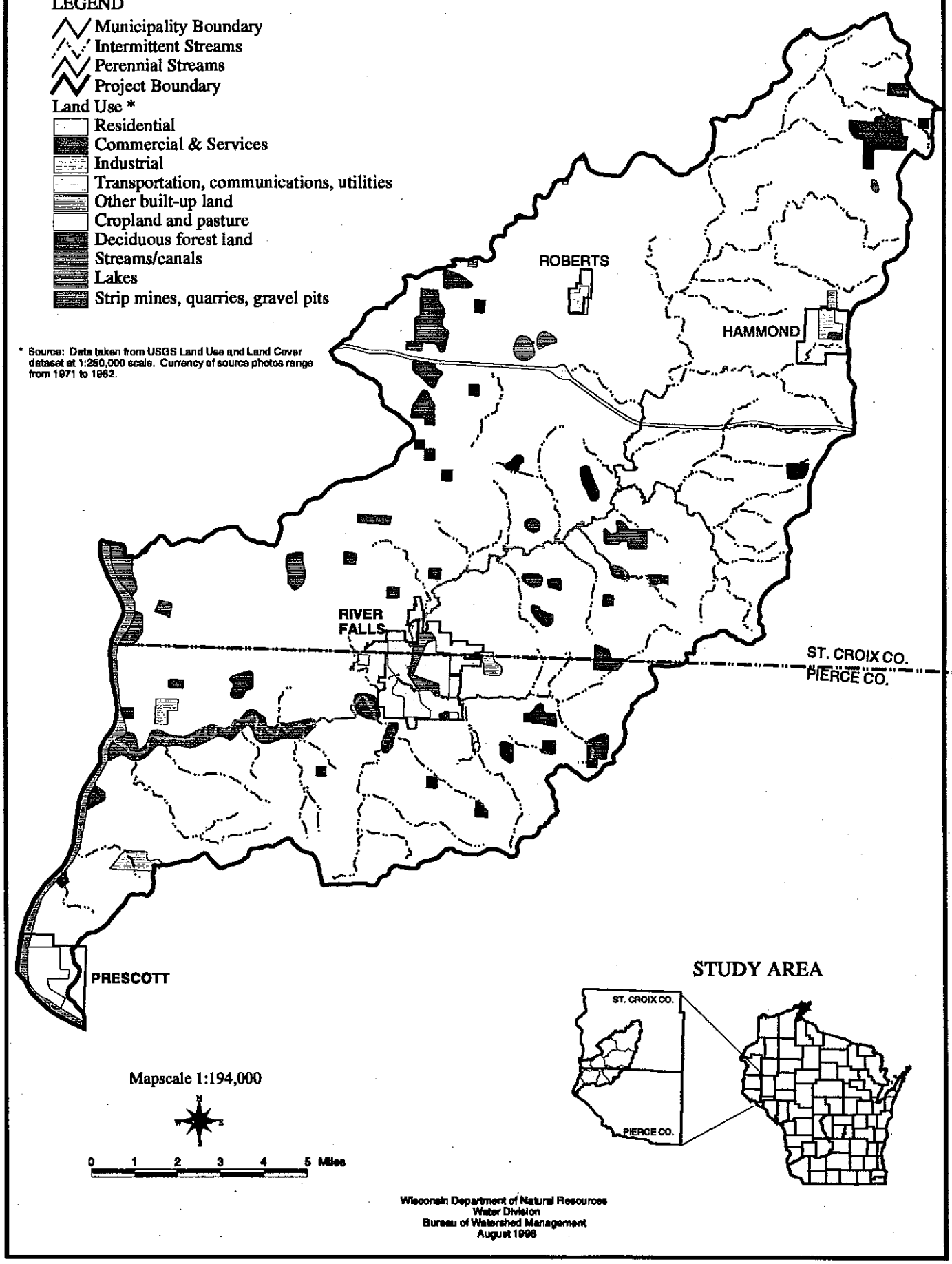
Rural land uses predominate in the watershed. Agriculture is the most important land use, comprising 78 percent. Dairy farming and cash cropping are the primary enterprises, with the average farm size being 205 acres. Woodlands cover 12 percent of the land area. Urban land uses occupy about five percent of the watershed (Table 1-1). Map 1-1 shows land uses in the watershed.

Table 1-1. Summary of Land Uses in the Kinnickinnic River Watershed

Land Uses	Acres	Percent
Agricultural	84,036	78%
Pasture	*8,220*	
Cropland	*72,956*	
Farmstead	*2,860*	
Woodland	12,650	12%
Urban	5,391	5%
Wetland	3,092	3%
Natural Area	2,632	2%
TOTAL	107,801	100%

Source: St. Croix Co. LCD (based on WINHUSLE inventory).
Urban acres based on information obtained from cities and villages for SLAMM modeling.

Map 1-1. Land Use within the Kinnickinnic River Watershed



CHAPTER TWO
Watershed Conditions

This chapter describes human impacts on and uses of the Kinnickinnic River, physical characteristics of the watershed, and the existing water resources. It also describes water use classifications and defines water quality goals and project objectives. Goals and objectives for the water resources in the Kinnickinnic River Priority Watershed are summarized, and detailed in Table 2-1. This chapter is organized in the following manner:

- Human impacts on and uses of the Kinnickinnic River
- Physical Characteristics of the Kinnickinnic River Watershed
- Summary of Water Resources of the Kinnickinnic River Watershed
- Water Use Classifications
- Definition of Water Quality Goals and Project Objectives
- Summary of Goals and Objectives for the Kinnickinnic River Watershed

Human Impacts on and Uses of the Kinnickinnic River

The Kinnickinnic River suffered its worst water quality conditions in the early to mid 1900's. Beginning in the late 1800's, prairies and woodlands were severely altered by human settlement, logging and intensive farming. These conditions and the presence of a number of mill and power dams on the river caused a loss of native trout species. Fish surveys in 1938 reported the upper river to be warm an sluggish, with few trout, and the lower river populated by rough fish. With the advent of soil conservation practices, removal of a number of dams and upgrading of the River Falls sewage treatment plant, water quality conditions improved. By the early 1970's river temperatures had dropped about 10 degrees, and by the late 1970's the brown trout population had rebounded. Appendix A is a history of events on the river, assembled by the Kinnickinnic River Land Trust and the area DNR Fish Manager.

Human Use

Human use and benefits from the Kinnickinnic River extend beyond the sport oriented recreational use that most frequently comes to mind. The presence of the river adds character and quality of life to the citizens of the City of River Falls and surrounding area. It provides a pleasant natural environment close at hand, and contributes to economic prosperity by enhancing the attractiveness of the community to businesses and residents. It also serves as an outdoor classroom for local schools, and for the University of Wisconsin-River Falls, located on the South Fork.

Recreational Use
The Kinnickinnic River is a premiere Midwest trout stream, with a self-sustaining brown and brook trout populations. The river attracts anglers from throughout the region, with very heavy usage on opening weekend, and at other times during late spring. Spring also brings canoeists and kayakers to the lower river. During the summer, local citizens fish for carp or other rough fish in the impoundments, and use the riverside parks and trails for walking and birdwatching. Snowshoeing, hiking, cross country skiing and trapping have been observed during the winter months, both above and below River Falls (personal communication, Craig Olson).

Kinnickinnic River State Park, at the mouth of the Kinnickinnic River, provides many recreational opportunities. An estimated 25,000 to 30,000 anglers access the river from the park annually. Annual attendance at the park is estimated to be 250,000. About a third of these users come to picnic, fish, swim, enjoy the view from the bluffs, and hike the 7-plus miles of trails. Twenty to 25 canoeists are estimated to come down the river per weekend during the summer. Two-thirds of the park visitors are boaters that access the park from the St. Croix River, and come to the park primarily to swim and recreate.

The portion of the St. Croix River that adjoins the Kinnickinnic River Priority Watershed is used by an average of 830 boats and 2,000 people on summer weekend days. The majority of these are recreational boaters, including sailboats and fishing boats (information provided by the Minnesota-Wisconsin Boundary Area Commission).

The Federal Waterfowl Production Area near Twin Lakes, and the Casey Lake Wildlife Area attract bird and wildlife watchers, hikers and hunters.

Physical Characteristics of the Kinnickinnic River Watershed

Climate and Precipitation
Surface and groundwater quality and quantity, soil moisture content, runoff characteristics, and the physical condition of waterways are all related to precipitation. The frequency, duration and amount of precipitation influences the watershed response. The climate within the Kinnickinnic River Watershed is characterized by winters which are long and relatively cold and snowy winters and summers which are mostly warm with periods of hot humid conditions. Mean annual precipitation for the region is about 29 inches of rain and melted snow; the majority falls in the form of thunderstorms during the months of May to September.

Topography
The Kinnickinnic River Watershed is located within the western uplands region of Wisconsin. This region is a northwest-southeast strip in western and southwestern Wisconsin, including all of Pierce and St. Croix Counties. Glacial deposits from the Wisconsin Lobe left a gently rolling topography with soils that support agriculture well. After the glaciers receded, nearly horizontal

bedrock and easily erodible glacial deposits allowed major streams and tributaries to develop deep valleys flanked by flat-topped ridges.

Geology and Hydrogeology

Geology in the Kinnickinnic River Watershed reflects the movement of the Superior Ice Lobe during the Wisconsinian glacial period approximately 13,000 years ago (Young and Hindall, 1973). The City of Prescott is located in an area of flat-topped and steep-sided bedrock hills and narrow stream valleys with moderately thick valley fill of glacially deposited clay, silt, sand and gravel and boulders. Wind blown silt called loess also covers some of the southern portion of the watershed (Rust, 1997).

In the northern portion of the watershed, the geology changes. Here the glacially deposited clay, silt, sand, and gravel was laid down under glacial ice as a blanket of unsorted sediments. The thickness of the glacially deposited sediments varies from zero to over one-hundred feet. West of the Village of Roberts there is "pitted outwash" deposited by glacial meltwater. Kettles which formed when buried blocks of ice left by the glacier melted, are present.

Underlying the glacial deposits are layers of bedrock. The bedrock from youngest (uppermost) to oldest (lower) is: Ordovician age (440-500 million years ago) dolomite formations (Galena, Decorah and Platteville formations); St. Peter Sandstone; Prairie du Chien Dolomite; Cambrian age (500-570 million years ago) sandstones and dolomitic sandstones (Trempealeau, Franconia, Galesville, Eau Claire, and Mt. Simon formations). Underlying the Cambrian bedrock is Precambrian age (over 570 million years ago) crystalline and sedimentary rock.

Dolomitic limestone has natural crevices and fissures which are the result of physical stress and chemical weathering. Surface pollutants can be transported through these fissures, making groundwater in these areas susceptible to pollution. Regional groundwater flow in the Kinnickinnic Watershed is west toward the St. Croix River. Local groundwater flow follows the topography with groundwater discharging into the Kinnickinnic River. Many springs in the vicinity of the Kinnickinnic are extremely important sources of cold groundwater discharge to the river.

Soils

Moderately deep loamy soils are found on the stream terraces of the southern portion of the watershed. These include silt loam, sandy loam and loess over glacial outwash plains (Antigo, Onamia, Dakota, Waukegan Associations). Farther upstream, loess overlies clay, shale and limestone and poorly cemented sandstone (Plainfield-Boone and Santiago-Otterholt-Arland Associations).

Near the Pierce-St. Croix County border, loess, loam and clay overlie limestone (Whalan and Otterholt Associations). Farther north, silty sediment, sandy loam and sandy soils overlie glacial sand and gravel (Vlasaty-Skyberg, Burkhardt-Chetek-Sattre, and Santiago-Jewett-Magnor Associations).

Subwatersheds of the Kinnickinnic River Watershed

A watershed is an area of land that drains to a specific stream, river or waterbody. Watershed divides are generally high points of land or ridgelines that cause runoff to drain to different waterbodies. Watersheds can be identified on scales ranging from small tributary streams to whole river basins. For the purposes of this project, the Kinnickinnic River Watershed is subdivided into eight individual subwatersheds. Major tributaries, associated streams, lakes and subwatershed divides are shown in Map 2-1.

Subwatersheds in the Kinnickinnic River Watershed

Upper Kinnickinnic	(UK)
Twin Lakes	(TL)
Middle Kinnickinnic	(MK)
South Fork	(SF)
River Falls	(RF)
Lower Kinnickinnic	(LK)
Upper St. Croix	(USC)
Lower St. Croix	(LSC)

Water Resources of the Kinnickinnic River Watershed

Streams

Streams are the predominant surface water features in the watershed. Perennial streams, which have a combined length of about 96 miles, maintain at least a small continuous flow throughout most of the year. The Kinnickinnic River (23 miles) is the longest perennial stream in the watershed. Other primary streams in the watershed are the St. Croix River, South Fork of the Kinnickinnic River and Rocky Branch.

The Kinnickinnic River is a high quality, COLD Class I trout fishery that originates in agricultural lands in St. Croix County, flows through the City of River Falls and eventually drains to the St. Croix River (Figure S-1). In rural areas of the watershed, the river is primarily impacted by agricultural runoff, flashy streamflow and sedimentation. As the stream flows through River Falls, it is also thermally impacted by urban stormwater runoff and two shallow impoundments (known locally as Lake George and Lake Louise).

The Kinnickinnic River, excepting the reach within the City of River Falls has been designated as an Outstanding Resource Water (ORW) (NR 102.10 of the Wisconsin Administrative Code). Numerous perennial streams in the watershed support coldwater fish communities. The Kinnickinnic River Watershed has 6 Class I (50 miles) and 18 Class II (38 miles) trout streams and one stream reach that supports a warmwater sport fishery. Fish surveys conducted at 46 sites in the watershed in 1996 found brook and brown trout, smallmouth bass and 22 minnow and forage fish species. Brook and brown trout dominate the coldwater fishery in this watershed. White sucker, brook stickleback, longnose dace, mottled sculpin and Johnny darter were the most common forage species.

Lakes

Casey, Bushnell, East Twin and West Twin Lakes, are located in the Kinnickinnic River Watershed. **Casey Lake** is a shallow 28 acre seepage lake with a limited warmwater fishery. Seepage lakes receive their water inflow primarily from groundwater and rainfall, and have no out-flowing stream. The lake is eutrophic (contains excessive nutrients) with summer algae blooms and occasional winterkills. **Bushnell Lake** is a shallow 17 acre seepage lake with a marginal warmwater fishery. The lake is highly eutrophic with summer algae blooms and frequent winterkills. **East and West Twin Lakes** are shallow seepage waterbodies (about 168 acres in size) located approximately one mile southwest of the Village of Roberts in St. Croix County. Both waterbodies suffer from severe summer algae blooms and winterkill due to dissolved oxygen (D.O.) depletion.

Wetlands

Wetlands are valuable natural resources. They provide wildlife habitat, fish spawning and rearing areas, recreation, storage of runoff and flood flows and removal of pollutants. Headwaters of the Kinnickinnic River and its tributaries are dry runs that give way to marshes and springs, providing important contributions to cold water stream base flow. Historic prairie lands have given way to agriculture in much of the watershed. Many wetland swales have been converted to grassed waterways, reducing the capacity of the watershed to absorb runoff and hence, reducing groundwater recharge. Portions of the Parker Creek drainage area are being tiled to drain wet agricultural soils (St. Croix Basin Water Quality Management Plan, 1994).

Forested flood plains and lowland hardwoods are found north of River Falls, and old oxbows support other wetlands. Along the portion of the South Fork that flows through River Falls, wetland communities have been and continue to be lost to development. Below River Falls, the river channel is canyon-like, and few wetlands are found.

Groundwater

Groundwater is the main source of drinking water in the Kinnickinnic River Priority Watershed. Groundwater is stored underground in pore spaces and cracks within the soil and rock layers. Unconsolidated sediments and porous rock layers which yield groundwater in usable quantities are called aquifers. Aquifers receive and store water (called recharge) and discharge groundwater to lakes, streams and wetlands.

In much of the watershed, sink holes and fissures in bedrock overlying aquifers make the groundwater susceptible to contamination from surface pollutants. More than 200 wells were sampled by project staff, as part of the watershed inventory, and analyzed by the Wisconsin State Laboratory of Hygiene. Many contained significant quantities of nitrates and/or atrazine. Detailed results of well sampling can be found in Chapter Five of this plan.

Water Use Classifications

Surface water quality standards and criteria are expressions of the conditions considered necessary to support biological and recreational uses. Water quality standards for recreational and biological uses are contained in Chapters NR 102, NR 104, and NR 105 Wisconsin Administrative Code. Use classifications and supporting water quality standards used in valuating water resource conditions are discussed below.

Biological Stream Use

Wisconsin streams are classified according to the biological uses desired for each stream. These classifications are listed for each stream in the St. Croix River Water Quality Management Plan (DNR, 1994). Stream classification is a factor in determining the impacts of pollutants and in setting pollutant load reduction goals. Streams are classified as one of the following:

COLD = Coldwater Communities include surface waters capable of supporting a community of coldwater fish and other aquatic life or serving as a spawning area for coldwater fish species.
WWSF = Warmwater Sport Fish Communities include surface waters capable of supporting a community of warmwater sport fish and/or serving as a spawning area for warmwater sport fish.
WWFF = Warmwater Forage Fish Communities include surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.
LFF = Limited Forage Fish Communities includes surface waters of limited capacity because of low flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of forage fish and aquatic life.

Trout streams carry a separate designation found in "Wisconsin Trout Streams" (DNR Publication number. 6-3600(80)) and Outstanding/Exceptional Resource Waters, Wisconsin Administrative Code NR 102.20 and NR 102.11. Trout stream classes are:

Class I trout streams are high quality, and populations are sustained by natural reproduction.
Class II trout streams have some natural reproduction but may need stocking to maintain a desirable fishery.
Class III trout streams have no natural reproduction and require annual stocking of legal-size fish to provide sport fishing.

The entire main stem of the Kinnickinnic River is classified as **COLD Class I** trout fishery. Most of the tributary streams to the Kinnickinnic River are classified as **COLD Class I or II.** The two impoundments in thge City of River Falls, Lake Louise and Lake George, support a warm water sport fishery (**WWSF**). Table 2-1 summarizes the water resource classifications and conditions for the Kinnickinnic River Watershed. See the *Kinnickinnic River Priority Watershed Surface Water Resources Appraisal Report.*(Schreiber, 1998) for more details.

Definition of Water Quality Goals and Project Objectives

Water Quality Goals

Water quality goals are commonly described by the following terms:

- **Protection**: Protection refers to *maintaining* the present biological and recreational uses supported by a stream or the reservoir. For example, if a stream supports a healthy cold water fishery and is used for full-body contact recreational activities, the goal seeks to maintain those uses.

- **Enhancement**: Enhancement refers to an *improvement* in the overall condition of a stream or lake *within* its given biological and recreational use category. For example, if a stream supports a warmwater fishery whose diversity could be enhanced, the goal focuses on changing those water quality conditions which keep it from achieving its full biological potential.

- **Restoration**: Restoration refers to *upgrading* the existing capability of the resource to support a higher category of biological use. An example would be a stream which historically supported healthy populations of warmwater game fish, but no longer does. This goal seeks to improve conditions allowing viable populations of forage and warmwater game fish species to become reestablished.

The water quality conditions needed to support the goals for streams and lakes are the basis for determining the type and level of nonpoint source control to be implemented under the priority watershed project. This determines the project **objectives**, which are the amount of control or reduction needed of rural and urban nonpoint sources of pollution. Often these objectives are numeric (percent reduction of a pollutant), but can also be qualitative. Chapter Three of this plan identifies *overall watershed* reduction objectives for a variety of nonpoint pollutants. Specific *subwatershed* objectives are found in Chapter Four of this plan.

Table 2-1. Summary of surface water resource uses, problems and goals for lakes and streams in the Kinnickinnic River Priority Watershed.

Subwatershed	Waterbody	WBIC*	Waterbody Size (Mi./ Ac.)	Biological Use** (Mi./ Ac.)	Limiting Factors***	Observed or Potential Sources****	Water Resource Goals*****
Upper Kinnickinnic	Casey Lake	2606700	28 ac.	WWFF	EUT, DO, SED, TURB	CR	Reduce sediment loading - High Reduce nutrient loading - High Improve macrophyte community
	Bushnell Lake	2606300	17 ac.	WWFF	EUT, DO, SED, TURB		
	Kinnickinnic River (above I-94)	2601800	1.5	Cold I (1.5)	SED, WET, FLOW SPR, TURB	CR, SB, PSB, GUL BDAM, BY	Reduce sediment loading - High Reduce nutrient loading - High Reduce gully erosion Reduce streambank erosion Improve stream hydrology Protect or restore spring areas Maintain brook trout conditions Restore wetlands
Twin Lakes	West Twin Lake	2598900	80 ac.	WWFF	EUT, DO, SED, TURB	CR , URB, PS , DCH	Reduce sediment loading - High Reduce nutrient loading - High Reduce urban runoff pollution Improve macrophyte community
	East Twin Lake	2462300	43 ac.	WWFF	WET		
Middle Kinnickinnic	Kinnickinnic R. (Steeple Rd. to I-94)	2601800	2.7	Cold I (2.7)	SED, WET, FLOW SPR, TURB	CR, SB, PSB, GUL, BY	Reduce nutrient loading - Med. Reduce sediment loading - High Protect or restore spring areas Reduce gully erosion Reduce streambank erosion Improve stream hydrology Maintain brook trout conditions Restore wetlands
	Kinnickinnic R. (STH 35 to Steeple Rd.)	2601800	8.5	Cold I (8.5)	SED, WET, TURB	CR, SB, PSB, BY, GUL	Reduce sediment loading - High Reduce nutrient loading - Med. Reduce gully erosion Reduce streambank erosion Improve stream hydrology

Table 2-1 (cont.)

Subwatershed	Waterbody	WBIC	Waterbody Size (Mi./ Ac.)	Biological Use (Mi./ Ac.)	Limiting Factors	Observed or Potential Sources	Water Resource Goals
Middle Kinnickinnic (cont.)	Kinnickinnic R. (STH 35 to Steeple Rd.) (cont.)	2601800					Protect or restore spring areas Maintain brown trout conditions Restore wetlands
	Parker Creek Cr. 13-2	2604700 2604800	6 3	Cold I (6) Cold I (3)	WET, TEMP, SED SPR, HAB, FLOW TURB	CR, SB, PSB, BY DCH, BDAM, FL	Reduce sediment loading - High Reduce nutrient loading - Med. Reduce gully erosion Reduce streambank erosion Improve stream hydrology Protect or restore spring areas Maintain brook trout conditions Restore wetlands Improve macroinvert. habitat
	Kelly Creek	2604600	1	Cold II (1)	SED, HAB, SPR	CR	Reduce sediment loading - High Reduce nutrient loading - Med. Reduce streambank erosion Maintain brook trout conditions Improve macroinvert. habitat
	Nye Creek	2604500	2	Cold II (2)	SED, HAB, WET	CR, PSB	Reduce sediment loading - High Reduce nutrient loading - Med. Reduce streambank erosion Maintain brook trout conditions Restore wetlands Improve macroinvert. habitat
	Ted Creek	2604400	2	Cold II (2)	SED, WET, HAB	GUL, PSB, CR	Reduce sediment loading - High Reduce gully erosion Reduce streambank erosion Restore wetlands Improve brook trout conditions

Table 2-1 (cont.)

Subwatershed	Waterbody	WBIC	Waterbody Size (Mi./ Ac.)	Biological Use (Mi./ Ac.)	Limiting Factors	Observed or Potential Sources	Water Resource Goals
Middle Kinnickinnic (cont.)	Cr. 21-4	2604300	3	Cold I (3)	WET, SED, HAB	PSB, CR, DCH	Reduce sediment loading - High Reduce nutrient loading - Med. Reduce streambank erosion Improve brook trout conditions Restore wetlands Improve macroinvert. habitat
	Cr. 30-1 Cr. 30-10	2604000 na	1 1	Cold 2 (1) Cold II (1)	WET, TEMP, SPR HAB, SED	CR, DCH	Reduce sediment loading - High Reduce nutrient loading - Med. Protect or restore spring areas Improve temp. conditions Improve brook trout conditions Restore wetlands
South Fork	South Fork Kinnickinnic R. Cr. 7-1 Cr. 5-15	2603100 2603200 na	9 5 2	Cold II (9) Cold II (5) Cold II (2)	TEMP, WET, SED FLOW, HAB	SB, PSB, URB BDAM, DCH, FL	Reduce sediment loading - High Reduce nutrient loading - Med. Reduce streambank erosion Improve stream hydrology Improve temp. conditions Reduce gully erosion Reduce urban runoff pollutants Improve brook trout conditions Restore wetlands Improve macroinvert. habitat
River Falls	Kinnickinnic R. (above Lake George to STH 35)	2601800	2	Cold I (2)	FLOW, HAB, SED TEMP	URB, GUL	Reduce sediment loading - High Reduce nutrient loading - High Improve stream hydrology Improve temp. conditions Protect or restore spring areas Improve macroinvert. habitat Maintain brown trout conditions

Table 2-1 (cont.)

Subwatershed	Waterbody	WBIC	Waterbody Size (Mi./ Ac.)	Biological Use (Mi./ Ac.)	Limiting Factors	Observed or Potential Sources	Water Resource Goals
River Falls (cont.)	Kinnickinnic R. (above Lake George) (cont.)	2601800					Reduce streambank erosion Reduce urban runoff pollutants
	Lake George (Upper Kinni. Pond) Lake Louise (Lower Kinni. Pond)	2603700 2603000	18 ac. 15 ac.	Cold I/ WWSF Cold I/ WWSF	EUT, SED, TURB HAB, SED, FLOW	URB, PS	Reduce sediment loading - High Reduce urban runoff pollutants Reduce nutrient loading - High
	Kinnickinnic R. (between Jct. Falls dam and Lake Louise)	2601800	0.2	Cold I (0.2)	TEMP, FLOW, TURB, SED	URB, HYDRO	Reduce sediment loading - High Reduce nutrient loading - High Reduce streambank erosion Improve stream hydrology Improve temp. conditions Reduce urban runoff pollutants Maintain brown trout conditions
	Kinnickinnic R. (below Powell Dam to Rocky Branch)	2601800	1	Cold I (1)	TEMP, FLOW, TURB, SED	URB, HYDRO, SB	Reduce sediment loading - High Reduce nutrient loading - High Improve stream hydrology Improve temp. conditions Reduce streambank erosion Reduce urban runoff pollutants Improve macroinvert. habitat Maintain brown trout conditions
	Cr. 36-1	2603900	3	Cold II (3)	FLOW, SED, HAB SPR	DCH, URB	Reduce sediment loading - High Reduce nutrient loading - High Improve stream hydrology Maintain brook trout conditions Reduce streambank erosion Reduce urban runoff pollutants

Table 2-1 (cont.)

Subwatershed	Waterbody	WBIC	Waterbody Size (Mi./ Ac.)	Biological Use (Mi./ Ac.)	Limiting Factors	Observed or Potential Sources	Water Resource Goals
River Falls (cont.)	Cr. 36-15	na	1	Cold II (1)	SPR, SED, FLOW HAB	URB, SB	Reduce sediment loading - High Reduce nutrient loading - High Reduce streambank erosion Improve stream hydrology Protect or restore spring areas Reduce urban runoff pollutants Improve brook trout conditions
	Mann Valley Creek (Cr. 2-16)	2602800	2	Cold II (2)	SED, SPR	CR, URB	Reduce sediment loading - High Reduce nutrient loading - High Improve stream hydrology Protect or restore spring areas Reduce streambank erosion Reduce urban runoff pollutants Maintain brook trout conditions
	Rocky Branch Cr. 12-11	2602400 2602500	6 3	Cold I (6) Cold II (3)	SED, FLOW, HAB	URB, GUL, SB, FL	Reduce sediment loading - High Reduce nutrient loading - High Improve stream hydrology Reduce gully erosion Reduce streambank erosion Reduce urban runoff pollutants Improve macroinvert. habitat Maintain brook trout conditions
Lower Kinnickinnic	Kinnickinnic R. (below Rocky Branch to CTH F)	2601800	6.8	Cold I (6.8)	TEMP, FLOW, SED	CR, SB, FL, GUL HYDRO	Reduce sediment loading - Med. Reduce nutrient loading - Med. Improve stream hydrology Reduce gully erosion Maintain brown trout conditions Reduce streambank erosion Reduce urban runoff pollutants

Table 2-1 (cont.)

Subwatershed	Waterbody	WBIC	Waterbody Size (Mi./ Ac.)	Biological Use (Mi./ Ac.)	Limiting Factors	Observed or Potential Sources	Water Resource Goals
Lower Kinnickinnic (cont.)	Kinnickinnic R. (CTH F to mouth)	2601800	2.3	Cold I (2) WWSF (0.3)	TEMP, FLOW, SED HAB	CR, SB, HYDRO, GUL FL	Reduce sediment loading - Med. Reduce nutrient loading - Med. Improve stream hydrology Reduce streambank erosion Reduce gully erosion Maintain brown trout conditions
	Cr. 9-11a	na	1	Cold II (1)	SED	CR, GUL	Reduce sediment loading - Med. Reduce nutrient loading - Med. Reduce gully erosion Maintain brook trout conditions
	Cr. 9-11b	2602140	1	Cold II (1)			
	Cr. 10-11	2602200	3	Cold II (3)			
	Cr. 8-13	2602120	0.5	Cold II (0.5)			
	Cr. 8.11	2602040	1	Cold II (1)			
	Cr. 17-6	2602020	1	Cold II (1)			
Upper St. Croix	St. Croix River	2601400	5	WWSF (5)	EUT, SED	CR, GUL	Reduce sediment loading - Med. Reduce gully erosion Reduce nutrient loading - Med.
Lower St. Croix	St. Croix River	2601400	6.7	WWSF (6.7)	EUT, SED	CR, GUL	Reduce sediment loading - Med. Reduce gully erosion Reduce nutrient loading - Med.
	Barkley Coulee	2601700	2	UNK (2)	SED	CR, GUL	Reduce sediment loading - Med. Reduce gully erosion Reduce nutrient loading - Med.

Table 2-1 (cont.)

*WBIC - Waterbody Identification Code

**Biological Use (Abbreviations):

WWSF - Warmwater Sport Fishery
WWFF - Warmwater Forage Fishery
Cold - Coldwater Fishery

Trout stream classifications (DNR, 1980):

Class I - sufficient natural reproduction to sustain populations of wild trout
Class II - some natural reproduction of trout, good survival and carryover of adult trout
Class III - no natural reproduction of trout, marginal trout habitat

***Limiting Factors (abbreviations):

HAB - Habitat (loss of cover, etc.)
SED - Sedimentation
TEMP - Temperature (elevated)
DO - Dissolved Oxygen (depletion)
SPR - Springhead alterations
EUT - Eutrophication
FLOW - altered streamflow hydrology
TURB - Turbidity
WET - Wetland alteration

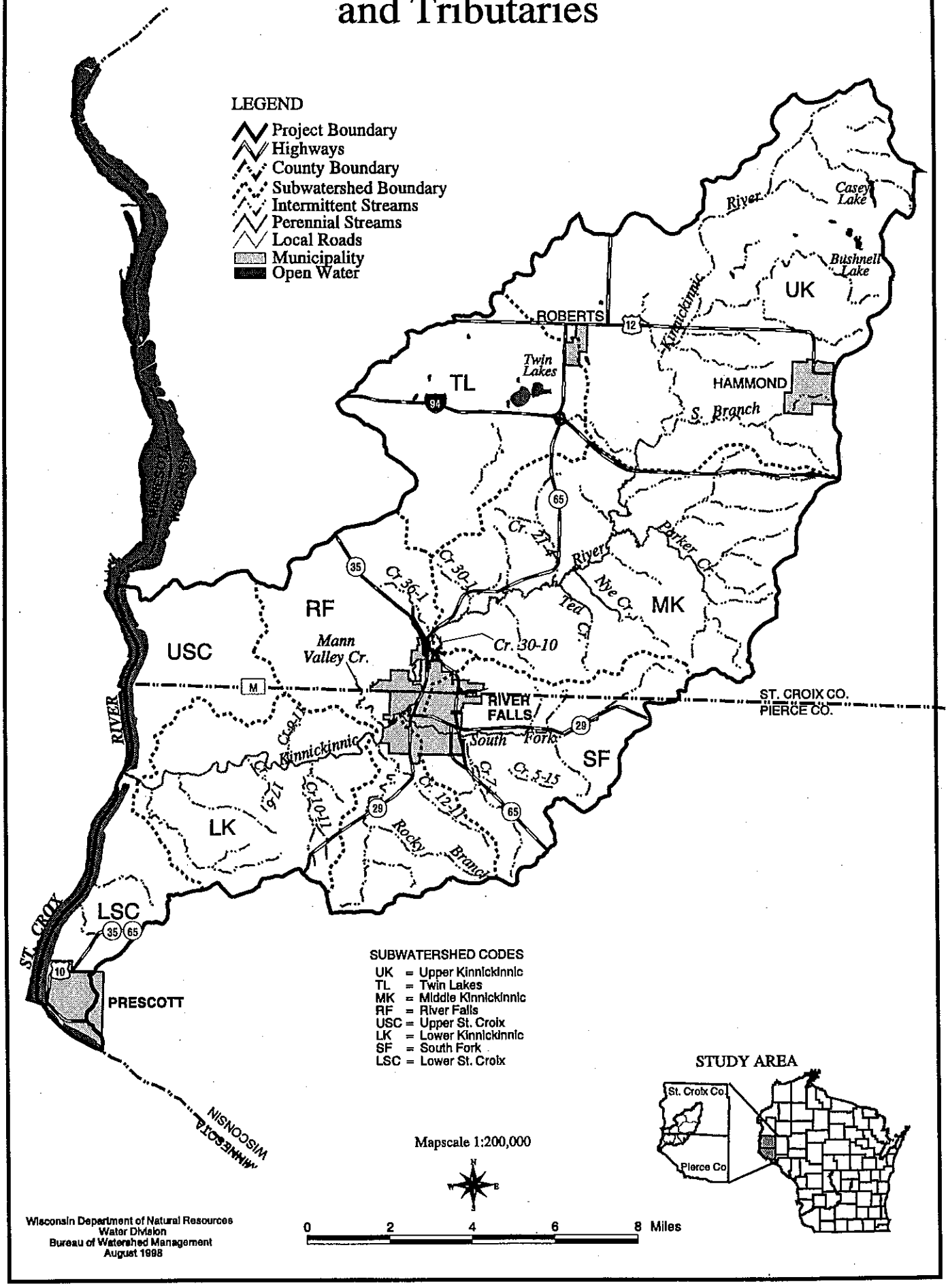
**** Observed or Potential Impacts (Abbreviations):

BDAM - Beaver Dams
DCH - Ditching
BY - Barnyard Runoff
CR - Cropland Runoff
GUL - Gully erosion
HYDRO - Hydropower flow impacts
PSB - Streambank Pasturing
FL - Flooding (Flashy flows)
SB - Streambank erosion
URB - Urban Stormwater Runoff
PS - Point Source Discharge

*****Water Resource Goals (Definitions):

Reduce sediment loading - High or Medium level of control (actual quantity to be determined by advisory committee)
Reduce nutrient loading - High or Medium level of control (actual quantity to be determined by advisory committee)
Reduce urban runoff pollutants - reduce urban runoff by using detention basins, street sweeping, increasing infiltration, etc.
Reduce gully erosion - reduce or eliminate downcutting of gullies through check dams, grassed waterways, etc.
Reduce streambank erosion - reduce or eliminate streambank erosion through rip-rap, stabilization, etc.
Improve macroinvert. habitat - improve stream bottom substrate composition for aquatic insects and other aquatic life
Improve temp. conditons - improve water temperature conditions for the coldwater aquatic community
Maintain trout conditions - prevent degadation of temperature, habitat or water quality conditions affecting the brook or brown trout fishery
Improve trout conditions - improve habitat and water quality conditions sufficiently to increase trout populations
Protect or restore spring areas - protect existing spring areas or prevent further degradation through fencing, rehabilitation, etc.
Restore wetlands - rehabilitate impacted wetlands through fencing, plugging ditches or tile drains, etc.
Improve stream hydrology - reduce streamflow "flashiness" by increasing infiltration of runoff waters

Map 2-1. Kinnickinnic River Subwatersheds and Tributaries



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CHAPTER THREE
Nonpoint Source Pollutants and Management Strategy

This section describes the nonpoint source inventories, objectives, and cost-share eligibility criteria for each pollutant source. These sources include barnyard runoff and sediment from upland, gully, streambank, and construction site erosion and urban runoff. Cost-share funds for installing pollution control measures, known as best management practices (BMPs), will be targeted at sites which contribute the greatest amounts of pollutants. This section is organized in the following manner:

- Project Objectives for Nonpoint Sources
- Management Categories for Cost Share Assistance and Participation
- Land Use Designations and Priority Areas for Pollutant Management
- Management Strategies for Rural, Urban and Growth Areas

Project Objectives for Nonpoint Sources

Goals for water quality in the Kinnickinnic River Watershed were identified in the previous chapter as protection and enhancement of water resources. These goals will be achieved through project objectives for sediment and phosphorus reduction, thermal pollution control, wetland habitat restoration and groundwater protection.

Sediment Reduction Objectives: Reduce the overall sediment load delivered to the Kinnickinnic River by 30 percent. To meet this objective, the sediment reductions shown in Table 3-1 are needed:

Table 3-1. Sediment Reduction Objectives for the Kinnickinnic River Watershed

Source	Inventoried Sediment Load (T/yr)	Percent of Total	Planned Percent Reduction	Planned Sediment Load (T/yr)
Cropland	16,824	78%	25%	12,618
Streambank	600	3%	60%	240
Dry Runs	988	5%	30%	593
Urban Runoff*	1,223	5%	35%	795
Construction Sites	720	3%	70%	216
Total	20,355	100%	30%	14,462

*Estimated future load

Phosphorus Reduction Objective: Achieve a 30% reduction in the current annual phosphorus load leaving the Kinnickinnic River Watershed and reaching the St. Croix River. Currently 16,400 pounds of phosphorus from agricultural uplands are estimated to flow from the Kinnickinnic River to the St. Croix River annually. Barnyards are a source of 3,900 pounds of phosphorus, some of which reaches the St. Croix River. To meet this objective, the phosphorus reductions shown in Table 3-2 are needed.

Table 3-2. Phosphorus Reduction Objectives for the Kinnickinnic River Watershed

Source	Inventoried Phosphorus Load (lbs/yr)	Percent of Total	Planned Percent Reduction	Planned Phosphorus Load (lbs/yr)
Agricultural Uplands[1] (amount leaving the Kinnickinnic R.)	16,400	97%	25%	12,300
Barnyards[2] (estimated delivery)	500	3%	35%	175
Land-spread Manure	unknown	Reduce through 60% participation in Nutrient Management Planning, with increased cost sharing incentives for higher buffer standards.		
Total	16,900	100%	30%	12,475

1 This reduction should be achieved through meeting the upland sediment reduction objectives.

2 Barnyard goals are actually established on the basis of "Combined Oxygen Demand", as described in Chapter Five, although phosphorus loads were estimated using BARNY.

Thermal Pollution Control Objectives: Prevent an increase in current thermal loading to the Kinnickinnic River. To meet this objective, the following are needed:

- Maintain existing thermal regime of the Kinnickinnic River and its tributaries by striving towards an effective level of impervious cover of 15%.
- The plan may be amended to reflect the outcome of ongoing thermal monitoring and modeling studies.

Wetland Habitat Restoration Objective: Maintain and improve wetland habitat for surface and groundwater quality protection. To meet this objective, the following is needed:

- Restore 10 percent of degraded or prior converted wetlands.

Groundwater Protection Objective: Prevent an increase or expansion of areas impacted by nitrates and triazine, and prevent contamination of municipal water supplies. To meet this objective, the following are needed:

- Enter 60% of agricultural land into Nutrient and Pest Management planning.
- Increase buffers around sensitive areas such as sinkholes and intermittent waterways.
- The municipalities of Roberts and River Falls should write Wellhead Protection Plans to protect the investment they have in their municipal wells. The City of Prescott should implement their wellhead protection plan, as anticipated in mid-1999. The Village of Hammond should continue with wellhead protection plan development and approval, as anticipated, in late 1998 or early 1999.

Management Categories for Cost Share Assistance and Participation

Management categories define which nonpoint sources are eligible for financial and technical cost share assistance. The management categories are based on the amount of pollution generated by a site. During the watershed inventory, sites or areas were identified and designated as either critical, eligible or ineligible for financial assistance for control of pollutants.

Management category eligibility criteria may be expressed in terms of tons of sediment or pounds of phosphorus delivered to surface water from an identified source. Criteria may also be qualitative, such as "all cropped fields are eligible for Nutrient and Pest Management Planning".

The Land Conservation Departments will assist landowners in applying Best Management Practices (BMPs). Practices range from alterations in farm management (such as changes in manure-spreading and crop rotations) to engineered structures (such as diversions, sediment

basins, and manure storage facilities), and are tailored to specific landowner situations. See Chapter Six of this plan for a complete list of BMPs.

Critical Management Category
When a site is designated as "critical", it is an indication that controlling the source of pollution is essential for meeting water quality objectives for the project. Critical nonpoint sources contribute a significant amount of the pollutants impacting surface waters. These sources are eligible for funding and technical assistance through the priority watershed project. Landowners with critical sites are required, by law, to address those sites by reducing the nonpoint source pollutant load to an acceptable level.

Eligible Management Category
Nonpoint sources of pollution from sites in this category contribute less significant amounts of pollutants to surface waters. These sites are eligible for technical and cost-share assistance but are not as important as the "critical" sites to reaching water quality objectives.

Ineligible Management Category
Sites which do not contribute significant amounts of pollutants are not eligible for funding or technical assistance through the priority watershed project. Other DNR programs, such as wildlife and fisheries management, may assist county project staff to control these sources as part of the implementation of the integrated resource management plan for this watershed. Other local, state, or federal programs may also be applicable to these lands.

Land Use Designations and Priority Areas for Pollutant Management

The eight designated subwatersheds of the Kinnickinnic River Watershed have varying mixes of urban, rural and growth areas. Each subwatershed, or drainage areas within a subwatershed can be characterized as Rural, Urban or Growth, based on the amount of impervious land draining to a delineated stream segment. A Rural, Urban or Growth management strategy can thus be developed and implemented for each subwatershed.

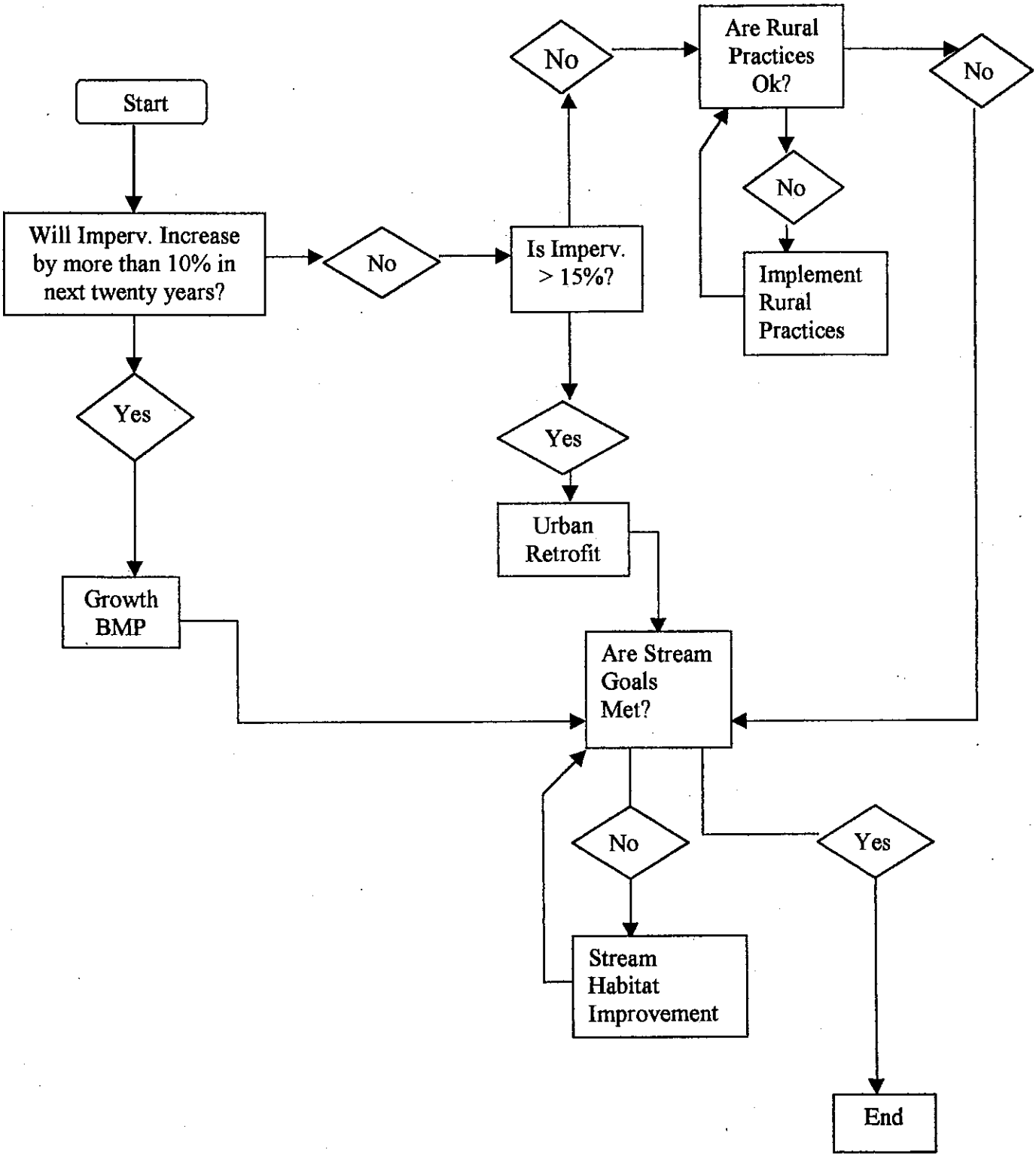
A decision making flow chart (Figure 3-1) illustrates how current and planned land uses, in combination with priority designations can be used to develop suitable arrays of Best Management Practices (BMPs) for subwatershed or stream segment areas. This decision making process will also guide periodic evaluation of progress toward goals, and development of plan updates.

Rural drainage areas are those that currently have less than 15% imperviousness and where imperviousness is not projected to increase by an additional 10% within the next twenty years. *Rural drainage areas* will primarily implement rural Best Management Practices throughout the life of the watershed project. Areas where surface and groundwater impacts are greatest will benefit most from rural BMP's.

Urban drainage areas are those that currently have greater than 15% imperviousness and where imperviousness is not projected to increase by an additional 10% within the next twenty years. *Urban drainage areas* may need "retrofitting", utilizing urban Best Management Practices, based on the cost effectiveness of the project. These practices include ordinance development and implementation, wellhead protection, "housekeeping" practices (such as street sweeping and reduction in urban fertilizer, herbicide and pesticide use), and in some cases structural practices to control stormwater pollution.

Growth drainage areas can be either (a) drainage areas that currently have less than 15% imperviousness (rural) but are projected to increase by an additional 10% within the next twenty years, or (b) drainage areas that have more than 15% imperviousness (urban) and are projected to increase by an additional 10% within the next twenty years. Thus, growth areas can be designated whether the land use is currently rural or urban. Impacts in these areas are likely to be increased imperviousness and stormwater runoff, reduced groundwater recharge, increased thermal pollution from runoff flowing over hot impervious surfaces and increased pollutants carried in runoff. *Growth areas* may utilize a combination of rural and urban Best Management Practices. Management in these areas will require some unique approaches, and should be targeted for coordination among local governing units. Growth strategies should minimize increases in runoff and thermal pollution, and increase groundwater recharge while at the same time ensuring groundwater protection.

Figure 3-1. Water Quality and Best Management Practices Flow Chart



Priority Area Designations for Rural, Urban and Growth Area Pollutants

During the planning phase, extensive inventories were conducted to identify major sources of pollutants in subwatersheds and stream segment drainage areas. Based on these inventories, priority areas for specific pollutant sources are designated, as shown in Table 3-3.

Criteria for high, medium and low priority rankings are based on total pollutant loads and on loading rates (eg. annual tons per acre). Those meeting or exceeding numeric criteria for both total pollutant load and loading rate are ranked high. Those meeting one of the two criteria are ranked medium. Those meeting neither are ranked low. These priority area designations and decision making flow chart (Figure 3-1) are key tools for grantees in allocating staff efforts and project funds.

Table 3-3. Matrix of Priorities for Rural and Urban Pollutants

Watershed *Tributary or Stream Reach*	**Rural Area Pollutants**				**Urban & Growth Area Pollutants**	
	Sediment Sources			**Nutrients**	**Sediment & Metals**	**Thermal or hydro-logic**
	Uplands	**Stream Banks**	**Dry Runs**	**Barn-yards**		
Upper Kinnickinnic	**H**	**M**	**H**	**M**		
Intermittent tributary - South Branch	H	H	H	M	L	L
Village of Hammond	NA	NA	NA		M	L
Twin Lakes	**H**	**NA**	**NA**	**H**		
Village of Roberts	NA	NA	NA		M	N/A
Middle Kinnickinnic	**M/H**	**H**	**H**	**H**		
Parker Creek	H	H	H		L	L
Kelly Creek	M	L	L		L	L
Nye Creek	M	L	L		L	L
Ted Creek	M	M	M		L	L
Creek 21-4	H	M	M		L	L
Creek 30-1	M	H	H		M	M
*Creek 30-10**	M	L	L		H*	H*
**Designated growth area - Quarry Road Corridor*						
*Kinnickinnic between Cr. 30-1 & Cr. 36-1**	M	L	L		H*	H*
** Designated growth area - Hwy 65 Corridor*						

Watershed *Tributary or Stream Reach*	Rural Area Pollutants				Urban & Growth Area Pollutants	
	Sediment Sources			Nutrients	Sediment & Metals	Thermal or hydro-logic
	Uplands	Stream Banks	Dry Runs	Barn-yards		
South Fork	**M**	**H**	**H**	**H**		
South Fork above Cr. 5-15	H	H	H		M	L
Creek 5-15	M	M	M		M	L
*South Fork between Cr. 7-1 & 5-15**	H	H	H		H	H
						* *Designated urban & growth areas*
*Creek 7-1**	M	M	H		H	H
						* *Designated urban & growth areas*
*S. F. betw. Cr. 7-1 & Kinnickinnic R.**	M	M	M		H	H
						* *Designated urban & growth areas*
River Falls	**L**	**L**	**L**	**M**		
*Creek 36-1**	L	L	L		H	H
						**Designated growth area - Hwy 35 corridor*
*Kinnickinnic between Cr. 36-1 & Rocky Branch**	L	L	L		H	H
						**Designated urban & growth areas*
*Creek 36-15**	L	M	M		H	H
						**Designated urban & growth areas*
*Cr 2-16 (Mann V.)**	M	L	L		M	M
						**Designated urban & growth areas*
Rocky Branch	H	H	H		M	M
Creek 12-11	H	M	L		M	M
Lower Kinnickinnic	**H**	**L**	**L**	**M**	**M**	**L**
(All reaches in the L K include some potential rural growth areas)						
Creek 9-11a	H	L	L		M	L
Creek 9-11b	H	L	L		M	L
Creek 10-11	H	L	L		M	L
Creek 8-13	H	L	L		M	L
Creek 8-11	M	L	L		M	L
Creek 17-6	H	L	L		M	L

Watershed *Tributary or Stream Reach*	Rural Area Pollutants				Urban & Growth Area Pollutants	
	Sediment Sources			Nutrients	Sediment & Metals	Thermal or hydro-logic
	Uplands	Stream Banks	Dry Runs	Barn-yards		
Upper St. Croix	**L**	**NA**	**NA**	**L**	**L**	**NA**
Lower St. Croix	**L**	**NA**	**NA**	**L**		
City of Prescott	L	NA	NA		H	L

Ranking:
Two criteria were considered for each sediment source. "H" means two criteria were exceeded. "M" means one criterion was exceeded. "L" means neither criteria were exceeded.

Upland sediment criteria: >2000 T/yr total (or >10% of total annual load from uplands) and >0.15 T/ac/yr
Stream bank sediment criteria: >100 T/yr total (or >10% of annual total load from stream banks) and >10 T/mi/yr
Dry run sediment criteria: > 50 T/yr total (or >10% of total annual load from dry runs) and >14 T/mi/yr (2.5 T/ac/yr)
Urban sediment criteria: >200 T/yr total, (or >10% of total annual load from urban sediment) and >.12 T/ac

For some stream segments within subwatersheds, inventory data were not sorted by sub-drainage areas. Staff observations were used to determine rankings in these cases.

Two criteria were considered for barnyards. "H" means two criteria were exceeded. "M" means one criterium was exceeded. "L" means neither criteria were exceeded.

Barnyard nutrient criteria: % Combined Oxygen Demand (COD) from the subwatershed exceeds 10% of the watershed COD load and a barnyard within the subwatershed exceeds 100 pounds of phosphorus delivered.

For urban thermal pollution or hydrologic changes, "H" means changes in the thermal or hydrologic regime of the reach were identified during the appraisal, or thermal or hydrologic regimes likely will be impacted. "M" means due to anticipated growth, the thermal or hydrologic regimes may be impacted. "L" means thermal or hydrologic impacts are not expected during the planning period.

Management Strategies for Rural, Urban and Growth Areas

Urban Drainage Areas

The principal water quality and quantity problems derived from urban runoff result from many factors including:

- Loading of sediment, nutrients, heavy metals and other toxic materials.
- Stream channel modifications, including straightening and lining with concrete.
- Hydrologic disturbances, including flashy high flows and loss of base flow.
- Streambank erosion.
- Stream warming (thermal pollution)

Urban runoff carries a variety of pollutants to surface water. Pollutants found in urban runoff include heavy metals (lead, copper and zinc) and a large number of toxic organic chemicals (polychlorinated biphenyls, polycyclic aromatic hydrocarbons, pesticides and many others). Other substances in urban runoff include sediment, nutrients, bacteria, and protozoans. The pollutants that are a priority for this watershed are sediment, phosphorus, and heavy metals (represented by copper).

The delivery of pollutants to streams from existing urban areas depends on the types of urban land use, the types of stormwater conveyance systems, and urban pollution prevention practices, such as street sweeping, yard waste collection, and waste oil recycling programs. Freeways, commercial and industrial areas have the highest unit/area/year pollutant loads, producing the most significant amounts of metals and other urban toxic pollutants. Medium density and multi-family residential areas also generate metals, sediment and phosphorus, and include large impervious areas. Residential areas contain more lawn area than commercial areas, while commercial areas have more rooftop, street, and parking lot surfaces. Lawns can also contribute nutrients and pesticides. Rooftop areas are important sources of zinc and atmospheric pollutants. Copper sources include rooftops, scrap metal piles and treated wood used in outdoor construction.

Hydrologic and Thermal Impacts

Impervious surfaces and other land use that promote over-land runoff rather than infiltration of rain have been shown to greatly affect stream hydrology. A stream with reduced watershed infiltration has water levels that peak sharply during and immediately after a rain event, followed by a steep drop in water level. Reduced infiltration causes low baseflow and a rise in stream temperature. Stormwater runoff from rooftops, streets and parking areas, especially during large summer storms, can dramatically increase stream temperature, with potentially devastating impacts to the trout fishery and cold water ecosystem.

Construction of structures such as stormwater detention basins can reduce the amount of pollution reaching streams, but can potentially add to thermal impacts. Reducing the temperature of runoff from fully developed urban areas is difficult and costly. Existing development in the River Falls area has already caused measurable changes in the temperature regime of the Kinnickinnic River and some of its tributaries. Prevention of further degradation of this outstanding resource will depend a great deal upon management of future growth, as described below.

Urban Management Strategy

A variety of management practices can effectively reduce pollutant loading from urban areas. These include low cost elements such as:

- Adopting and enforcing construction site erosion control ordinances
- Implementing urban good housekeeping practices, such as street sweeping, regulating pet wastes, leaf and grass clipping collection
- Educational efforts, such as storm drain stenciling

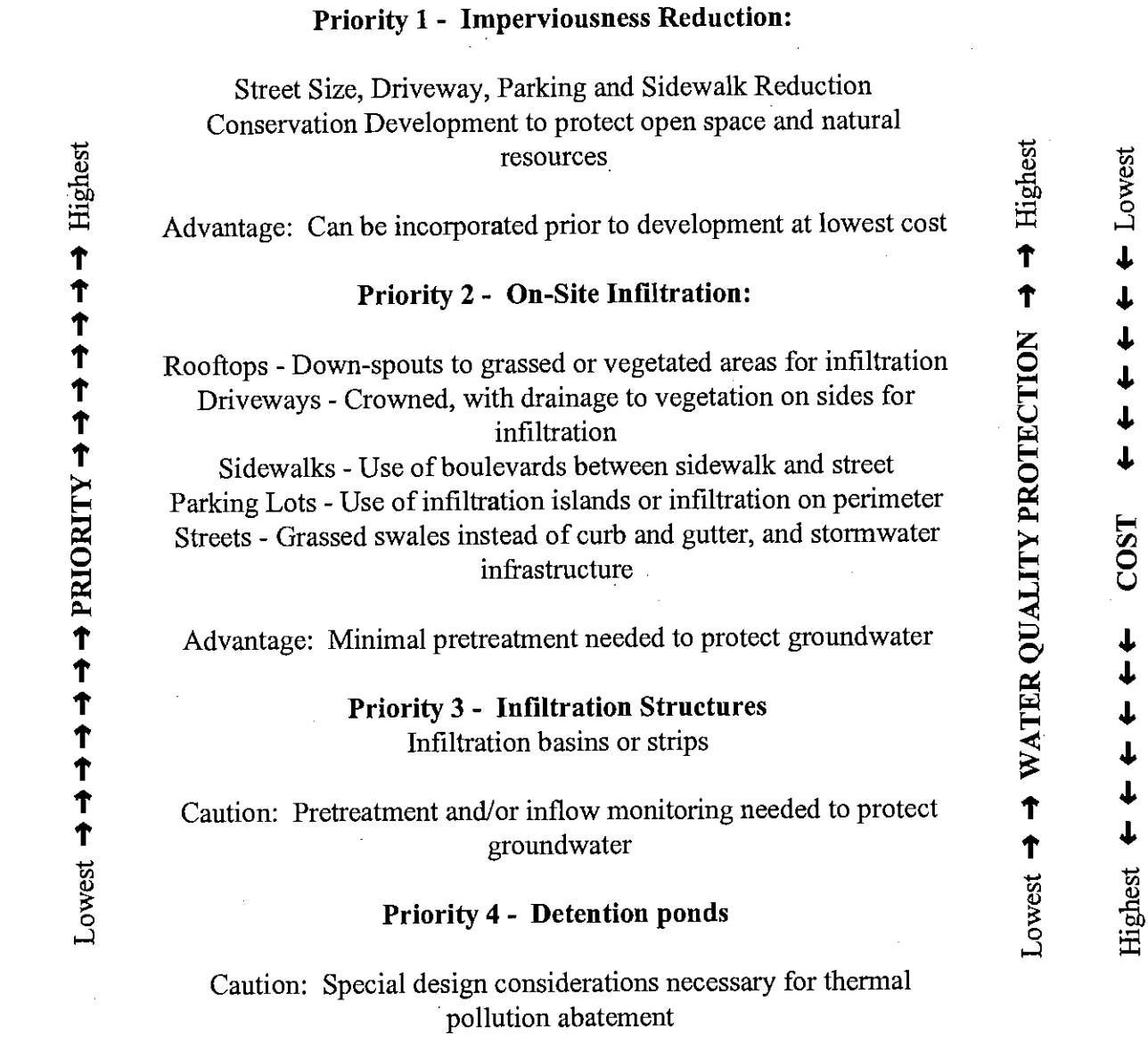
These basic activities are expected of all communities in the Kinnickinnic River Watershed. For communities that implement these low cost activities, technical and financial assistance will be available for more extensive activities, including:

- Stormwater management planning
- Stormwater ordinance development
- Engineering studies
- Construction of structures to maximize infiltration areas

Structural "retrofitting" in urban areas to control stormwater pollutants and increase infiltration will be considered. The priority matrix (Table 3-1) and decision making flow chart (Figure 3-1) will be used to identify and prioritize activities and best management practices based on cost effectiveness, and resource need and benefit. Figure 3-2 identifies priority categories of best management practices for urban and growth areas, based on cost effectiveness and water quality protection.

In addition, all communities are eligible for assistance in developing wellhead protection plans for existing municipal wells, as this is an important element of ground water and drinking water protection.

Figure 3-2. Priorities for Best Management Practices for Water Quality Protection in Urban and Growth Areas



The City of River Falls has already adopted a water management plan (WMP) (described below) and is developing a stormwater and erosion control ordinance. The WMP will be an important tool for implementing the urban program in River Falls. Much of the growth management strategy, below, applies to urban areas.

Growth Drainage Areas

The Kinnickinnic River Watershed is located at the mouth of the Lower St. Croix River Basin. In 1997, the St. Croix River was named by American Rivers as one of the 20 most threatened rivers in America because of concerns about the impacts of accelerated urban growth on the lower St. Croix Watershed. Growth in the eastern Twin Cities Metropolitan Area and western Wisconsin promises large-scale land use changes in the watershed. Poor growth management could result in deteriorating water quality in the Kinnickinnic River with similar adverse impacts as threaten the St. Croix River. Alternatively, good land use practices will sustain water quality for generations to come.

There are an array of growth management techniques that could be used to minimize and mitigate the impacts of development (Figure 3-2). These include focusing planning efforts on stream drainage areas within subwatersheds, as well as on a larger watershed scale; protecting sensitive areas from development; establishing stream and river buffers; limiting disturbance of soils; limiting creation of impervious cover; maintaining stream protection measures, such as stormwater BMP's; and properly treating wastewater.

These strategies have been compiled and are described in Appendix B, "Guidance for Watershed Stewardship". This document summarizes research from many sources, and was compiled for use by the St. Croix River Basin Water Resources Management Team (Johnson, 1998). These strategies will be a priority for identified growth areas. Cities, towns and villages that share drainage areas identified as urban and growth areas should work together in developing and implementing management plans. For the City of River Falls and surrounding townships, the plan described below will be an additional tool.

City of River Falls Water Management Plan

In 1991, the City of River Falls received a state grant to develop an action plan to minimize adverse water quality impacts from existing and future storm water discharges to the Kinnickinnic River. The *City of River Falls Water Management Plan for the Kinnickinnic River and its Tributaries* (WMP) was completed in 1995 (Short, Elliot, Hendrickson, Inc). The plan encompasses 64 square miles, including the surrounding towns of Troy, Kinnickinnic, River Falls and Clifton., although it specifically applies only to the areas within the corporate limits of the City of River Falls. The WMP focuses all basic information and planning data into a single document which describes existing conditions, specifies policies and standards, and recommends actions for the future enhancement of the communities' water resources. It addresses:

- Thermal pollution
- Flooding as it relates to bank erosion and habitat degradation
- Sediment delivery
- Pollutant loading including nutrients and heavy metals
- Groundwater

The plan identifies in detail priority areas for control of nonpoint source pollutants and water resource protection.

The WMP is an important tool for implementation of the Kinnickinnic River Priority Watershed Plan and will be used in conjunction with the decision making flow chart (Figure 3-1) and Matrix of Priorities (Table 3-1) to determine best management practices and other strategies in priority urban and growth areas within the WMP boundaries.

Because townships surrounding River Falls all face similar problems related to growth management, it is recommended that they develop consistent ordinances and enforcement strategies. The hiring of a consultant experienced in evaluating and enforcing stormwater and erosion control site plans would be extremely beneficial and cost effective for these townships.

Rural Drainage Areas

The water quality and quantity problems derived from rural runoff result primarily from agricultural practices. Other rural land cover such as woodlands, prairies and wetlands are generally beneficial to water quality. Agricultural practices can result in the following:

- Loadings of sediment from cropped or over-pastured fields and from gullies
- Excessive nutrients to surface water from barnyards, fertilizers and manure spreading
- Oxygen depletion in surface waters from nutrient-laden runoff water
- Streambank erosion caused by cattle trampling and flashy water flows
- Hydrologic disturbances, including flashy high flows and loss of base flow.
- Groundwater contamination from nutrients and pesticides

The delivery of pollutants to streams or lakes from rural areas depends on the land cover or crops, soil types, topography and hydrologic connection to surface water. Natural areas such as prairies and woodlands generally have undisturbed soils capable of soaking up rainfall, and vegetative cover that protects soil from the physical impact of rain drops. Wetlands can act as sponges, temporarily holding and slowly releasing heavy rainfall. Soils with good vegetative cover can trap nutrients and soil particles dislodged by rainfall.

The impacts of agriculture can vary greatly, depending on management practices. Tillage practices including contour and strip cropping and low or no-till methods can greatly reduce soil loss from agricultural fields. On the other hand, bare and compacted soils are vulnerable to excessive erosion and can cause silting in of stream habitat, downstream flooding and streambank erosion.

Areas where livestock are concentrated can also cause soil compaction, excessive nutrient laden runoff, erosion and trampled streambanks. Rotational grazing and streambank fencing can alleviate these impacts. Concentrated runoff from barnyards, manure-spread fields, or manure storage spills can cause excessive aquatic weed growth, and can deplete streams or lakes of oxygen, causing fish kills and die-offs of aquatic organisms important to the ecosystem.

Groundwater can become polluted from agricultural practices when pesticides, such as atrazine, and nitrates from fertilizers reach the water table. Excessive application of these substances, linked with bedrock fissures (karst topography) have made groundwater in the Kinnickinnic River Watershed vulnerable to agricultural pollution.

Rural Management Strategy

A variety of management practices can effectively reduce pollutant loading from agricultural sources, including appropriate tillage practices, barnyard runoff controls, nutrient and pest management, grassed waterways, streambank fencing and streambank repair. These and others are described in Chapters Five and Six of this plan, and can be cost-shared with eligible landowners.

Each subwatershed, and some individual stream segments were inventoried to identify nutrient and sediment sources. Rural sediment sources include crop lands, streambanks, gullies and dry runs. Barnyards and crop lands were inventoried to identify sources of excessive nutrients. Eligibility criteria for specific cost-shareable best management practices are described in Chapter 5 of this plan.

County staff will direct their efforts toward cost-share agreements and educational programs as indicated in the priority matrix (Table 3-1).

CHAPTER FOUR
Subwatershed Discussions

As described in Chapter Two of this plan and shown on Maps 2-1 and 3-1, the Kinnickinnic River Watershed is subdivided into eight individual subwatersheds. Although they are all part of the Kinnickinnic River Watershed, each of these subwatersheds is unique in its location in the watershed, natural features and land uses, and therefore has somewhat unique impacts on the Kinnickinnic River and other water resources of the watershed. In this chapter, each subwatershed is described in detail.

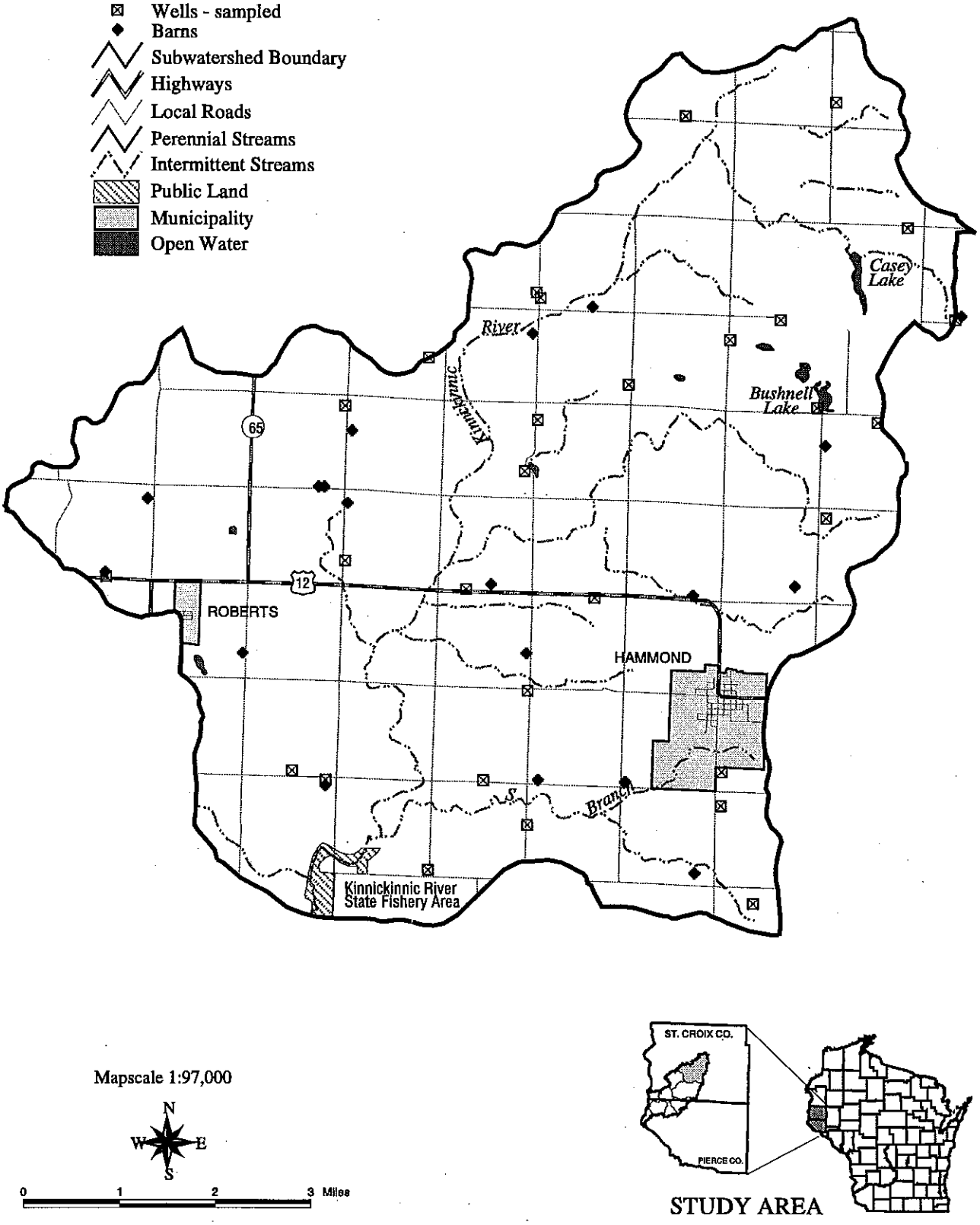
Information found in this chapter may also be found elsewhere in this plan. For instance, Chapter Three discusses watershed-wide pollutant reduction objectives and general management strategies for rural, urban and growth areas; Chapter Five reports inventory results in several categories, such as upland erosion, for the entire watershed. The purpose of this chapter is to bring together in one place, pertinent information about each subwatershed. This chapter is organized by subwatershed in the following manner:

- Upper Kinnickinnic Subwatershed (UK)
- Twin Lakes Subwatershed (TL)
- Middle Kinnickinnic Subwatershed (MK)
- South Fork Subwatershed (SF)
- River Falls Subwatershed (RF)
- Lower Kinnickinnic Subwatershed (LK)
- Upper St. Croix Subwatershed (USC)
- Lower St. Croix Subwatershed (LSC)

Each subwatershed discussion is organized in the following manner:

- Description
- Water Quality Conditions
- Management Needs
- Nonpoint Source Pollutant Reduction Objectives

Map 4-1. Upper Kinnickinnic Subwatershed



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1998

Upper Kinnickinnic Subwatershed (UK)

Description

The Upper Kinnickinnic Subwatershed is 46 square miles and includes the headwaters of the Kinnickinnic River, and Casey and Bushnell Lakes. Permanent flow in the Kinnickinnic River begins about 1.5 miles upstream of the I-94 bridge, approximately at the northern boundary of the Kinnickinnic River State Fishery Area, shown on Map 4-1. The watershed above this location, which includes nearly all of this subwatershed, is drained by intermittent streams and dry runs, and is largely farmed land. The South Branch is an intermittent stream in this subwatershed that delivers heavy loads of agricultural sediments and organic materials to the Kinnickinnic River, especially during spring runoff and after storms. Uplands and dry runs are major sources of sediment.

The Village of Hammond is drained by an intermittent stream located just north of the South Branch. Hammond covers about 810 acres, and is anticipated to grow to 890 acres or more by 2017. A developing industrial park is located on the south side of Hammond. Although most of the time, runoff from the Hammond infiltrates before reaching the Kinnickinnic River, this is an increasing concern during high runoff times, and as the village continues to grow.

Water Quality Conditions

The permanent portion of the stream reach in the Upper Kinnickinnic Subwatershed is managed as a Class I brook and brown trout fishery. The fish habitat rating and Index of Biotic Integrity (IBI) for this reach are good to excellent. The stream has high brown trout densities and relatively low brook trout densities in this reach.

Strong baseflow from several large springs in this reach resulted in the lowest summer maximum water temperatures found throughout the Kinnickinnic River during the 1996 fish surveys. However, the stream experiences occasional high peak flows due to agricultural and urban stormwater runoff in the watershed. The stream is also impacted by excessive sediment loading from upland runoff and streambank and dry run erosion.

Casey Lake is a shallow 28 acre seepage lake with a limited warmwater fishery. The lake is eutrophic with summer algae blooms and occasional winterkills.

Bushnell Lake is a shallow 17 acre seepage lake with a marginal warmwater fishery. The lake is highly eutrophic with summer algae blooms and frequent winterkills.

Management Needs

This section describes identified sources of pollutants in the Upper Kinnickinnic Subwatershed, and the relative significance of these sources within this subwatershed, as well as to the whole Kinnickinnic River Watershed.

Upland Sediments: Almost all (97%) of the sediments delivered by the Upper Kinnickinnic Subwatershed come from croplands. This subwatershed also contributes 35% of the total Kinnickinnic River Watershed upland sediment load, more than any other subwatershed, and has the highest average delivery rate of 0.28 tons/acre/year. Control of upland sediments is a *high* priority.

Streambanks and Dry Runs: Stream banks and dry runs contribute less than 1% of the Upper Kinnickinnic Subwatershed sediment load, since there are only 2 stream and 9 dry run miles. However, the highest erosion *rates* for streambanks and dry runs (13 and 19 tons/mile) are present in this subwatershed. Streambanks deliver 20 tons, and dry runs, 176 tons of sediment per year. This subwatershed delivers the second highest total tons per year from dry runs. Although these sediment sources comprise only a small part of the total sediment load in this subwatershed, the local impacts to stream habitat are significant. Controlling sediments from streambanks is a *medium* priority, and from dry runs, a *high* priority.

Agricultural Nutrients: The Upper Kinnickinnic Subwatershed contains 23 barnyards, with 9 eligible and none critical. These barnyards deliver 15% of the total Kinnickinnic River Watershed Combined Oxygen Demand (COD) load. The reduction goal for barnyards in the Upper Kinnickinnic Subwatershed is 23%, somewhat less than the reduction goal of 35% for the entire Kinnickinnic River Watershed. The priority is *medium.*

A 25% reduction in phosphorus reaching streams from croplands should be achieved by controlling upland sediments. This is a *high* priority.

Urban Nutrients, Sediment and Toxic Pollutants: The Village of Hammond contributes less than 1% of the Upper Kinnickinnic Subwatershed sediment load, and 8 to 9% of the total Kinnickinnic River Watershed urban pollutant loads (sediment, copper, phosphorus and lead) within the Kinnickinnic River Watershed. Urban toxic pollutants generally come from rooftops, roadways, industrial and other areas, and are described in more detail in Chapter Five of this plan. These pollutant loads from Hammond are expected to more than double in the planning period (20 years). Spring runoff and heavy rains may deliver sediment and associated pollutants to the river. However, because of the distance between Hammond and the Kinnickinnic River, thermal impacts from runoff are likely to be minimal. Urban house keeping practices, construction site erosion control ordinance development and/or enforcement, and stormwater planning are highly recommended.

Drinking water: Hammond is developing a wellhead protection plan for its two municipal wells, with completion expected in late 1998. Approving and implementing this wellhead protection plan is a *high* priority.

Groundwater: In the Upper Kinnickinnic Subwatershed, 19 of 38 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 17 exceeded Enforcement Standards (ES). Of 27 wells sampled for atrazine 17 exceeded PAL and 2 exceeded ES. More details on this inventory can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as proper well abandonment and nutrient and pest management planning.

Wetlands: There were 1,150 acres of wetlands inventoried in the Upper Kinnickinnic Subwatershed. Of these, 238 acres have been altered by farming, drainage or other uses. Practices to restore or protect wetlands will be extremely valuable for promoting groundwater recharge, protecting spring areas, surface waters and groundwater, and providing valuable wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the Upper Kinnickinnic Subwatershed. The inventoried pollutant loads for sediments and nutrients, reduction objectives and priorities for control are summarized below.

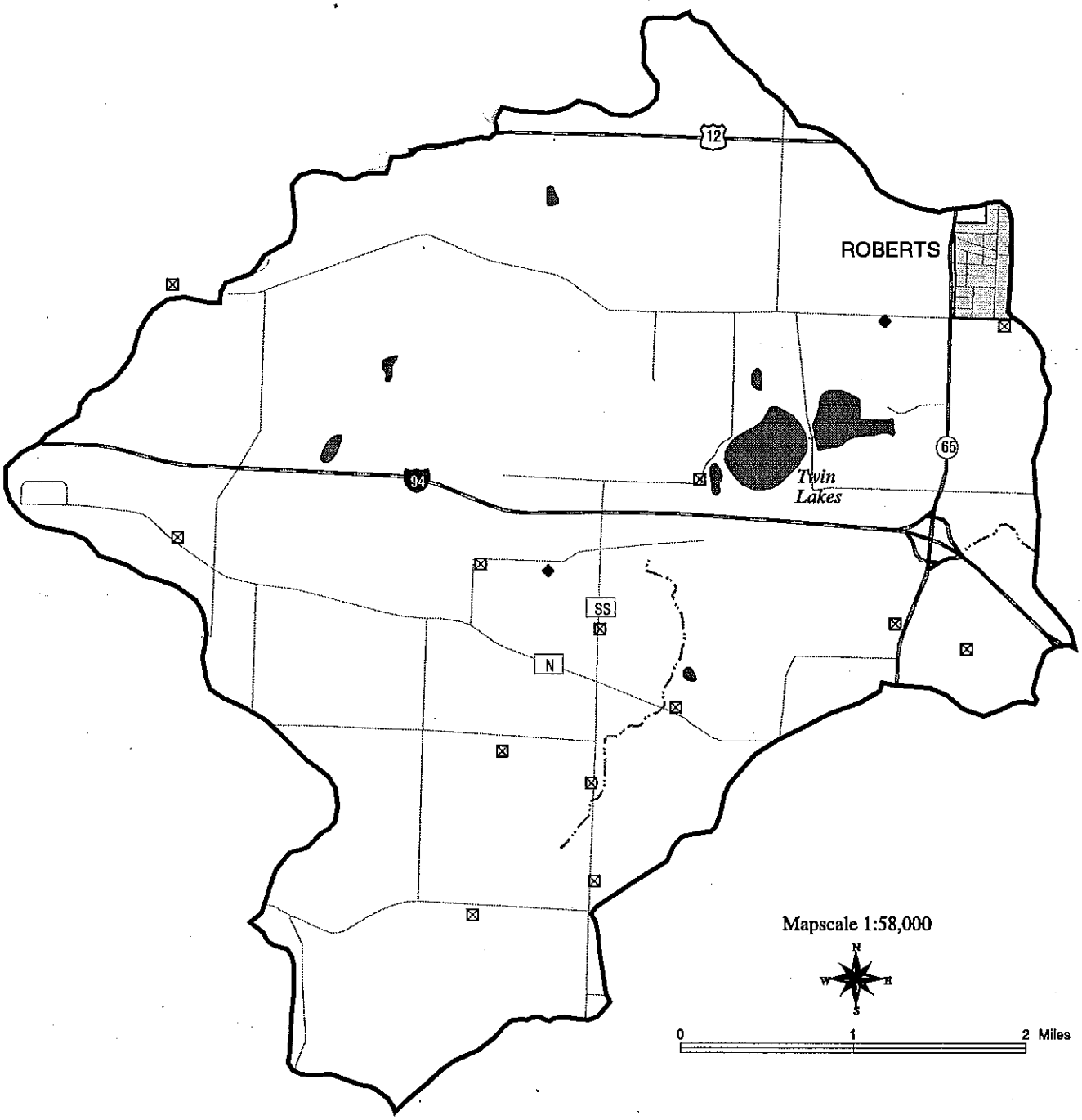
SEDIMENT - Upper Kinnickinnic					
Source	**Load from source (T/yr)**	**% of total Kinnickinnic R. Watershed sediment load**	**% of UK sediment load**	**UK % sediment reduction goal**	**Priority for control**
All Uplands	7,674	35%	97%	28%	High
Streambank	20	0%	0%	18%	Medium
Dry Runs	176	1%	2%	25%	High
Urban Runoff *(Hammond)*	111	1%	1%	35%	Medium
Construction Sites	40	0%	0%	70%	Medium
TOTAL	8,021	37%	100%	27%	

BARNYARD ORGANIC POLLUTANTS - Upper Kinnickinnic						
Number Inventoried	**Number Eligible**	**Number Critical**	**Total lbs/yr COD**	**% of total Kinnickinnic R. Watershed COD load**	**UK % Reduction Goal**	**Priority for control**
23	9	0	35,736	15%	23%	Medium

PHOSPHORUS - Upper Kinnickinnic		
Source	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	25 % reduction in phosphorus reaching streams from agricultural uplands (controlled through upland sediment reductions)	High
Barnyards	23% reduction through control of barnyard COD	Medium
Landspread Manure	Reduce through 80% participation in Nutrient and Pest Management	High

URBAN AND GROWTH AREA POLLUTANTS *(Hammond)*		
Pollutant	**Reduction Objectives**	**Priority**
Sediment and Metals	Reduce through urban housekeeping practices, construction site ordinance, stormwater management	Medium
Nutrients	Reduce through urban housekeeping practices, construction site ordinance, stormwater management	Medium
Hydrologic	Reduce through future stormwater management planning	Low

Map 4-2. Twin Lakes Subwatershed

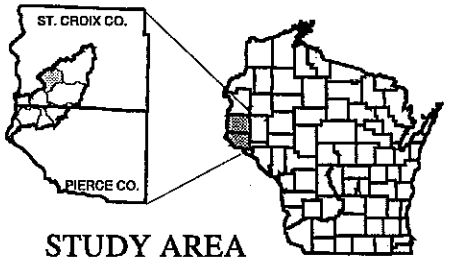


Mapscale 1:58,000

0 1 2 Miles

LEGEND

- Wells - sampled
- Barns
- Highways
- Local Roads
- County Boundary
- Perennial Streams
- Intermittent Streams
- Municipality
- Open Water



STUDY AREA

Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1998

Twin Lakes Subwatershed (TL)

Description

The Twin Lakes Subwatershed (Map 4-2) is 20.7 square miles and drains entirely to East and West Twin Lakes. These are a pair of shallow, seepage waterbodies with a surface area of about 168 acres, located approximately one mile southwest of the Village of Roberts. "Seepage" means that the water sources for these lakes are groundwater recharge and overland runoff. There is no stream inflow or outflow. Seepage lakes are very susceptible to the effects of nutrient loads, including excessive algae growth and loss of oxygen, which can cause winter kills of fish populations.

The major pollutant concern for Twin Lakes is excessive nutrients. The major sources of these nutrient loads are agricultural lands and the Village of Roberts wastewater treatment plant.

Water Quality Conditions

Water levels in East and West Twin Lakes fluctuate considerably, depending on prevailing climatic conditions. The maximum depth of West Twin Lake reportedly ranges from about 9-12 feet. East Twin is hydraulically connected to West Twin by a culvert, and has a maximum depth ranging from about 3-6 feet. Historically, Twin Lakes and other comparable waterbodies in the region have fluctuated from a wetland condition with little open water during dry periods, to open-water lakes capable of supporting a limited forage fishery during wet periods.

Both lakes suffer from severe summer algae blooms and winterkill due to dissolved oxygen (D.O.) depletion. During July 1991, the Department received reports of an intense algae bloom in Twin Lakes and water samples confirmed the presence of blue-green algal toxins. An ice-cover survey conducted in February 1993 found dissolved oxygen levels throughout the water column below 1.0 mg/l in both portions of Twin Lakes, indicating probable winterkill conditions.

Twin Lakes/Roberts Waste Water Treatment Plant Study. Anecdotal evidence suggests water quality may have deteriorated in Twin Lakes since the 1960's. A DNR study, *Twin Lakes/Roberts Waste Water Treatment Plant (WWTP) Water Quality Assessment* (Schreiber, 1995) was undertaken to evaluate past and present water quality conditions and to estimate nutrient loading from point and nonpoint sources in the watershed.

The Village of Roberts discharges wastewater effluent to two wastewater stabilization ponds located in the northeastern portion of East Twin Lakes. The plant is currently required to meet Wisconsin Pollution Discharge Elimination System (WPDES) permit limits, but is not required to remove phosphorus or nitrogen. The Schreiber (1995) study concluded:

1. Twin Lakes are highly eutrophic as a result of phosphorus loading from a) the Roberts WWTP, b) internal recycling of phosphorus and c) nonpoint source loading from the Twin

Lakes Subwatershed. Release of phosphorus from the bottom sediments was estimated to contribute about half of the annual phosphorus load to Twin Lakes, and most of this phosphorus load likely originates from the watershed. During 1993, the Roberts WWTP contributed about 15% of the annual phosphorus load. The predominance of *dissolved phosphorus* from this source, which is readily available for agal uptake, may be a significant factor during the summer growing season.

2. East Twin exhibits extremely high phosphorus levels during most of the growing season. Nitrogen to phosphorus ratios in East Twin and in sediments suggest the WWTP discharge has been a major source of phosphorus in recent years.

As a part of watershed plan development, the West Central Wisconsin Regional Planning Commission provided updated land use data, and phosphorus loads from upland runoff were recalculated. These calculations showed a moderate increase in phosphorus loads attributable to upland runoff. However, these changes do not contradict the conclusions of the 1995 study.

Management Needs

This section describes identified sources of pollutants in the Twin Lakes Subwatershed, and the relative significance of these sources within this subwatershed, as well as to the whole Kinnickinnic River Watershed.

Upland Sediments: Almost all (93%) of the sediments delivered from Twin Lakes Subwatershed come from croplands. This subwatershed produces 11% of the total Kinnickinnic River Watershed sediment load, and it is entirely delivered to Twin Lakes. Because the average delivery rate of 0.16 tons/acre/year is low, there are few cropland practices available to reduce this load. As a result, the estimated reduction that will occur is 10%. Control of upland sediment is a *medium* priority.

Agricultural Nutrients: The Twin Lakes Subwatershed contains 3 barnyards, with 1 eligible and 1 critical. These barnyards deliver 16% of the total Kinnickinnic River Watershed Combined Oxygen Demand (COD) load. The reduction goal for barnyards in the Twin Lakes Subwatershed is 42%, higher than the overall barnyard reduction goal of 35% for the entire Kinnickinnic River Watershed. The priority is *high.*

Lake modeling has shown that about 2,500 pounds/year of phosphorus reach the lakes from agricultural uplands. Controlling upland sediments, and cropping and nutrient and pest management practices should achieve an overall 50% reduction in phosphorus from agricultural uplands. Reducing this load is a *high* priority.

Urban Nutrients, Sediment and Toxic Pollutants: The Village of Roberts, excluding the waste water treatment plant (discussed above), contributes 5% of the Twin Lakes Subwatershed sediment pollutant loads. About 4% of the urban pollutant loads (sediment, copper, phosphorus and lead) within the whole Kinnickinnic River Watershed come from Roberts. Pollutant loads

from Roberts are expected to increase to about five times the current load by 2017. Urban best management practices, construction site erosion control ordinance development and/or enforcement, and stormwater planning are highly recommended.

Drinking water: Roberts does not have a wellhead protection plan for its two municipal wells. Approving and implementing a wellhead protection plan is a *high* priority, and eligible for grant assistance.

Groundwater: In the Twin Lakes Subwatershed, 8 of 11 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 1 exceeded Enforcement Standards (ES). Of 8 wells sampled for atrazine none exceeded PAL. More details on this inventory can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as proper well abandonment and nutrient and pest management practices.

Wetlands: There were 556 acres of wetlands inventoried in the Twin Lakes Subwatershed. Of these, 113 acres have been altered by farming, drainage or other uses. Practices to restore or protect wetlands can protect surface and groundwater, and provide valuable wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the Twin Lakes Subwatershed. The inventoried pollutant loads for sediments and nutrients, and reduction objectives and priorities for control are summarized below.

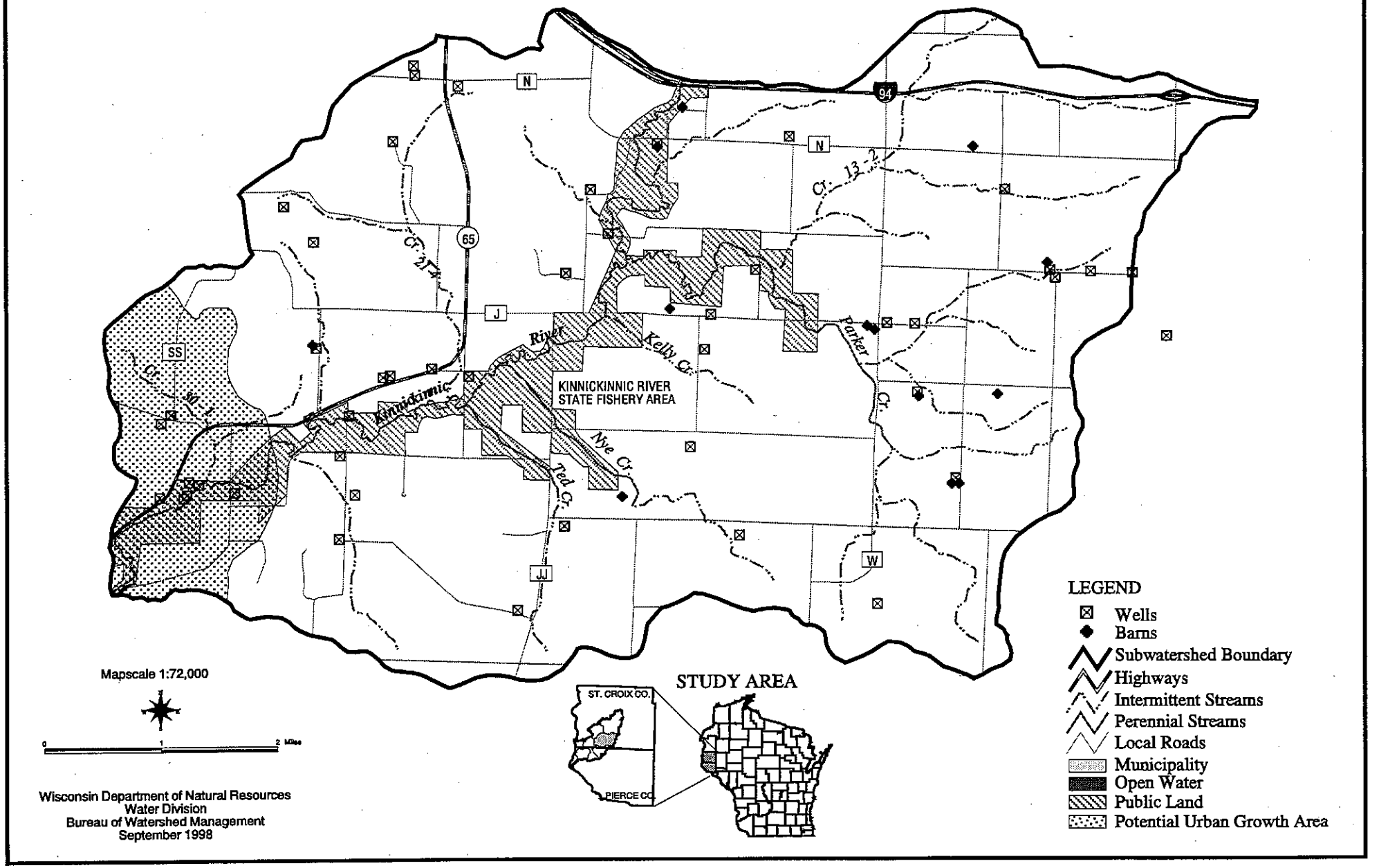
SEDIMENT - Twin Lakes					
Source	**Load from Source (T/yr)**	**% of total Kinnickinnic R. Watershed sediment load**	**% of TL sediment load**	**TL % sediment reduction goal**	**Priority for control**
All Uplands	2,183	10%	93%	10%	High
Streambank	0	0%	0%	0%	NA
Dry Runs	0	0%	0%	0%	NA
Urban *(Roberts)*	117	1%	5%	35%	Medium
Construction Sites	60	0%	3%	70%	Medium
TOTAL	2,360	11%	101%	13%	

BARNYARD ORGANIC POLLUTANTS - Twin Lakes						
Number Inventoried	**Number Eligible**	**Number Critical**	**Total Lbs/yr COD**	**% of total Kinnickinnic River Watershed COD Load**	**% Reduction Goal**	**Priority for control**
3	1	1	38709	16%	42%	High

PHOSPHORUS - Twin Lakes				
Source	**Load (lbs/yr)**	**% of TL subwatershed load**	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	2,528	39%	50% through sediment reduction and participation in Nutrient and Pest Management	High
Urban Runoff	536	8%	Reduce through urban housekeeping practices, erosion and stormwater ordinances	Medium
Atmospheric	78	1%	N/A	N/A
Roberts WWTP	783	12%		N/A
Internal P	2,558	39%	N/A	N/A
Total	6,483	100%		

URBAN AND GROWTH AREA POLLUTANTS *(Roberts)*		
Pollutant	**Reduction Objectives**	**Priority**
Sediment and Metals	Reduce through urban housekeeping practices, construction site and stormwater management	Medium
Nutrients	Reduce through urban housekeeping practices, construction site and stormwater management	High
Thermal or Hydrologic	Reduce through future stormwater management planning	Low

Map 4-3. Middle Kinnickinnic Subwatershed



Middle Kinnickinnic Subwatershed (MK)

Description

The Middle Kinnickinnic Subwatershed is 39.2 square miles and includes 11 miles of the mainstem of the Kinnickinnic River (Map 4-3). Parker Creek is the largest tributary, and drains almost entirely agricultural land in the eastern third of this subwatershed, largely via intermittent tributary streams and dry runs. Kelly, Nye and Ted Creeks also drain agricultural and wooded lands to the east of the Kinnickinnic River. The entire mainstem and perennial portions of these tributary streams are included in the Kinnickinnic River State Fishery Area. These lands are owned or managed through easements by the state, and provide public access and a measure of protection to stream habitat.

Several unnamed intermittent tributaries drain the Northwestern third of this subwatershed. This area is also largely agricultural, though fairly steep partially wooded slopes drain to these intermittent tributaries. The steepness of this terrain is reflected in the steeply channeled nature of some of these tributaries, and the heavy sediment loads delivered from these areas.

The Middle Kinnickinnic Subwatershed is a huge source of sediment to the Kinnickinnic River. It contributes 20% of the upland sediments and more than half of the streambank and dry run sediments.

State Highway 65 parallels the Kinnickinnic River for the downstream half of its length in the Middle Kinnickinnic Subwatershed. Approximately five square miles, including the lower two stream miles of the Kinnickinnic River in this subwatershed, are areas where urban growth and development are likely to occur. In this area, particularly the Highway 65 corridor, land use and development strategies that minimize runoff will be very important.

Water Quality Conditions

The Middle Kinnickinnic reach of the Kinnickinnic River supports a Class I brook and brown trout fishery. The upper 2.7 miles support brook and brown trout, and the lower 8.5 miles support brown trout only. Brown trout densities are high to very high in this reach, with a significant brook trout population at the furthest upstream site (CTH N). The stream Habitat Biotic Index (HBI) was very good, indicating minimal organic loading. The fish habitat ratings and coldwater Index of Biotic Integrity (IBI) values were fair to good (Schreiber, 1998).

Water resource problems in this reach include sedimentation, barnyard runoff (from one barnyard), streambank erosion, wetland grazing and gully erosion in the dry runs. The stream is also impacted by flashy stream flows during runoff events.

Parker Creek is 6 miles in length and supports a Class I brook and brown trout fishery. Brown trout densities are low in the headwaters area and very high near the mouth. The stream supports

relatively low brook trout densities. The stream HBI was very good indicating minimal organic loading, and the fish habitat rating was fair to good. The coldwater IBI was poor at the two upstream stations and good at the lower stations. This drainage area is *high* priority for upland, streambank and dry run sediment control.

Kelly Creek (Kelly Spring) is very small (less than 1 mile in length) and supports a low density, Class II brook and brown trout fishery. The coldwater IBI was good and fish habitat rating was fair. The stream is limited by its small size, sedimentation and dense tag alder growth in the riparian area. Portions of this drainage area are being impacted by conversion from agricultural land use to residential development.

Nye Creek is 2 miles in length and supports a Class II brook trout fishery. The stream HBI was very good, indicating minimal organic loading. The fish habitat rating was good and the coldwater IBI was excellent. The stream is impacted by sedimentation and streambank and gully erosion. The stream is also impacted by wetland alterations and cattle pasturing in the headwaters area.

Ted Creek is 2 miles in length and supports a Class II brook trout fishery. The stream HBI was excellent, indicating little or no organic loading. The fish habitat rating was fair and coldwater IBI was excellent. The stream is impacted by sedimentation, streambank and gully erosion and wetland grazing.

The drainage areas for the lower portion of Parker, and for Kelly, Nye and Ted creeks should be a *high* priority for management to maximize infiltration and recharge to spring areas.

Unnamed Creek 21-4 has become ditched and channelized due to large runoff volumes. It carries heavy upland sediment loads from surrounding steep terrain.

Unnamed Creek 30-1 is impacted by heavy loads of fine sediments and streambank and dry run erosion. Control of upland sediments in the drainage areas of both these creeks is needed.

Unnamed Creek 30-10 is just north of the City of River Falls. It is wide, shallow and short, fed largely by springs. It currently receives few sediments, and is an important contributor of cold water to the Kinnickinnic River. It is a *high* priority to manage this drainage area to maximize infiltration and recharge to these springs.

Management Needs

This section describes identified sources of pollutants coming from the Middle Kinnickinnic Subwatershed, and the relative significance of these sources within this subwatershed, as well as to the Kinnickinnic River Watershed as a whole.

Upland Sediments: Most (79%) of the sediments delivered from the Middle Kinnickinnic Subwatershed come from croplands. This subwatershed also contributes 18%, or 3,868 tons/year

of the total Kinnickinnic River Watershed upland sediment load at an average delivery rate of 0.19 tons/acre/year. This load is second only to that of the Upper Kinnickinnic Subwatershed. The reduction objective for upland sediments in the Middle Kinnickinnic Subwatershed is 17%. A greater reduction in upland sediment loads is desirable, but may be difficult to achieve, due to the low number of critical acres in the Middle Kinnickinnic Subwatershed, and the generally low sediment delivery rates. Control of upland sediments is a *high* priority.

Streambanks and Dry Runs: Thirty miles of streambank contribute 370 tons/year of sediment, 8% of the Middle Kinnickinnic Subwatershed load. Steambanks in the Middle Kinnickinnic Subwatershed erode at an average rate of 12 tons/mile, the second highest in the entire Kinnickinnic River Watershed. Twenty-seven miles of dry runs contribute 584 tons/year of sediment, 12% of the Middle Kinnickinnic Subwatershed load. Dry runs in this subwatershed erode at a rate of 21.5 tons/mile/year, the highest in the entire Kinnickinnic River Watershed. These sediments have an extremely high local impact on stream habitat, particularly on Parker Creek and on Creek 30-1. Controlling sediments from streambanks and dry runs is a *high* priority.

Agricultural Nutrients: The Middle Kinnickinnic Subwatershed contains 19 barnyards, with 5 eligible and none critical. These barnyards deliver 16% of the total Kinnickinnic River Watershed Combined Oxygen Demand (COD) load to the Kinnickinnic River. The reduction goal for barnyards in the Middle Kinnickinnic Subwatershed is 31%, about the same as the overall Kinnickinnic River Watershed reduction goal of 35%. The priority is *high.*

Controlling phosphorus reaching streams from croplands is considered a *high* priority. A goal of 17% reduction should be achieved by controlling 17% of upland sediments.

Urban Nutrients, Sediment and Toxic Pollutants: There are no urban areas (areas with greater than 15% imperviousness) identified in this subwatershed, and thus no calculated urban loads. However, state highway 65 runs through the length of this subwatershed, and it is within an area of St. Croix County that is experiencing very rapid growth. Areas of concentrated growth, such as subdivisions are very likely to occur here. High growth areas are also identified in the Quarry Road corridor (Creek 30-10 drainage area). Growth management strategies described in Chapter Three of this plan will be very important in these areas. Construction site erosion control, stormwater ordinance implementation and land use planning to protect open space and maximize infiltration will be necessary.

Groundwater: In the Middle Kinnickinnic Subwatershed, 28 of 38 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 4 exceeded Enforcement Standards (ES). Of 25 wells sampled for atrazine, 4 exceeded PAL. More details can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as well abandonment and nutrient and pest management planning.

Wetlands: There were 1,478 acres of wetlands inventoried in the Middle Kinnickinnic Subwatershed. Of these, 209 acres have been altered by farming, drainage or other uses.

Practices to restore or protect wetlands will be extremely valuable for protecting spring recharge areas, surface waters, groundwater, and providing valuable wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the Middle Kinnickinic Subwatershed. The inventoried pollutant loads for sediments and nutrients, and reduction objectives and priorities for control are summarized below.

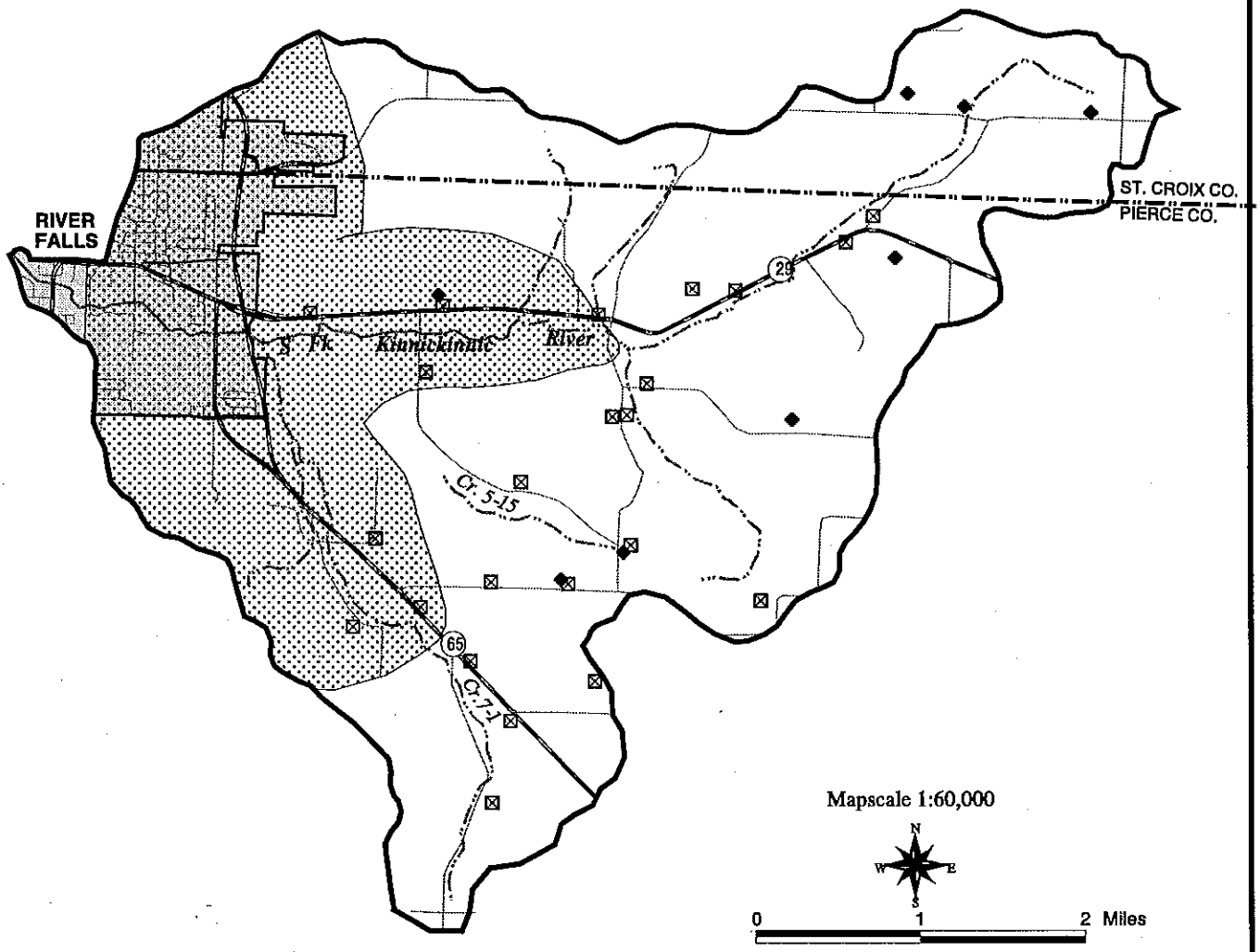
SEDIMENT - Middle Kinnickinnic					
Source	**Load from Source (T/yr)**	**% of total Kinnickinnic R. Watershed sediment load**	**% of MK total sediment load**	**MK % Sediment reduction goal**	**Priority for control**
All Uplands	3,868	18%	79%	17%	High
Streambank	370	2%	8%	76%	High
Dry Runs	584	3%	12%	31%	High
Urban	0	0%	0%	0%	Medium
Construction Sites	80	0%	2%	70%	Medium
TOTAL	4,902	23%	101%	24%	

BARNYARD ORGANIC POLLUTANTS - Middle Kinnickinnic						
Number Inventoried	**Number Eligible**	**Number Critical**	**Total lbs/yr COD**	**% of Kinnickinnic R. Watershed COD Load**	**% Reduction Goal**	**Priority for control**
19	5	0	37,271	16%	31%	High

PHOSPHORUS - Middle Kinnickinnic		
Source	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	17 % reduction in phosphorus reaching streams from agricultural uplands (controlled through upland sediment reductions)	High
Barnyards	31% reduction through control of barnyard COD	High
Landspread Manure	Reduce through 60% participation in Nutrient and Pest Management	High

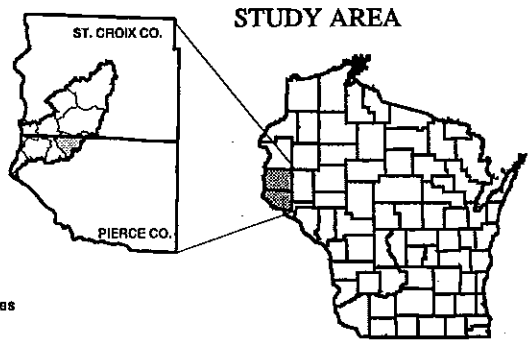
URBAN AND GROWTH AREA POLLUTANTS - Middle Kinnickinnic *(Growth areas on tributary creeks 30-10, Hwy 65 corridor)*		
Pollutant	**Reduction Objectives**	**Priority**
Sediment and Metals	Reduce through urban housekeeping practices, construction site and stormwater ordinance implementation	Medium (High for growth corridors)
Nutrients	Reduce through urban housekeeping practices, construction site and stormwater ordinance implementaton	Medium (High for growth corridors)
Thermal or Hydrologic	Reduce through stormwater management plan and ordinance implementation	Medium (High for growth corridors)

Map 4-4. South Fork Subwatershed



LEGEND

- Wells
- Barns
- Subwatershed Boundary
- County Boundary
- Local Roads
- Highways
- Perennial Streams
- Intermittent Streams
- Potential Urban Growth Areas
- Open Water
- Municipality



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1998

South Fork Subwatershed (SF)

Description

The South Fork Subwatershed is 19.3 square miles and includes the South Fork of the Kinnickinnic River, two unnamed tributaries (Creeks 7-1 and 5-15) and several intermittent streams and dry runs draiming to the South Fork (Map 4-4). It includes about 2.5 square miles of existing urban area, and a large projected growth area, generally around the perimeter of the existing urban area, east along the Highway 29 corridor and southeast along the Highway 65 corridor. About 10% of the South Fork Subwatershed is already developed, and as much as 25% may be developed in the future. About 75% is likely to remain a mixture of agriculture and woodlands.

The upper reaches of the stream support brook trout spawning habitat, though active beaver dams are a threat to the cold water thermal regime in this area. The downstream end of the South Fork has been highly impacted by development. This portion of the stream flows through the University of Wisconsin - River Falls campus, where this impact is evident. The campus has been involved in planning and management efforts to improve this portion of the stream.

Water Quality Conditions

The South Fork of the Kinnickinnic River flows 9 miles in a westerly direction., entering the Kinnickinnic River between Lake George and Lake Louise in River Falls. The stream supports a moderate density Class II brook trout fishery. Stream habitat conditions range from good in the headwaters area, to poor in the lower reaches. The coldwater Index of Biotic Integrity (IBI) was fair to excellent and the Habitat Biotic Index (HBI) was good to very good, indicating minimal organic loading.

The upper portion of the South Fork of the Kinnickinnic River is impacted by sedimentation, bank and upland erosion, wetland grazing and beaver dams on the tributaries. The lower portion, which flows through River Falls, is impacted by flashy streamflow, sedimentation, elevated temperatures and lack of adequate fish habitat. The South Fork of the Kinnickinnic River is significantly impacted by excessive peak streamflow and elevated water temperatures during summer storm events. However, there is a high potential to achieve improvement in this reach (Schreiber, 1998).

Management Needs

This section describes identified sources of pollutants in the South Fork Subwatershed, and the relative significance of these sources within this subwatershed, as well as to the whole Kinnickinnic River Watershed.

Upland Sediments: Most (68%) of the sediments delivered from the South Fork Subwatershed come from croplands. Only 7% (1528 tons/acre/year) of the total Kinnickinnic River Watershed upland sediment load comes f rom the South Fork Subwatershed, at a lower than an average delivery rate of 0.14 tons/acre/year. The reduction goal for upland sediments is 33%, about the same as the Kinnickinnic River Watershed goal of 35% . Control of upland sediments is a *medium* priority, except for the South Fork of the Kinnickinnic River above Creek 5-15, where the priority is *high.*

Streambanks and Dry Runs: Sixteen miles of streambank in the South Fork Subwatershed erode at an average rate of 8 tons/mile/year, and contributes 130 tons/year, the second largest subwatershed load from streambanks. Eleven miles of dry runs contribute 153 tons/year of sediment, at an average rate of 15 tons/mile/year. These loads make up 6% and 7% of the South Fork Subwatershed sediment loads, respectively. They have a high local impact on stream habitat in the South Fork, and have a *high* priority in these areas.

Agricultural Nutrients: The South Fork Subwatershed contains 15 barnyards, with 5 eligible and 1 critical. These barnyards deliver 68,871 pounds of Combined Oxygen Demand (COD) per year, by far the largest subwatershed load. The South Fork Subwatershed produces 29% of the total COD in the whole Kinnickinnic River Watershed. The reduction goal for barnyards in the South Fork Subwatershed is 54%, higher than the reduction goal of 35% for the whole Kinnickinnic River Watershed. The priority is *high.*

Controlling phosphorus reaching streams from croplands is considered a *high* priority for lands draining to the South Fork of the Kinnickinnic River above Creek 7-1, and a *medium* priority elsewhere. A 33% reduction goal should be achieved by controlling upland sediments.

Urban nutrients, sediment and toxic pollutants: Urban areas, primarily the City of River Falls and the Town of River Falls, contribute 368 tons of sediment per year, 8% of the total sediment load in the South Fork Subwatershed. This is almost 60% of the urban pollutant loads (sediment, copper, phosphorus and lead) in the whole Kinnickinnic River Watershed. Pollutant loads from this urban area are expected to almost double in the planning period (20 years). Areas of concentrated growth, especially along the highway corridors, are likely to occur here. Much of this area drains to the South Fork, a Class II brook trout fishery, which is impacted by sedimentation, flashy stream flow and thermal pollution. Growth management strategies described in Chapter Three of this plan will be very important in these areas. The *City of River Falls Water Management Plan* (Short, Elliott, Hendrickson, Inc, 1995) provides a detailed assessment of the conditions of the urban portion of the South Fork Subwatershed and should be referenced in developing urban and growth management strategies.
Construction site erosion control, stormwater ordinance implementation and land use planning to protect open space and maximize infiltration will be necessary. Measures such as stormwater infiltration structures and site designs to minimize impervious surfaces will be needed to prevent increases in thermal impacts on cold water streams in this subwatershed. The greatest benefit will be attained if the local governmental units within this growth area work together to assure consistent and effective land use management.

Groundwater: In the South Fork Subwatershed, 8 of 23 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 5 exceeded Enforcement Standards (ES). Of 23 wells sampled for atrazine 3, exceeded PAL. More details on this inventory can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as well abandonment and nutrient management planning.

Wetlands: There were 147 acres of wetlands inventoried in the South Fork Subwatershed. Of these, 65 acres have been altered by farming, drainage, development or other uses. Practices to restore or protect wetlands will be extremely valuable for protecting springs, surface waters and groundwater, and providing valuable wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the South Fork Subwatershed. The inventoried pollutant loads for sediments and nutrients, and reduction goals and priorities are summarized below.

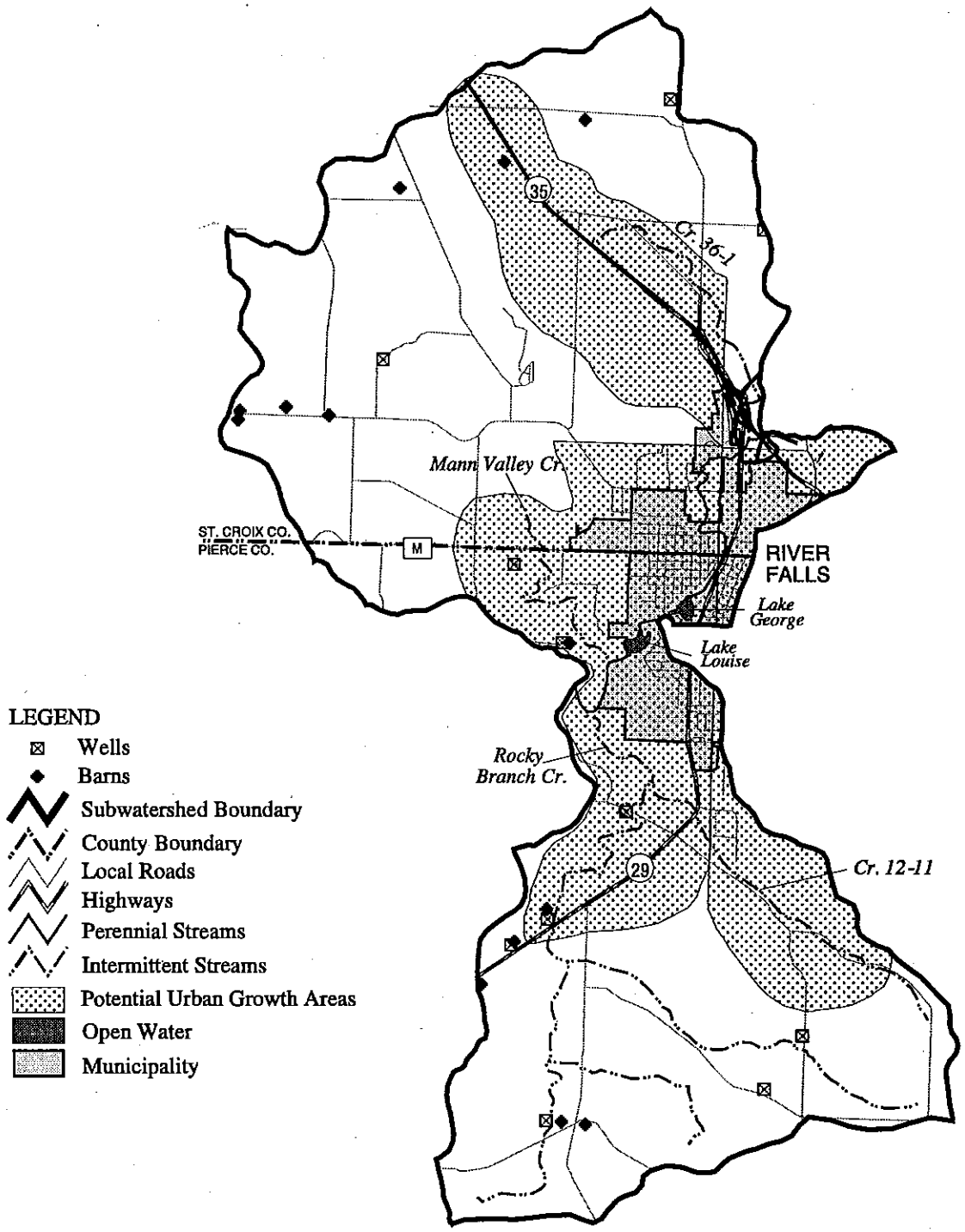
SEDIMENT - South Fork					
Source	**Load from Source (T/yr)**	**% of total Kinnickinnic R. Watershed sediment load**	**% of SF total sediment load**	**SF % reduction goal**	**Priority for control**
All Uplands	1,528	7%	68%	33%	Medium (High above Cr.5-15)
Streambank	130	1%	6%	49%	High
Dry Runs	153	1%	7%	25%	High
Urban *(part of River Falls)*	368	1%	16%	35%	High
Construction Sites	60	0%	3%	70%	High
TOTAL	2,239	10%	100%	35%	

BARNYARD ORGANIC POLLUTANTS - South Fork						
Number Inventoried	**Number Eligible**	**Number Critical**	**Total Lbs/yr COD**	**% of total Kinnickinnic R. Watershed COD Load**	**SF % Reduction Goal**	**Priority for control**
15	5	1	68,871	29%	54%	High

PHOSPHORUS - South Fork		
Source	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	33 % reduction in phosphorus reaching streams from agricultural uplands (controlled through upland sediment reductions)	Medium/High
Barnyards	54% reduction through control of barnyard COD	High
Landspread Manure	Reduce through 50% participation in Nutrient and Pest Management	Medium

URBAN AND GROWTH AREA POLLUTANTS - South Fork		
Pollutant	**Reduction Objectives**	**Priority**
Sediment and Metals	Reduce through urban housekeeping practices, construction site and stormwater ordinance implementation	High
Nutrients	Reduce through urban housekeeping practices, promotion of phosphorus-free fertilizers, education and stormwater management	High
Thermal or Hydrologic	Reduce through stormwater management plan and ordinance implementation	High (Low for Cr.5-15 & SF above Cr.5-15)

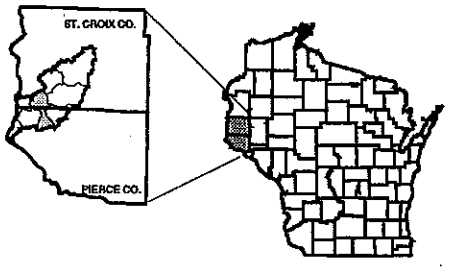
Map 4-5. River Falls Subwatershed



LEGEND

- Wells
- Barns
- Subwatershed Boundary
- County Boundary
- Local Roads
- Highways
- Perennial Streams
- Intermittent Streams
- Potential Urban Growth Areas
- Open Water
- Municipality

STUDY AREA



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Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1998

River Falls Subwatershed (RF)

Description

The River Falls Subwatershed is 16.2 square miles and includes the Kinnickinnic River, Mann Valley Creek, Rocky Branch and several small unnamed streams (Map 4-5). This reach of the Kinnickinnic River also includes two impoundments known locally as Lake George and Lake Louise. The River Falls Subwatershed includes about 2.5 square miles of existing urban area, and a large projected growth area, generally around the perimeter of the existing urban area, in a northwesterly direction along the Highway 35, southwesterly along Highway 29 and southeasterly along County Highway FF. About 15% of the River Falls Subwatershed is already developed, and as much as 35% may be developed in the future.

The portion of the River Falls Subwatershed north and west of the Kinnickinnic River is drained by several intermittent waterways (Map 4-5). Creek 36-1 roughly parallels Highway 35, and currently drains largely agricultural lands, however, this drainage is identified as a growth area . It is a cold water source for the Kinnickinnic River, and contains brown and brook trout.

Creek 36-15 drains a small area containing industrial development, wetlands and open space just north of Division Street, and east of the Kinnickinnic River. It is a valuable source of cold water to the river, and groundwater recharge to this area needs to be protected.

The Mann Valley Creek drainage area includes largely agricultural areas to the north and west, and residential and growth areas near the city of River Falls. The creek itself is short, but provides some of the coldest flows measured. Groundwater recharge areas and springs need to be protected.

The Rocky Branch and its unnamed tributary, Creek 12-11, drain most of the River Falls Subwatershed south of the Kinnickinnic River. Increased residential development is likely to occur in this drainage area, however agricultural impacts will likely remain the greatest threat to this stream. The stream bed of the Rocky Branch has received extremely heavy sediment loads in the past, and all but a few hundred feet of stream near the mouth are sediment covered. This stream is an excellent source of cold water to the lower Kinnickinnic River, originating from springs along the creeks, particularly near the confluence of the Rocky Branch and Creek 12-11. Further work to identify the sources of the heavy sand loads to this tributary should be a *high* priority.

Lake George and Lake Louise are formed by dams on the Kinnickinnic River, and have been prominent water features in the City of River Falls for over 100 years. Most long-time residents have come to appreciate the lakes for their placid ambiance. The *River Falls Water Management Plan* (Short, Elliott, Hendrickson, Inc, 1995) and the *Kinnickinnic River Priority Watershed Surface Water Resources Appraisal Report* (Schreiber, 1998), have identified that the condition

of the Kinnickinnic River downstream from the City of River Falls is worse than the condition upstream. Increased temperatures resulting from the two lakes and flow fluctuations caused by dam management procedures contribute to adverse impacts on the Kinnickinnic River ecosystem.

Water Quality Conditions

The Kinnickinnic River in this subwatershed includes three separate reaches:

(1) a 2 mile upper reach from above Lake George to STH 35,
(2) a 0.2 mile reach from below Junction Falls to upper Lake Louise, and
(3) a 1.0 mile lower reach from below Powell Dam to the confluence with Rocky Branch.

Each of these reaches currently support a Class I brown trout fishery, however, the middle reach was not inventoried during the 1996 fish surveys. The 1996 surveys found very high brown trout densities in the upper and lower reaches.

The coldwater Index of Biotic Integrity (IBI) and habitat rating was fair in the upper (downtown River Falls) reach. The stream Habitat Biotic Index (HBI) was very good indicating minimal organic loading. The upstream reach is impacted by urban runoff pollution (including thermal), flashy flows and lack of adequate fish habitat.

The middle reach (between the two impoundments) is deep, slow moving and has marginal trout habitat conditions. The South Fork of the Kinnickinnic River enters this reach and provides a source of relatively cool water to the Kinnickinnic River.

The downstream reach (below Lake Louise and Powell Dam) had a fair coldwater IBI and good habitat rating. This reach had an excellent HBI indicating minimal organic loading. The stream is impacted in this reach by flashy stream flows caused by urban runoff and hydropower manipulations. The stream also has elevated water temperatures and occasional turbidity caused by the two upstream impoundments and stormwater runoff.

Lake George is a shallow, eutrophic 18-acre impoundment of the Kinnickinnic River formed by the Junction Falls dam. The lake has a limited warmwater and coldwater sport fishery consisting of largemouth bass, panfish and brown trout. The lake is nearly filled with sediment and experiences summer algae blooms and turbidity. Water temperatures in the original stream channel are generally cool enough to support brown trout. However, warming in the shallow areas tends to cause a general increase in downstream water temperatures.

Lake Louise is a shallow, eutrophic 15-acre impoundment of the Kinnickinnic River formed by Powell Dam. Similar to Lake George, the lake has a limited warmwater and coldwater sport fishery consisting of largemouth bass, panfish and brown trout. The lake also supports a significant carp population. The lake is nearly filled with sediment and experiences summer algae blooms and turbidity.

The impoundments have an overall constant warming effect of about 3^0 C. (5^0 F.) on downstream water temperatures during base flow (Schreiber, 1998).

Mann Valley Creek is 2 miles in length and supports a low density, Class II brook and brown trout fishery. The fish habitat rating was good and coldwater IBI was excellent. This small stream experiences flashy flows, streambank erosion and sedimentation.

Rocky Branch is 6 miles in length and supports a moderate density, Class I brown trout fishery. The headwaters area had minimal flow and supported no trout. The stream had a good habitat rating and a very good HBI, suggesting minimal organic loading. The coldwater IBI was good at the lower station and fair at the upper station. The stream is impacted by severe streambank and gully erosion, flashy streamflows, sedimentation and lack of suitable habitat.

Management Needs

This section describes identified sources of pollutants in the River Falls Subwatershed, and the relative significance of these sources within this subwatershed, as well as to the whole Kinnickinnic River Watershed.

Upland Sediments: About half (54%) of the sediments delivered by the River Falls Subwatershed come from croplands. This percentage is low compared to most other subwatersheds in the Kinnickinnic River Watershed, because urban and construction site sources contribute a total of 40% of the sediment load. Upland sediments in the River Falls Subwatershed contributes only 849 tons/yr, 4% of the annual sediment load of the whole Kinnickinnic River Watershed. The average sediment delivery rate of 0.11 tons/acre/year is lower than the Kinnickinnic River Watershed average of 0.18 tons/acre/year. However, the River Falls Subwatershed contains 270 critical acres that contribute at a much higher delivery rate. For this reason, the reduction goal for upland sediments is 51%, higher than the Kinnickinnic River Watershed average of 35%. Control of upland sediments is a *low* priority for the River Falls Subwatershed as a whole, because of the low contribution to the Kinnickinnic River Watershed from this source. However, control of upland sediments is a *high* priority in the Rocky Branch and Creek 12-11 drainage areas, because of severe sedimentation problems in these streams.

Streambanks and Dry Runs: Streambanks and dry runs each contribute 3% of the River Falls Subwatershed sediment load. The total sediment load from these sources in just 90 tons/year. Eighteen miles of streambanks and five miles of dry runs erode at an average rate of 2 tons/mile/year and 9 tons/mile/year, respectively. They have a *low* priority, except on Creek 36-15 and Creek 12-11, where the priority is *medium,* and on Rocky Branch where the priority is *high* because of severe sedimentation problems.

Agricultural Nutrients: The River Falls Subwatershed contains 10 barnyards, with 1 eligible and none critical. These barnyards deliver 22,337 pounds/year of Combined Oxygen Demand

(COD), just 9% of the total annual COD in the Kinnickinnic River Watershed. The reduction goal for barnyards is 19%, and the priority is *low.*

Controlling phosphorus reaching streams from croplands is considered a *low* priority, except for lands draining to Mann Valley Creek, where there is a *medium* priority. A goal of 51% reduction should be achieved by controlling upland sediments.

Urban nutrients, sediments and toxic pollutants: Urban areas, including part of the City of River Falls and the Towns of Troy, Clifton and River Falls, contribute 20% of the River Falls Subwatershed sediment load, and 29% of the urban pollutant loads (sediment, copper, phosphorus and lead) in the whole Kinnickinnic River Watershed. Construction site erosion is estimated to contribute an additional 20% of the sediment load in the River Falls Subwatershed.. Pollutant loads from this urban area are expected to double in the planning period (20 years). Urban and high growth areas include lands that drain to the mainstem of the Kinnickinnic River and most of its tributaries in the River Falls Subwatershed. Areas of concentrated growth are anticipated. Much of this area drains to the Kinnickinnic River below Powell Dam, a Class I brown trout fishery, that is impacted by flashy stream flows and thermal pollution.

Growth management strategies described in Chapter Three of this plan will be very important in these areas. The *City of River Falls Water Management Plan* (Short, Elliott, Hendrickson, Inc, 1995) provides a detailed assessment of the conditions of the urban portion of the River Falls Subwatershed, and should be referenced in developing urban and growth management strategies for this area.

Construction site erosion control, stormwater ordinance implementation and land use planning to protect open space and maximize infiltration will be necessary. Measures such as stormwater infiltration structures and site designs to minimize impervious surfaces will be needed to prevent increases in thermal impacts on cold water streams in this subwatershed. Managing development along Highway 35 and Highway 29 growth corridors, to protect groundwater recharge and protect streambanks from degradation caused by changes in flow regimes will be very important. Lakes Louise and George will benefit from nutrient load reductions. The greatest benefit will be attained if the local governmental units within the River Falls growth area work together to assure consistent and effective land use management.

Lake George and Lake Louise: These lakes are used for casual outdoor recreation, wildlife habitat, canoeing and fishing. The hydroelectric generating plant has a positive impact by providing electricity for the general population; however, it is costly to run and maintain. In the late 1980's, the City of River Falls invested millions of dollars in repair of the dams. Within the next ten to twenty year period, significant infrastructure reinvestment may be required in order to maintain the dams. At that time a fair assessment of the social, economic and ecological impacts of the dams and their associated lakes should be determined before additional money is invested in them. This plan does not take a position relative to the future of the dams in River Falls. However, it is important to recognize that the dams do create both positive and negative impacts for the ecosystem and human users of the watershed that should be analyzed prior to major reinvestment in the future.

Drinking Water: The City of River Falls has four wells, and recently investigated two potential sites for installing a fifth well, on either the north end of River Falls, or southeast of the City. A feasibility study was completed for the southeast site, including components of a wellhead protection plan. Recent increases in pumping capacities for two existing wells have delayed or halted this plan. No wellhead protection plans have been written for existing wells. Developing and implementing wellhead protection plans for the City of River Falls wells is a *high* priority.

Groundwater: In the River Falls Subwatershed, 13 of 25 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 5 exceeded Enforcement Standards (ES). Of 21 wells sampled for atrazine 5 exceeded PAL. More details on this inventory can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as proper well abandonment and nutrient management planning.

Wetlands: There were 213 acres of wetlands inventoried in the River Falls Subwatershed. Of these, 74 acres have been altered by farming, drainage, development or other uses. Practices to restore or protect wetlands will be extremely valuable for protecting spring areas, surface waters, groundwater, and providing valuable wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the River Falls Subwatershed. The inventoried pollutant loads for sediments and nutrients, and reduction objectives and priorities for control are summarized below.

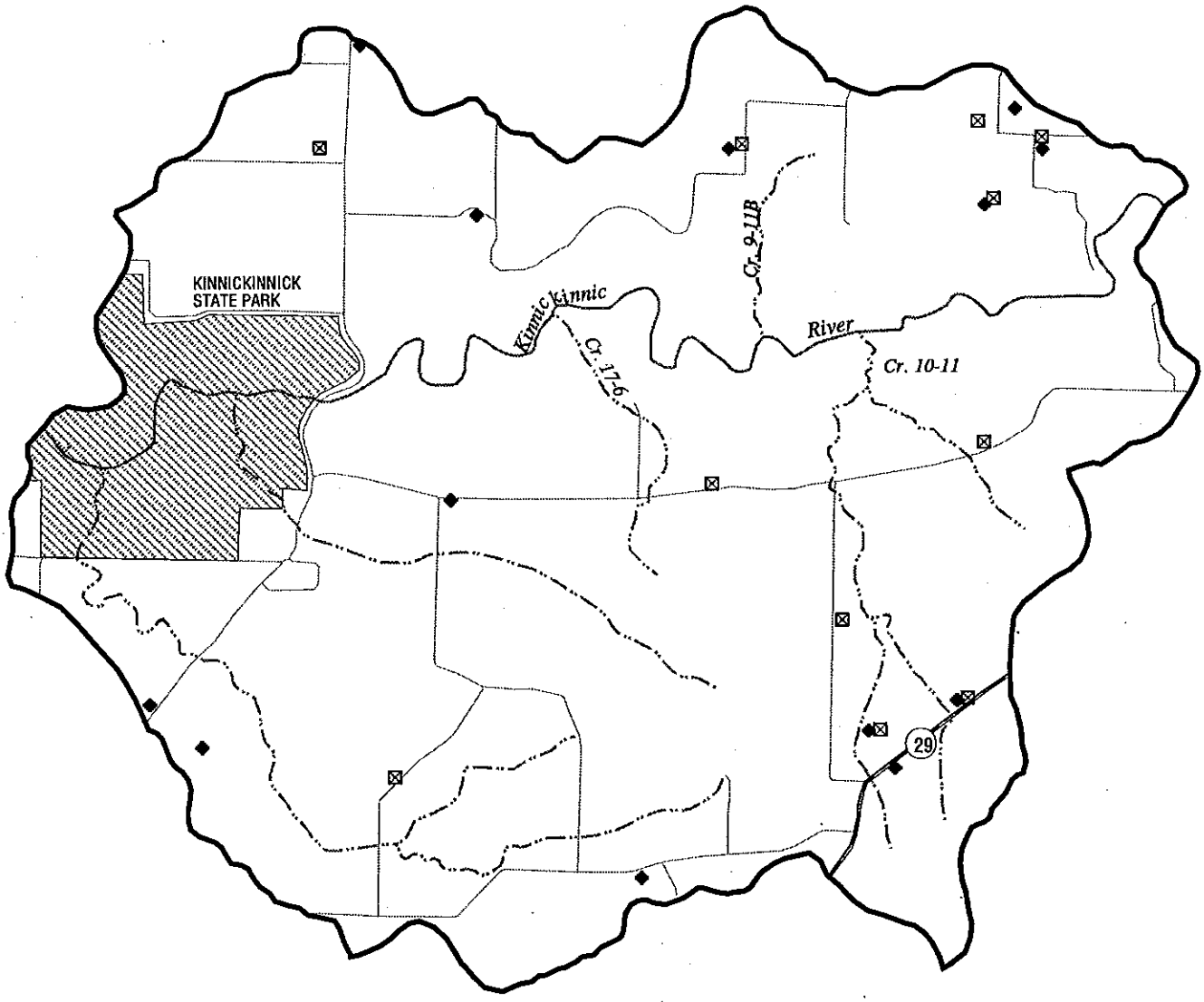
SEDIMENT - River Falls					
Source	**Load from Source (T/yr)**	**% of Kinnickinnic R. Watershed sediment load**	**% of RF total sediment load**	**RF % reduction goal**	**Priority for control**
All Uplands	849	4%	54%	51%	Low Medium for Mann V. Cr High for Rocky Br., & Cr. 12-11
Streambank	40	0%	3%	23%	Low (Medium for Cr. 36-15)
Dry Runs	51	0%	3%	25%	Low Medium for Cr. 36-15 High for Rocky Branch
Urban *(part of River Falls)*	317	1%	20%	35%	High
Construction Sites	320	1%	20%	70%	Very High
TOTAL	1,577	6%	100%	47%	

BARNYARD ORGANIC POLLUTANTS - River Falls						
Number Inventoried	**Number Eligible**	**Number Critical**	**Total lbs/yr COD**	**% of total Kinnickinnic R. Watershed COD Load**	**% RF Reduction Goal**	**Priority for control**
10	1	0	22,337	9%	19%	High

PHOSPHORUS -River Falls		
Source	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	51 % reduction in phosphorus reaching streams from agricultural uplands (controlled through upland sediment reductions)	Low
Barnyards	19% reduction through control of barnyard COD	Medium
Landspread Manure	Reduce through 40% participation in Nutrient and Pest Management	Low

URBAN AND GROWTH AREA POLLUTANTS - River Falls		
Pollutant	**Reduction Objectives**	**Priority**
Sediment and Metals	Reduce through urban housekeeping practices, construction site and stormwater ordinance implementation	High
Nutrients	Reduce through urban housekeeping practices, use of phosphorus free fertilizers, composting of yard wastes, construction site and stormwater ordinance implementation	High
Thermal or Hydrologic	Reduce through stormwater management plan and ordinance implementation	High

Map 4-6. Lower Kinnickinnic River Subwatershed



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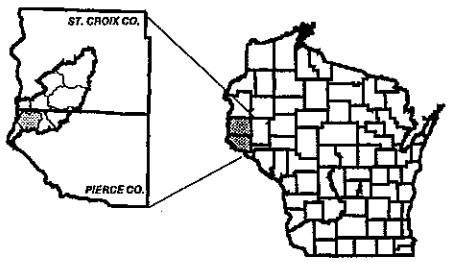
0 1 2 Miles

LEGEND

- Wells
- Barns
- Highways
- Local Roads
- County Boundary
- Perennial Streams
- Intermittent Streams
- Public Land
- Municipality
- Open Water

STUDY AREA



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Lower Kinnickinnic Subwatershed (LK)

Description

The Lower Kinnickinnic Subwatershed is 19.9 square miles and includes the Kinnickinnic River and six unnamed tributaries. The Kinnickinnic River flows 9.1 miles through what is locally known as "The Canyon" to the St. Croix River. The mainstem below River Falls is broader (about 40 feet wide) and shallower (one to two feet deep) than the upper river. Stream temperatures are about 3^0 C. (5^0 F.) warmer during base flow, largely due to the effects of the upstream impoundments and urbanization (Schreiber, 1998). This subwatershed contains a number of unique natural features, including goat prairies, pine relics, weeping cliffs and spring ponds. Much of this reach is canyon-like and wooded. The Kinnickinnic River State Park includes about 1,000 acres of land around the mouth of the river at its confluence with the St. Croix River.

This subwatershed is almost entirely agricultural and woodlands.

Water Quality Conditions

The Kinnickinnic River in the Lower Kinnickinnic Subwatershed supports a moderate to high density Class I brown trout fishery in the upper 6.8 miles, and a warmwater sport fishery in the lower 2.3 miles (below CTH F). Fish habitat ratings ranged from fair to good, with a poor rating at the furthest downstream site. Coldwater Index of Biotic Integrity (IBI) values ranged from fair to good, with poor values at the three furthest downstream sites. The poor IBI values were a result of the lack of brook trout and presence of some warmwater species.

The river in this reach is impacted by urban runoff pollution, elevated water temperatures, flashy flows (due to urban stormwater runoff and hydropower manipulations) and sediment from upland and gully erosion. All of the unnamed tributaries to the Kinnickinnic River in this subwatershed have low density, Class II brown trout fisheries. These streams are also impacted by gully erosion, sedimentation and cropland runoff.

Management Needs

This section describes identified sources of pollutants in the Lower Kinnickinnic Subwatershed, and the relative significance of these sources within this subwatershed, as well as to the whole Kinnickinnic River Watershed.

Upland Sediments: Nearly all (92%) of the sediments delivered by the Lower Kinnickinnic Subwatershed come from croplands. This subwatershed contributes only 2010 tons/year, just 9% of the whole Kinnickinnic River Watershed annual sediment load, and has a 0.16 tons/acre/year delivery rate. The reduction goal for upland sediments is 13% (the overall upland sediment

reduction goal for the Kinnickinnic River Watershed is 25%). The relatively low percent reduction goal for the Lower Kinnickinnic Subwatershed is a result of the low average delivery rate of eligible acres, making further reductions difficult to achieve. However, control of upland sediments is a *high* priority, because of the high proportion (92%) of the Lower Kinnickinnic Subwatershed sediment load that comes from uplands, and because delivery from this subwatershed is to the St. Croix River, where sediment loads have been identified as a major concern.

Streambanks and Dry Runs: Sixteen miles of streambank in the Lower Kinnickinnic Subwatershed erode at an average rate of 2.5 tons/mile/year, and contribute 40 tons/year, one of the smaller subwatershed loads from streambanks. Five miles of dry run contribute 24 tons/year of sediment, at an average rate of 5 tons/mile. These loads make up 2% and 1% of the Lower Kinnickinnic Subwatershed sediment loads, respectively. They have a *low* priority, because of their low delivery rates and relatively small total loads to the Lower Kinnickinnic River Subwatershed.

Agricultural Nutrients: The Lower Kinnickinnic Subwatershed contains 25 barnyards, with 2 eligible and none critical. These barnyards deliver 29,808 pounds per year of Combined Oxygen Demand (COD). Streams in the Lower Kinnickinnic Subwatershed receive 5% of the total COD in the whole Kinnickinnic River Watershed. The reduction goal for barnyards in the Lower Kinnickinnic Subwatershed is 13%. The priority is *medium.*

Controlling phosphorus reaching streams from croplands is considered a *high* priority, except for lands draining to Creek 8-11, where there is a *medium* priority. A goal of 13% reduction should be achieved by controlling upland sediments.

Urban nutrients, sediment and toxic pollutants: There are only 200 existing urban acres, primarily residential development on the southern outskirts of the City of River Falls, in the Towns of Clifton and River Falls. Minimal growth is anticipated, and most is likely to be in the form of scattered rural residential development. Management strategies in this subwatershed will be primarily for rural land uses. Land use planning for rural residential development is important for the Towns of Clifton and River Falls, and construction site erosion control enforcement should be a priority. The greatest benefit will be attained if the local governmental units within identified growth areas work together to assure consistent and effective land use management.

Groundwater: In the Lower Kinnickinnic Subwatershed, 10 of 16 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 5 exceeded Enforcement Standards (ES). Of 15 wells sampled for atrazine, 6 exceeded PAL. More details on this inventory can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as well abandonment, sink hole protection, and nutrient and pest management planning.

Springs in the Lower Kinnickinnic Subwatershed are very important for maintenance of cold base flow in this reach of the Kinnickinnic River. There is *high* priority for identification and protection of springs.

Wetlands: There were 436 acres of wetlands inventoried in the Lower Kinnickinnic Subwatershed. Of these, 435 have been altered by farming, drainage or other uses. Practices to restore or protect wetlands will be extremely valuable for protecting surface waters, groundwater, and providing valuable wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the Lower Kinnickinnic Subwatershed. The inventoried pollutant loads for sediments and nutrients, and reduction objectives and priorities for control are summarized below.

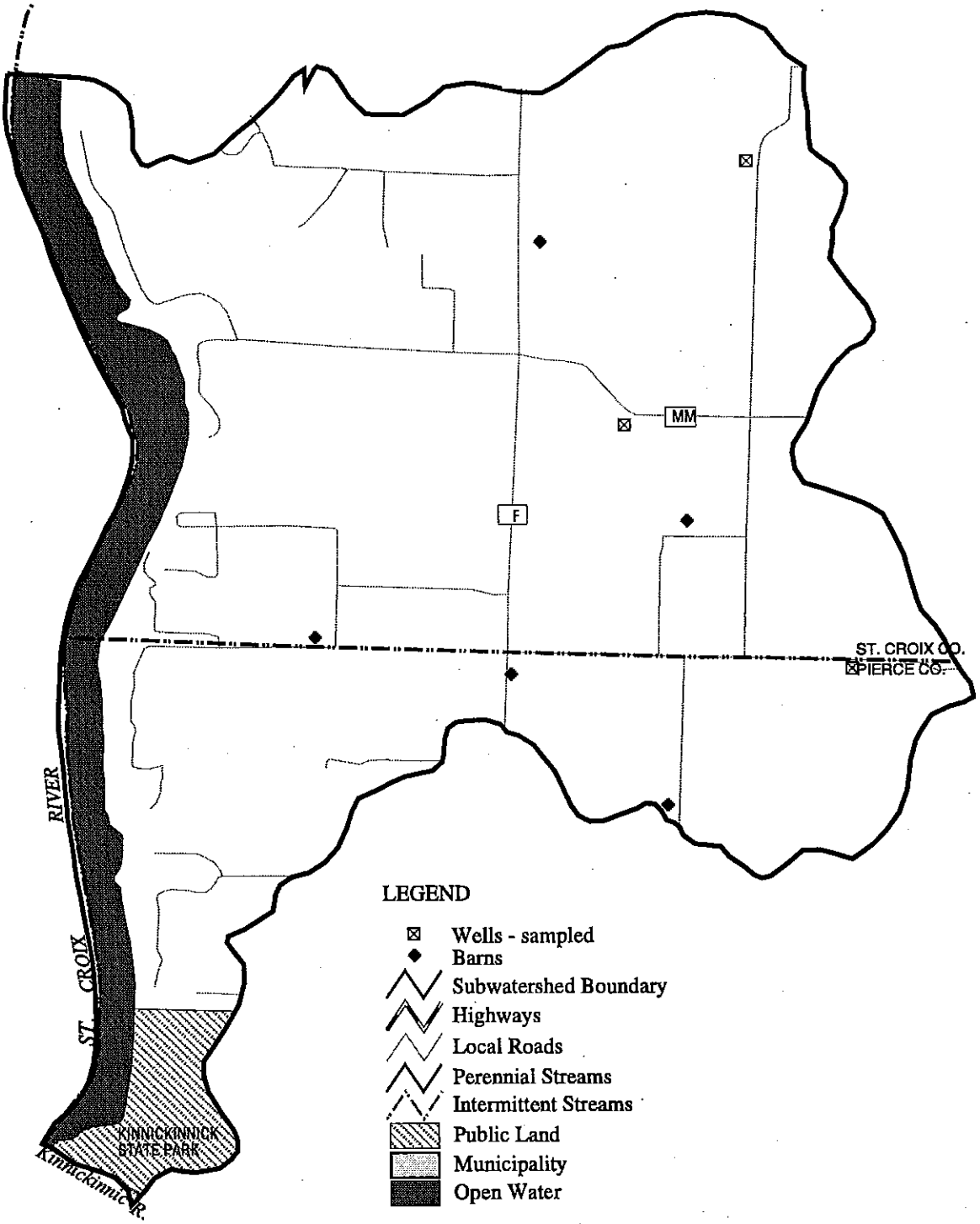
SEDIMENT -Lower Kinnickinnic					
Source	**Load from Source (T/yr)**	**% of total Kinnickinnic R. Watershed sediment load**	**% of LK total sediment load**	**LK % sediment reduction goal**	**Priority for control**
All Uplands	2,010	10%	92%	13%	High
Streambank	40	0%	2%	14%	Low
Dry Runs	24	0%	1%	25%	Low
Urban *(part of River Falls)*	51	0%	2%	35%	Medium
Construction Sites	60	0%	3%	70%	Medium
TOTAL	2,185	10%	100%	15%	

BARNYARD ORGANIC POLLUTANTS - Lower Kinnickinnic						
Number Inventoried	**Number Eligible**	**Number Critical**	**Total Lbs/yr COD**	**% of total Kinnickinnic R. Watershed COD Load**	**LK % Reduction Goal**	**Priority for control**
25	2	0	29,808	13%	13%	Medium

PHOSPHORUS -Lower Kinnickinnic		
Source	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	13 % reduction in phosphorus reaching streams from agricultural uplands (controlled through upland sediment reductions)	High
Barnyards	13% reduction through control of barnyard COD	Medium
Landspread Manure	Reduce through 50% participation in Nutrient and Pest Management	Medium

URBAN AND GROWTH AREA POLLUTANTS -Lower Kinnickinnic		
Pollutant	**Reduction Objectives**	**Priority**
Sediment and Metals	Reduce through urban housekeeping practices, construction site and stormwater ordinance implementation	Medium
Nutrients	Reduce through urban housekeeping practices, construction site and stormwater ordinance implementation	Medium
Thermal or Hydrologic	Reduce through stormwater management plan and ordinance implementation, protection of wetlands and springs	Low

Map 4-7. Upper St. Croix Subwatershed



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1998

Upper St. Croix Subwatershed (USC)

Description and Water Quality Conditions

The Upper St. Croix Subwatershed is 8.8 square miles and includes a 5 mile reach of the St. Croix River. Except within Kinnickinnic River State Park, this subwatershed drains entirely to the St. Croix River. Land uses are almost entirely agricultural, with some woodlands.

The St. Croix River supports a warmwater sport fishery and is impacted by sediment loading from gully and cropland erosion, and nutrient loading from croplands.

Management Needs

This section describes identified sources of pollutants in the Upper St. Croix Subwatershed, and the relative significance of these sources within this subwatershed, as well as to the whole Kinnickinnic River Watershed.

Upland Sediments: Nearly all (91%) of the sediments delivered from the Upper St. Croix Subwatershed come from croplands. However, this subwatershed contributes only 200 tons per year, less than 1% of the whole Kinnickinnic River Watershed sediment load. Uplands in the Upper St. Croix Subwatershed have a very low delivery rate of 0.08 tons/acre/year. The reduction goal for upland sediments is 11% . Control of upland sediments is a *low* priority, because of the low total annual load and low delivery rate. However, there are several unnamed dry runs to the St. Croix River from this subwatershed, and where agricultural fields drain to these dry runs, they should be given higher priority for upland sediment control.

Streambanks and Dry Runs: Streambanks and dry runs were not inventoried in the Upper St. Croix Subwatershed, and are not known to be a significant concern. However, if erosion from these sources is identified in the future, they should be given a medium to high priority, depending upon conditions, since reduction of sediment delivery to the St. Croix River is a goal.

Agricultural Nutrients: The Upper St. Croix Subwatershed contains 4 barnyards, with none eligible or critical. These barnyards deliver 2,490 pounds of Combined Oxygen Demand (COD). Streams in the Lower Kinnickinnic Subwatershed receive 1% of the total COD in the whole Kinnickinnic River Watershed. There is no reduction goal for barnyards in the Upper St. Croix Subwatershed, since none are eligible.

An 11% reduction in phosphorus reaching streams from croplands should be achieved by controlling upland sediments.

Urban Nutrients, Sediment and Toxic Pollutants: There are no existing urban acres, and minimal increased growth is anticipated. Most growth is likely to be in the form of scattered rural residential development, so management strategies in this subwatershed will be primarily

for rural land uses. Land use planning for rural residential development is important for the Towns of Troy and Clifton which encompass this subwatershed, and construction site erosion control enforcement should be a priority. The greatest benefit will be attained if the local governmental units within the Twin Cities commuter area work together to assure consistent and effective land use management.

Groundwater: In the Upper St. Croix Subwatershed, 7 of 12 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 4 exceeded Enforcement Standards (ES). Of 10 wells sampled for atrazine, 3 exceeded PAL. More details on this inventory can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as well abandonment and sink hole protection.

Wetlands: There were 30 acres of wetlands inventoried in the Upper St. Croix Subwatershed, of which 23 acres have been altered by farming, drainage or other uses. Practices to restore or protect wetlands are valuable for protecting surface waters and groundwater, and providing wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

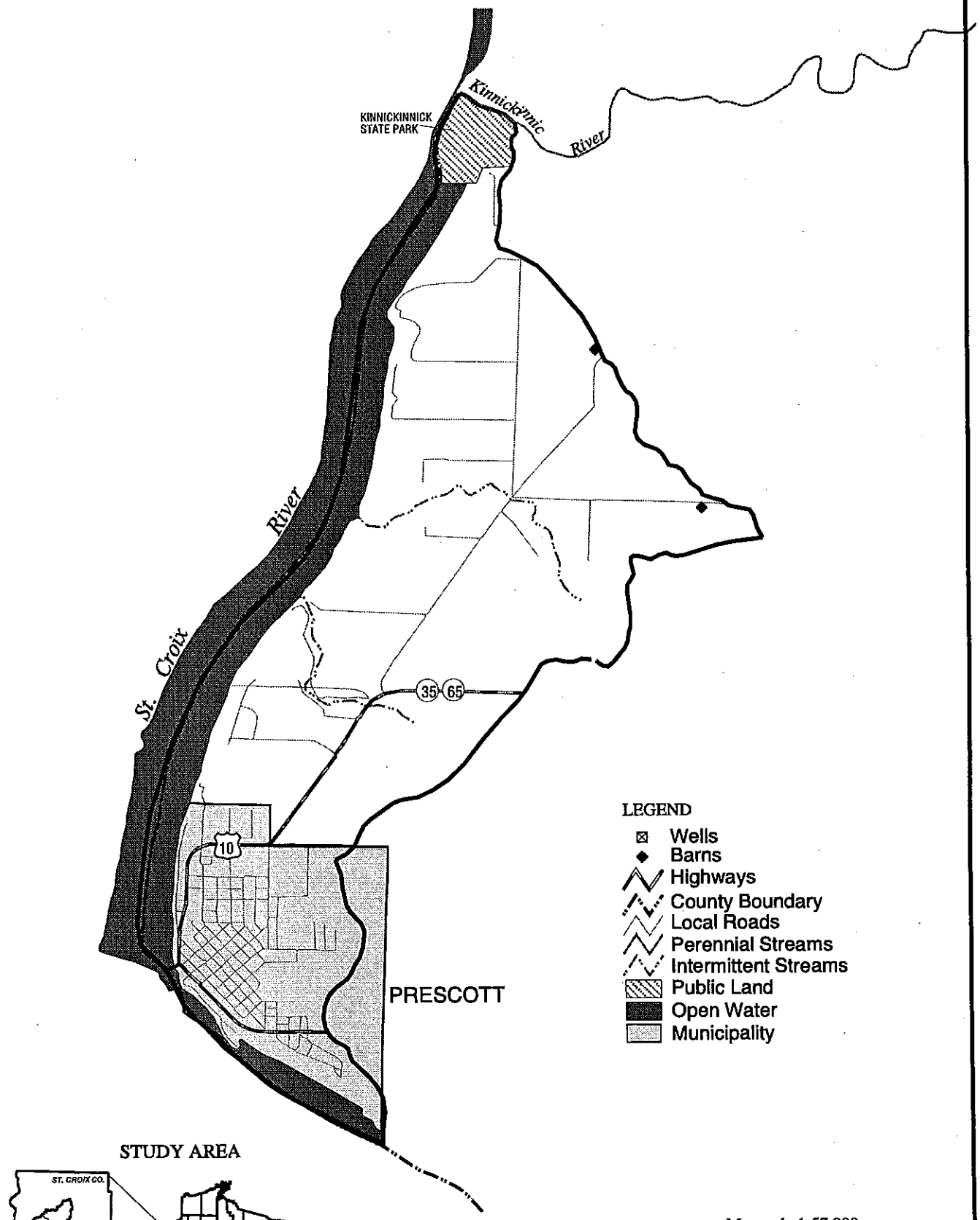
The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the Upper St. Croix Subwatershed. The inventoried pollutant loads for sediments and nutrients, and reduction objectives and priorities for control are summarized below.

SEDIMENT -Upper St. Croix					
Source	**Load from Source (Tons)**	**% of total Kinnickinnic R. Watershed sediment load**	**% of USC total sediment load**	**USC % sediment reduction goal**	**Priority for control**
All Uplands	204	1%	91%	11%	Low
Streambank	0	0%	0%	0%	NA
Dry Runs	0	0%	0%	0%	NA
Urban *(part of River Falls)*	0	0%	0%	0%	NA
Construction Sites	20	0%	9%	70%	Low
TOTAL	224	1%	100%	11%	

BARNYARDS -Upper St. Croix						
Number Inventoried	**Number Eligible**	**Number Critical**	**Total lbs/yr COD**	**% of Kinnickinnic R. Watershed COD Load**	**USC % Reduction Goal**	**Priority for control**
4	0	0	2,490	1%	None	NA

PHOSPHORUS - Upper St. Croix		
Source	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	11 % reduction in phosphorus reaching streams from agricultural uplands (controlled through upland sediment reductions)	Low
Barnyards	None	NA
Landspread Manure	Reduce through 25% participation in Nutrient and Pest Management	Low

Map 4-8. Lower St. Croix Subwatershed



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
September 1998

Lower St. Croix Subwatershed (LSC)

Description and Water Quality Conditions

The Lower St. Croix Subwatershed is 16.5 square miles and includes a 6.7 mile reach of the St. Croix River and Barkley Coulee Creek. The City of Prescott is located in the Lower St. Croix Subwatershed, at the mouth of the St. Croix River, where it joins the Mississippi River. The St. Croix River supports a warmwater sport fishery and is impacted by sediment loading from gully and cropland erosion, and nutrient loading from croplands.

Management Needs

Upland Sediments: Just 39% of the sediments delivered from the Lower St. Croix Subwatershed come from croplands. Croplands contribute only 200 tons per year, less than 1% of the whole Kinnickinnic River Watershed sediment load, and have a very low delivery rate of 0.08 tons/acre/year. The reduction goal for upland sediments is 11%. Control of upland sediments is a *low* priority, because of the low load and delivery rate of upland sediments. There are several unnamed dry runs that drain to the St. Croix River from the Lower St. Croix Subwatershed, and where agricultural fields drain to these dry runs, they should be given higher priority.

Streambanks and Dry Runs: Streambanks and dry runs were not inventoried in this subwatershed, and are not known to be a significant concern. However, if erosion from these sources is identified in the future, they should be given a medium to high priority, depending upon conditions, since reduction of sediment delivery to the St. Croix River is a goal.

Agricultural Nutrients: The Lower St. Croix Subwatershed contains no barnyards.

An 11% reduction in phosphorus reaching streams from croplands can be achieved by controlling upland sediments.

Urban Nutrients, Sediment and Toxic Pollutants: The City of Prescott contributes nearly half (46%) of the Lower St. Croix Subwatershed sediment load, and about 27% of the urban pollutants (sediment, copper, phosphorus and lead) in the whole Kinnickinnic River Watershed. Construction site erosion is a source of an additional 15% of the sediment load in the Lower St. Croix Subwatershed.

The City of Prescott delivers an estimated 800 pounds/year of phosphorus from nonpoint sources to the St. Croix River, and that amount is projected to increase to 1100 pounds/year during the planning period. Reducing nutrient loads to the St. Croix River from the City of Prescott should be a *high* priority.

Subdivisions and other areas of concentrated growth are very likely to occur here. Much of this area is connected directly to the St. Croix River, which is impacted by sediment and nutrient loads. Growth management strategies described in Chapter Three of this plan will be important in these areas. Land use planning for rural residential development is important for the City of Prescott and the Town of Clifton, which encompasses this subwatershed. Construction site erosion control enforcement should be a priority. Stormwater ordinance development and/or implementation, and land use planning to protect open space and maximize infiltration are highly recommended. The greatest benefit will be attained if the local governmental units within the identified growth area work together to assure consistent and effective land use management.

Drinking water: The City of Prescott is developing a wellhead protection plan for its three municipal wells, with implementation expected in mid-1999. Approving and implementing this wellhead protection plan is a *high* priority.

Groundwater: In the Lower St. Croix Subwatershed, 7 of 12 wells sampled for nitrates exceeded Preventive Action Limits (PAL) and 4 exceeded Enforcement Standards (ES). Of 10 wells sampled for atrazine, 3 exceeded PAL. More details on this inventory can be found in Chapter Five of this plan. Because of the susceptibility of groundwater to contamination, there is a *high* priority for groundwater protection through best management practices such as well abandonment and sink hole protection.

Wetlands: There were 30 acres of wetlands inventoried, of which 23 acres have been altered by farming, drainage or other uses. Practices to restore or protect wetlands are valuable for protecting surface waters and groundwater, and providing wildlife habitat.

Nonpoint Source Pollutant Reduction Objectives

The discussions above identify the qualitative priorities (high, medium, low) for managing various pollutant sources in the Lower St. Croix Subwatershed. The inventoried pollutant loads for sediments and nutrients, reduction objectives and priorities for control are summarized below.

SEDIMENT - Lower St. Croix					
Source	**Load from Source (T/yr)**	**% of Kinnickinnic R. Watershed sediment load**	**% of LSC total sediment load**	**LSC % reduction goal**	**Priority for control**
All Uplands	204	1%	39%	11%	Low
Streambank	0	0%	0%	0%	NA
Dry Runs	0	0%	0%	0%	NA
Urban *(Prescott)*	242	0%	46%	35%	Medium
Construction Sites	80	0%	15%	70%	Low
TOTAL	526	1%	100%	11%	

BARNYARDS - Lower St. Croix						
Nnmber Inventoried	**Number Eligible**	**Number Critical**	**Total Lbs COD**	**% of total Kinnickinnic R. Watershed COD Load**	**% Reduction Goal**	**Priority for control**
0	0	0	0	0%	None	NA

PHOSPHORUS - Lower St. Croix		
Source	**Reduction Objectives**	**Priority f or Control**
Agricultural Uplands	11 % reduction in phosphorus reaching streams from agricultural uplands (controlled through upland sediment reductions)	Low
Barnyards	None	NA
Landspread Manure	Reduce through 25% participation in Nutrient and Pest Management	Low

URBAN AND GROWTH AREA POLLUTANTS -Prescott		
Source	**Reduction Objectives**	**Priority**
Sediment and Metals	Reduce through urban housekeeping practices, construction site and stormwater ordinance implementation	Medium
Nutrients	Reduce through urban housekeeping practices, use of phosphorus-free fertilizers, composting, construction site ordinance, stormwater management	High
Thermal or Hydrologic	Reduce through stormwater management plan and ordinance implementation, however, the St. Croix River susceptibility is low.	Low

CHAPTER FIVE
Nonpoint Source Pollutant Inventory Results, Reduction Objectives and Cost-Share Eligibility Criteria

This chapter describes the results of inventories that were conducted of nonpoint source of pollution in the watershed. "Nonpoint" pollutants are generally carried to surface water or groundwater by runoff, and come from dispersed locations, rather than a "point" source. This chapter contains a summary of inventory results, pollutant reduction objectives, and cost-share eligibility criteria for each described pollutant source.

A **pollutant load reduction objective** is a "target" amount of pollutant reduction determined for each pollutant type or source. These "target" reductions are based on a number of factors, including (a) the seriousness of the impact of each pollutant within the watershed, (b) the availability of effective practices to reduce that pollutant load, and (c) the cost-effectiveness of the available practices. Pollutant load reduction objectives are intended to reflect realistic, achievable load reductions.

Inventories were conducted in both urban and rural areas, using appropriate inventory and modeling techniques. Where pollutants and pollutant sources "overlap" into both urban and rural areas (such as stream bank erosion), they will be discussed in the section where the pollutant predominates. Rural pollutants include nutrients from barnyard runoff, uplands and manure management, and sediment from uplands, gullies and streambanks. Urban pollutants include sediment from construction sites and other sources, and other pollutants, including thermal pollution from stormwater.

This chapter also describes the results of other inventories that were conducted, in order to identify existing or potential threats to surface and groundwater quality, as well as activities or regulatory tools already in use to protect surface and groundwater. These include and inventory of wetlands, public water supplies, existing ordinances and urban pollution prevention practices.

This chapter is organized in the following manner:

- Rural Inventories:
  - Nutrient sources
  - Sediment sources
  - Wetlands
  - Groundwater well sampling
- Urban Inventories:
  - Total suspended solids and toxic pollutants
  - Municipal wells
  - Pollution prevention practices
- Other Pollutant Sources

Within these sections, as appropriate, information presented will be organized in the following manner:

- Discussion
- Inventory methods and results
- Pollutant reduction or other objectives
- Cost share eligibility criteria and management strategies

Rural Nonpoint Source Inventory

Nutrient Sources

Barnyard Runoff

Description

Runoff carrying a variety of pollutants from barnyards and other confined livestock areas is a source of pollutants in the streams and lakes of the Kinnickinnic River Watershed. A measure of pollution from barnyards is *chemical oxygen demand.* As organisms utilize organic wastes in barnyard runoff, they deplete oxygen supplies in surface water, degrading water quality. Chemical oxygen demand (COD) is a measurement of oxygen demanded by organisms for decomposition. Most of the oxygen-demanding pollutants and nutrients associated with barnyards drain via concentrated flow to creeks and wetlands. Organic material also poses a human health hazard because of the presence of bacteria and pathogens that make the water unfit for recreational use as well as for consumption. Water quality is further degraded by the excessive aquatic plant growth stimulated by phosphorus and nitrogen in barnyard runoff. The dense aquatic plant growth causes severe oxygen fluctuations during plant photosynthesis (daytime), and respiration (nighttime), that causes additional stress to aquatic life.

Inventory Results

Ninety-nine barnyards or other confined livestock areas in the Kinnickinnic River Watershed are a source of 235,222 pounds of COD (Table 5-1). Of these barnyards, 2 meet the "critical" criteria of producing greater than 20,000 pounds of COD annually. Twenty-six meet the "eligible" criteria of producing greater than 2,000 pounds of COD annually.

Pollutant Reduction Objectives

The barnyard pollution control objective is to reduce chemical oxygen demand (COD) in the streams and lakes of the Kinnickinnic River Watershed by 35%, or 82,328 pounds of COD annually. In order to meet this pollutant load reduction objective, a cost share eligibility and implementation strategy was developed, as described below.

Cost Share Eligibility and Implementation Strategy

Barnyard sites contributing a COD load greater than 20,000 pounds annually will be designated as **"critical"** sites for control. Those landowners with an animal lot designated as a critical site for control will be required, as described in Chapter 3 of this plan, to install clean water diversion practices and control COD down to 10,000 pounds annually. Clean water diversion practices include practices such as rain gutters and downspouts for rooftops, and contouring of land to divert clean water around a barnyard. Installation of these low-cost, required, practices will reduce the current annual load of 235,222 by 13%, or 30,499 pounds of COD/year. Control of pollutants from critical sites will achieve a 37% control of the reduction goal of 82,328 pounds of COD annually.

Barnyard sites that contribute between 2,000 pounds and 20,000 pounds of COD annually, will be considered **eligible** for cost-sharing. There are approximately 26 landowners with animal lots in this category. Voluntary participation by eligible livestock operations will be the most expedient and cost effective method of controlling the manure runoff and will be essential for reducing the annual COD load by 35 percent. Landowners in this voluntary category are eligible for cost sharing on clean water diversion practices. Installation of these low-cost, practices will reduce the current annual load of 235,222 pounds of COD by 22%, or 51,829 pounds of COD/year. Control of pollutants from eligible sites will achieve a 63% control of the reduction goal of 82,328 pounds of COD annually. These reduction amounts are based on an estimated 75 percent participation rate of eligible sites.

Barnyard sites that contribute less than 2000 pounds of COD annually **will not be eligible** for cost sharing. There are approximately 71 landowners with animal lots in this category.

Those landowners installing low cost clean water diversions or roof gutters will be encouraged to develop an nutrient and pest management plan. All nutrient and pest management plans will be developed with a certified crop consultant, or farmer-developed and approved by knowledgeable county conservation staff.

Certain components of animal waste management systems (as specified in NRCS Std. 312), specifically those involving collection, handling and storage, *require* the preparation of a nutrient management plan (NRCS Std. 590) for the acreage upon which manure may be spread. Roof Runoff Management (NRCS Std. 588), Livestock Exclusion (NRCS Std. 472), Clean Water Diversion (NRCS Std. 362) are practices that are exempt from this requirement. Operations eligible for waste management systems are also eligible for cost-sharing of nutrient management and pest management (NRCS Std. 595) plans, soil testing and crop scouting. See "Cropland Spread Manure & Pesticide Runoff" later in this chapter for additional detail.

Internally Drained Barnyards

Internally drained barnyards drain to surface depressions rather than directly to surface waters. The key to groundwater protection is prevention of groundwater contamination. Contamination prevention is the best public policy and is more cost-effective than remediation once groundwater has been contaminated. Proper barnyard management, including nutrient management, is important for groundwater protection.

One internally drained barnyard was identified in the watershed. Eligibility for internally drained animal lots is based on a site by site analysis conducted by the St. Croix or Pierce County Land and Water Conservation Department, to determine likelihood of groundwater contamination.

Tables 5-1 and 5-2 show the barnyard inventory results. Map 5-1 shows the locations of inventoried barnyards and wells.

Table 5-1. Barnyard Inventory Results (Goal is 35 % Reduction in Annual COD Loads)

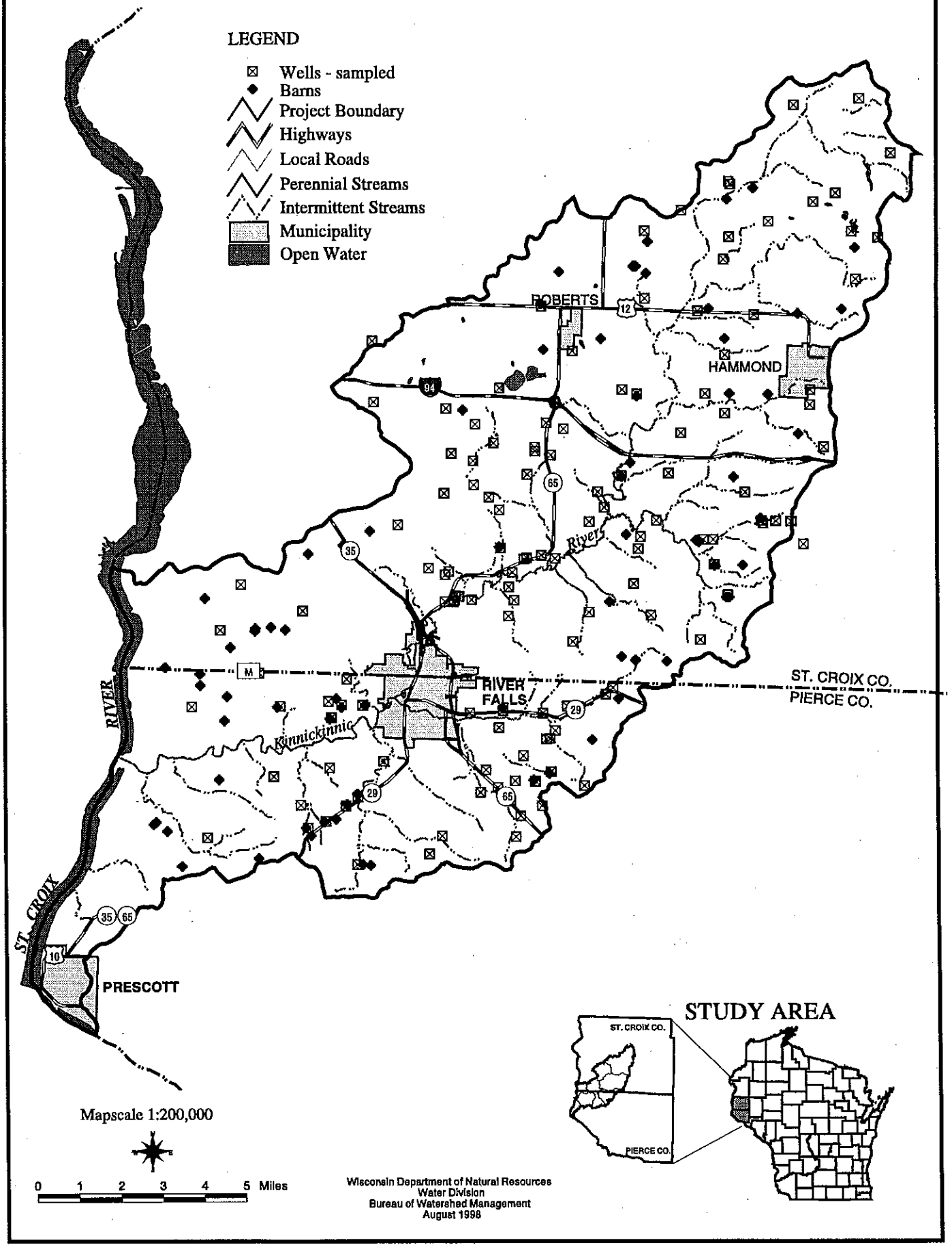
Subwatershed	Inventory Results			# of Critical Sites	# of Eligible Sites
	Number of Barnyards	Annual Pounds of COD	Percent of Annual Pounds of COD by Subwatershed		
Upper Kinnickinnic	23	35,736	15		9
Twin Lakes	3	38,709	16	1	1
Middle Kinnickinnic	19	37,271	16		5
South Fork	15	68,871	29	1	5
River Falls	10	22,337	9		1
Lower Kinnickinnic	25	29,808	13		5
Upper St. Croix	4	2,490	1		0
Lower St. Croix	0	0	0		0
Total	99	235,222	99	2	26

Table 5-2. Summary of COD Annual Load Reductions from "Critical" and "Eligible" Barnyards

Number of Critical Sites:	2		**Number of Eligible Sites:**	26	**Total Critical & Eligible Sites**	28
COD Reduced by Critical Sites	30,499 lbs		COD Reduced by Eligible Sites	51,829 lbs	Reduction Goal (35% of Total Load)	82,328 lbs
% of Total COD Load Reduced	13%		% of Total COD Load Reduced	22%	% of Total COD Load Reduced	35%
%of Reduction Goal Reduced	37%		% of Reduction Goal Reduced	63%	% of Reduction Goal Reduced	100%

Source: St. Croix and Pierce Co. LWCD, BARNY model

Map 5-1. Kinnickinnic River Well and Barnyard Inventory



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
August 1998

Cropland Nutrient and Pesticide Application

Description

Under some storm event conditions, land spread manure can cause a serious threat to water quality. Nutrient management and runoff from manure spreading are addressed through Natural Resource Conservation Service (NRCS) Nutrient Management Standard 590. Pest management is addressed through NRCS Pest Management Standard 595. These Standards are available at county LWCD offices. Crop consultants are available to work with farmers who want to develop their own nutrient management plans, through a professional services contract currently held by the county. These plans will be acceptable for cost sharing with review and approval by knowledgeable county staff. Nutrient and pest management plans may also be developed by private consultants. Landowners will be eligible to participate for up to three years. County LWCD staff will prepare soil conservation plans and materials for the nutrient and pest management plan. County LWCD staff will also review the nutrient and pest management plans.

Inventory Results

There are approximately 73,000 acres of cropland, managed by approximately 405 operators in the Kinnickinnic River Watershed. Of the 405 farm operators, there are 94 dairy farms and 311 farms without animals. Many dairy farms operation expansions are underway or anticipated within the watershed.

Pollutant Reduction Objectives

Nutrient and pest management activities will result in pollutant load reductions, although actual amounts are difficult to track due to a number of variables. However, fertilizer application rates must be tracked and reported. Professional services contracts developed for nutrient and pest management consulting must include a provision for reporting the required information to the LWCD.

It is a goal of the Kinnickinnic River Priority Watershed Project to implement Nutrient and Pest Management Planning as a practice on all farms which participate in agricultural cost-shared practices.

Cost Share Eligibility Criteria

All cropland in the Kinnickinnic River Watershed will be eligible for cost sharing for development of a nutrient and pest management plan. County manure storage ordinances require Nutrient Management Planning on farms where manure storage facilities are installed.

Under some storm event conditions, land spread manure can cause a serious threat to water quality, even when the operator is in compliance with Nutrient Management Standard 590. A severe fish kill occurred in the summer of 1998 when manure was spread on nearly saturated fields adjacent to a flowing dry run tributary to Parker Creek. A rain event after spreading and before incorporation washed large quantities of manure into the creek. Farmers in the Kinnickinnic River Watershed will be offered a cost sharing incentive to manage fields near waterways to higher standards than required by Standard 590. A 40 percent cost share rate will be offered to operators who implement Standard 590 plans. A 50 percent cost share rate will be

available to those who implement higher standards, including immediate incorporation within 200 feet of a waterway, and no manure applications within 100 feet of designated environmentally sensitive areas. There may also be increased crop residue requirements within 200 feet of a waterway.

Manure Storage Facilities

Description

Surface water and groundwater resources are at risk when manure storage facilities are improperly located, designed, or constructed. Manure overflows and storage facility failures are a serious threat to aquatic life. St. Croix County adopted a manure storage ordinance in 1985, and Pierce County adopted a manure storage ordinance in 1990. Counties adopt manure storage ordinances to prevent ground and surface water pollution by assuring the proper design, construction, location, and management of permitted facilities. An ordinance must meet the guidelines adopted by DATCP and cite the applicable NRCS construction and management standards. Ordinances require permits for the installation, modification and major repair of manure storage facilities.

Inventory Results and Pollutant Reduction Objectives

An inventory of manure storage facilities has not been conducted. It is a goal of the plan to assure that all manure storage facilities meet the requirements of the county's Manure Storage Ordinance. St. Croix and Pierce County Kinnickinnic River Priority Watershed staff will assist in updating manure storage ordinances as needed.

Cost Share Eligibility Criteria

Landowners receiving cost-sharing funds for manure storage are required to develop a nutrient management plan for those acres that will receive manure applications resulting from this practice. The storage facility must be needed to manage manure during periods of snow covered, frozen and saturated conditions in order to protect water quality. Landowners must develop a preliminary Nutrient Management Plan, in accordance with NRCS Standard 590, in order to determine cost share eligibility, and must also demonstrate that proper utilization of the manure can be achieved following adoption of the intended storage practice.

Cost sharing will be based on the least cost system. Options may include, but are not limited to: (1) properly sited, unconfined manure stacks (in accordance with NRCS Standard 312); (2) the construction of a short term storage facility (capacity for 30 to 100 days manure production in accordance with NRCS Standard 313); (3) the construction of a long term storage facility (capacity for up to 210 days production in accordance with Std. 313 or 425); (4) a reduction in the number of animals; (5) the rental of additional lands; (6) or haul or broker manure to a neighboring farm that can use the manure in accordance with a nutrient management plan.

Sediment Sources

Upland Sediment

Description

Agricultural practices have caused considerable amounts of eroded soil to reach streams, ponds, and wetlands in the Kinnickinnic River Watershed. Upland erosion is the major source of the sediments that are deposited on the lake or stream bed, or carried downstream, beyond individual subwatershed boundaries.

Upland sediment sources were evaluated through subarea sampling and extrapolation for the entire rural portions of the watershed. Soil erosion was calculated using the Universal Soil Loss Equation (USLE). Sediment delivery was calculated using USLE and hydrology information using the FOCS WINHUSLE computer model.

Tolerable soil loss, "T", is a measure of the annual "acceptable" soil loss for any given field. Variables in determining "T" include rainfall, erodability of the soil, steepness, length of the slope, cropping practices and tillage practices. Fields can generally regenerate approximately the amount of soil lost when the annual soil loss does not exceed "T".

Inventory Results

An estimated 72,956 acres of cropland deliver 16,800 tons of soil per year to lakes, wetlands or streams in the watershed. An additional 1,648 tons/year are delivered from farmsteads, pastures and woodlots. The average sediment delivery rate for all subwatersheds is 0.23 tons/acre/year for croplands, and 0.18 tons/acre/year for all uplands. Uplands are the source of 85 percent of the sediment delivered to surface waters. The remaining 12 percent of the sediment load comes from streambanks, dry runs and urban areas. Table 5-3 summarizes upland sediment loading by land use for all subwatersheds.

Pollutant Load Reduction Objectives

A 25 percent reduction (4,200 tons/year) in the 16,824 tons/year of sediment coming from croplands is targeted for agricultural lands. To meet this objective, all croplands that are currently delivering sediment at a rate of greater than 0.3 tons/acre/year must be reduced to a delivery rate of 0.3 tons/acre/year. Although a 25 percent reduction objective may seem modest, cost effectiveness considerations preclude setting a higher reduction objective. Croplands are the major source of sediment loads within the watershed, but on many fields, soil loss is already being controlled to well below "T". Further reductions in soil loss become impractical and cost prohibitive. Table 5-4 summarizes the cropland sediment loads and eligibility criteria. Table 5-5 summarizes the cropland sediment reduction goals.

Cost Share Eligibility Criteria

Fields with sediment loss exceeding "T", and delivering greater than 0.9 tons/acre/year of sediment are **critical sites**, and must be reduced to below "T". There are an estimated 997 "critical" acres of cropland, delivering an estimated 1,189 tons per year, at an average rate of 1.2 tons/acre/year. Landowners with land designated as "critical" will be required, as described in

Chapter 3 of this plan, to install practices and control sediment delivery down to 0.3 tons/acre/year. If all critical acres are reduced to 0.3 tons/acre/year, 930 tons would be controlled. Control of sediments from critical sites will achieve a 22 percent control of the reduction goal of 4,200 tons/year, and a 7 percent reduction of the total cropland sediment load of 16,824 tons per year.

Fields delivering sediment at a rate greater than or equal to 0.2 tons/acre/year **eligible**. About 49,712 acres of eligible cropland deliver an estimated 14,500 tons/year of sediment at an average rate of 0.3 tons/acre/year. If 75 percent of eligible acres are reduced to a delivery rate 0.20 tons/acre/year, about 3,276 tons would be controlled. Control of sediments from eligible fields will achieve a 78 percent control of the reduction goal of 4,200 tons/year, and a 19 percent reduction of the total cropland sediment load of 16,824 tons per year.

Table 5-3. Summary of Upland Sediment Loading By Land Use.

Subwatershed		Crop land	Farm steads	Pasture	Grazed Wood land	Wood land	Totals	% of total acres and upland sediment
Twin Lakes	Acres	9,149	479	809	195	1,845	13,283	13%
	Sediment	1,964 T/yr	156 T/yr	43 T/yr	1 T/yr	20 T/yr	2,183 T/yr	12%
Upper Kinnickinnic	Acres	24,205	788	423	48	1,306	27,451	27%
	Sediment	7,298 T/yr	352 T/yr	18 T/yr	1 T/yr	3 T/yr	7,674 T/yr	41%
Middle Kinnickinnic	Acres	17,704	876	983	462	3,038	25,151	24%
	Sediment	3,462 T/yr	274 T/yr	4 T/yr	20 T/yr	78 T/yr	3,868 T/yr	21%
River Falls	Acres	3,924	119	2,149		957	7,667	7%
	Sediment	653 T/yr	35 T/yr	152 T/yr	NA	6 T/yr	849 T/yr	5%
South Fork	Acres	5,498	267	1,756		2,255	11,195	11%
	Sediment	1,283 T/yr	92 T/yr	134 T/yr	NA	14 T/yr	1,528 T/yr	8%
Lower Kinnickinnic	Acres	8,614	191	1,574		2,008	12,736	12%
	Sediment	1,829 T/yr	58 T/yr	110 T/yr	NA	10 T/yr	2,010 T/yr	11%
Upper & Lower St. Croix	Acres	3,862	140	526		536	5,204	5%
	Sediment	335 T/yr	40 T/yr	26 T/yr	NA	1 T/yr	404 T/yr	2%
Total	Acres	72,956	2,860	8,220	705	11,945	102,687	100%
	Sediment	16,824 T/yr	1,007 T/yr	487 T/yr	22 T/yr	132 T/yr	18,516 T/yr	100%

Source: St. Croix and Pierce Co. LWCD, WINHUSLE Model

Table 5-4. Cropland Sediments Inventory Results

Subwatershed	Estimated Watersbed Inventory Results			Goal- 25 % reduction in sediment delivered						
				Critical			Eligible			Total % of goal from each subwater-shed
	Cropped Acres	Tons per year - Sediment delivered	% contributed by sub-watershed	# Acres	Target - Tons/yr Reduced	% of goal Reduced	# Acres	Target - Tons/yr Reduced	% of goal Reduced	
Upper Kinnickinnic	24,205	7,298	43%	188	112	3%	18,937	2,073	50%	53%
Twin Lakes	9,149	1,964	12%	0	0	0%	7,271	226	5%	5%
Middle Kinnickinnic	17,704	3,462	21%	77	61	2%	9,444	607	15%	17%
River Falls	3,924	653	4%	274	315	8%	2,493	191	5%	13%
South Fork	5,498	1,283	8%	256	209	6%	2,716	225	5%	11%
Lower Kinnickinnic	8,614	1,829	11%	118	187	5%	5,481	75	2%	7%
Upper & Lower St. Croix	3,862	335	2%	84	46	1%	3,370	0	0%	1%
Total	72,956	16,824	100%	997	930	25%	49,712	3,397	75%	100%

Table 5-5. Summary of Sediment Reduction from Croplands (25% Reduction Goal)

Number of Critical Acres:	997	**Eligible Acres:**	49,712	**Total Eligible & Critical Acres**	50,697
Tons/yr Reduced by Critical Acres	930	Tons/yr Reduced by Eligible Acres (75% participation)	3,000	Total Tons Reduced	3,930
% of Total Load from Critical Sites	5%	% of Total Load from Eligible Acres	20%	% of Total Load Reduced by Eligible & Critical Acres	25%
% of Goal from Critical Sites	22%	% of Goal from Eligible Acres	78%	% of Goal from Eligible & Critical Acres	100%

Source: St. Croix and Pierce Co. LWCD, WINHUSLE Model

Gully Erosion

Inventory Results

A field inventory of gully erosion was not done because they often are temporary and are difficult to identify during an inventory. During runoff events, the gullies erode and aggrade; but after the runoff has dissipated, they may appear no different than the surrounding land.

Sediment Reduction Objective

When working with landowners, LWCD staff will attempt to highlight areas susceptible to gully erosion and examine options for prevention and/or treatment.

Cost Share Eligibility and Implementation Strategy

Any active gully site that is determined by county LWCD staff to be cost-effective will be eligible for structural practices in order to stabilize the area. Soil erosion that occurs from gully activity on cropland will mainly be controlled through the installation of structural practices such as grassed waterways and/or grade stabilization structures. In some instances, other Best Management Practices such as no-till residue management or contour strips may alleviate the need for such structural practices.

Streambank Erosion

Inventory Results

Approximately 82 miles of inventoried streambanks deliver an estimated 600 tons of sediment annually into streams. Streambank erosion contributes 3 percent of the total sediment to surface waters in the Kinnickinnic River Watershed. Significant erosion has occurred and/or aquatic habitat and water quality were degraded along approximately 7 miles of streambank. Tables 5-6 and 5-7 show streambank inventory results, eligibility criteria and reduction objectives.

Pollutant Reduction Objectives

The streambank sediment control objective is to reduce the annual load of 600 tons by 60%, or by 356 tons/year. Although the percentage of the total sediment load from streambanks is small, the local impacts on invertebrate and spawning habitat are severe.

Cost Share Eligibility and Implementation Strategy

Streambank sites eroding at greater than 10 T/year and caused by animal access or landowner management practices are designated as **"critical".** There are 10 critical sites, all in the Middle Kinnickinnic subwatershed. These sites deliver 105 tons of sediment annually to streams, and account for 18% of the 600 ton annual load.

Streambank sites eroding at 5 tons or more per year are designated **"eligible".** There are 18 eligible sites that deliver 358 tons/year to streams. If 70% of eligible sites are treated, 251 tons/year of sediment from eligible sites can be controlled. This is 42% of the 600 ton annual load.

Sites that erode at less than 5 tons per year are designated **"ineligible"** for cost sharing. However, if a landowner has an eligible site, other eroding sites on the property may be cost shared if the county LWCD staff determines that control is cost effective.

Streambank stabilization techniques should effectively control all or nearly all of the potentially eroding sediment at sites where best management practices (BMPs) are installed. In addition, peak flow reduction through application of upstream infiltration, detention or other BMPs may be needed to reduce streambank erosion.

Management options for eroding streambanks are based on the rate at which sediment is being released into streams by the cutting action of stream flows, stream channel obstructions and riparian habitat degradation. They include structural controls such as riprap, shaping and seeding, fiber rolls and other bioengineering techniques. Less intrusive measures such as brush cutting to increase light penetration and vegetation establishment may also be effective. Foregoing control altogether may be necessary if the degree of site disturbance needed to install practices offsets the benefits to the stream.

Table 5-6. Streambank Inventory Results

Subwatershed	Inventoried Streambank miles	Total Sediment Loss Tons/Year	Average T/mi/yr	Critical Tons	Eligible Tons	Ineligible Tons	% of Total Bank Erosion in Watershed	Subshed Rank for Bank Erosion
Upper Kinnickinnic	1.5	20	13.3	0	5	15	3%	M
Twin Lakes				0	0	0	0%	NA
Middle Kinnickinnic	30	370	12.3	105	244	21	62%	H
South Fork	16	130	8.1	0	88	42	22%	H
River Falls	18	40	2.2	0	13	27	7%	L
Lower Kinnickinnic	16	40	2.5	0	8	32	7%	L
Upper & Lower St. Croix		0		0	0	0	0%	NA
Totals	82	600	7.4	105	358	137	100%	

Table 5-7. Sediment Reduction from Streambanks - 60% reduction goal (356 Tons/year)

Nnmber of Critical Sites:	10		**Number of Eligible Sites:**	18		**Total Sites**	27
Tons of Sediment Reduced	105		Tons of Sediment Reduced (70% participation)	251		Total Tons/Year Reduced	356
% of Total Load Reduced	18%		% of Total Load Reduced	42%		% of Total Tons Reduced	60%
% of Goal Reduced	29%		% of Goal Reduced	71%		% of Goal Reduced	100%

Source: St. Croix and Pierce Co. LWCD field inventory

Dry Run Erosion

Description

Dry runs are areas of intermittent concentrated or channelized flow of runoff water. They can be identified by reviewing sites for evidence or history of crops impacted by inundation, or flattened by water flow. Intermittent waterways are also identified in the USDA/NRCS Soil Surveys of St. Croix and Pierce Counties. Dry runs were classified during inventory as grassed swales, pastured, or cropped.

Cropped and pastured dry runs have the potential for heavy erosion, especially in the spring, before pasture grasses or crops are established. Dry runs have serious local impacts where sediment is delivered. Gravel beds which are important habitat for trout spawning and aquatic insect production, are often temporarily or permanently obliterated by sand deposits, and channel widening, which occurs when sediments are deposited, can cause adverse increases in stream temperature.

Inventory Results

Approximately 57 miles of inventoried dry runs deliver an estimated 988 tons of sediment annually into streams. Dry run erosion contributes 5% of the total sediment to surface waters in the Kinnickinnic River Watershed. Four critical dry runs were identified and estimated to deliver 50 tons/year of sediment to the Kinnickinnic River. All are in the Middle Kinnickinnic Subwatershed. Tables 5-8 and 5-9 show dry run inventory results and reduction objectives.

Pollutant Load Reduction Objectives

The pollutant load reduction objective is to reduce the annual sediment load by 30%, or 290 tons/year.

Cost Share Eligibility

Dry runs that are cropped or pastured, and at least 1700 feet or more in length will be designated **"critical".** Critical sites must be stabilized with permanent vegetative cover, as described above.

Any cropped or pastured dry runs are considered **"eligible".**

Dry runs are eligible for practices that establish permanent vegetative cover (such as grassed waterways), critical area stabilization, wetland restoration, and in some cases, easements. See the discussion of easements in this chapter.

Table 5-8. Dry Run Inventory Results

Subwatershed	Inventoried Dry Run miles	Total Sediment Loss Tons/Year	Average T/mi/yr	Critical Tons	Eligible Tons	% of Total Dry Run Erosion in Watershed	Subshed Rank for Dry Run Erosion
Upper Kinnickinnic	9	176	19	0	176	19%	H
Twin Lakes	0	0	0	0	0	0%	NA
Middle Kinnickinnic	27	584	22	50	534	57%	H
South Fork	11	153	15	0	153	16%	H
River Falls	5	51	9	0	51	5%	L
Lower Kinnickinnic	5	24	5	0	24	3%	L
Upper & Lower St. Croix	0	0	0	0	0	0%	NA
Totals	57	988	17	50	938	100%	

Table 5-9. Sediment Reduction from Dry Runs: 30% reduction goal.

Number of Critical Miles	1.6	**Number of Eligible Miles**	31.7	**Total Eligible & Critical Miles**	33.3
Tons of Sediment Reduced	50	Tons of Sediment Reduced (25% participation)	235	Total Reduction	285
% of Dry Run Load Reduced	5%	Reduction from Eligible Sites	24%	% of Dry Run Load Reduced	30%
%of Goal Reduced	18%	%of Goal Reduced	82%	% of Goal Reduced	100%

Source: St. Croix and Pierce Co. LWCD, field inventoy

Wetlands Inventory

Description
Prior to European settlement, Wisconsin had an estimated 10 million acres of wetlands. Today, slightly more than 5.3 million acres remain. Many thousands of pre-development wetlands have been converted to cropland. Thousands more have been filled for highways and urban development.

Wetlands are an important part of our ecosystem. When water enters a wetland, the wetland acts as a purifier, cleaning the water before it exits. Wetlands do this by removing, retaining, and transforming nutrients, processing wastes, and trapping sediment. Wetlands are a principal conduit for rain water flowing to lakes and streams. Their importance to water quality, water supply, flood control, erosion control, flora and fauna, and the food chain is significant.

Wetlands vary from areas with seasonally saturated soil conditions to areas with standing water year-round. Some of the diverse types of vegetation that can be found in wetlands include pond lilies, cattails, rush, black ash, and willow.

Inventory Results
A wetland and wildlife habitat inventory was conducted to identify existing and modified or converted wetlands for the purpose of protection from degradation or potential restoration. The focus of the inventory was on wetlands that have been or are presently being degraded through drainage, grazing, cropping, or other activities causing water storage loss, and build up of sediments. Data were collected on 4,219 acres of wetlands. Data were gathered from Natural Resource Conservation Service maps, air photos, and the DNR wetland inventory maps. Guidelines for wetland restoration, which will be a component of this project, are outlined at the end of this chapter. See table 5-10 for the wetland inventory summary.

Wetland Restoration Objectives
The targeted goal is to restore at least 10 percent (425 acres) of the wetlands inventoried, and to protect wetlands through the use of easements.

Cost Share Eligibility and Implementation Strategy
Wetland restoration may include plugging or breaking up existing tile drainage systems, the plugging of open channel drainage systems, other methods of restoring the pre-development water levels of an altered wetland, and fencing of wetlands to exclude livestock. Restoration must be in accordance with NRCS Standard 657 (Wetland Restoration), and wetland specialist recommendations. Native seed and plants will be used wherever possible and no reed canary grass will be planted.

The following two conditions must be met in order for wetland restoration to be cost-shared:

- All upland fields draining to the wetland must be controlled to a soil loss rate that is less than or equal to the soil's "T" value.
- Wetland restoration costs must be the least-cost practice to reach sediment reduction goals.

The highest priority wetlands for restoration are those that provide at least one of the water quality benefits listed below, and provide essential habitat for fish, waterfowl, animals, and plants, including endangered species:

a. Cultivated hydric soils with tile or open channel drainage systems discharging to a stream or tributary. Wetland restoration will reduce the amount of nutrients and pesticides draining from the altered wetland to a water resource by establishing permanent vegetation, altering the drainage system, and enhancing groundwater recharge.

b. Pastured wetlands riparian to streams, or tributaries. Eliminating livestock grazing within wetlands will reduce the organic and sediment loading to the wetland and adjacent water resource, and reduce the direct damage to the wetland from the livestock. Livestock exclusion by fencing will control the pollutants and restore the wetland.

c. Wetlands down-slope or up-slope from fields identified as significant upland sediment sources. Restoration of wetlands in these situations may do three things: **1)** create a wetland filter which reduces the pollutants from an up-slope field(s) to a water resource; **2)** reduces the volume and velocity of water flowing from an up-slope wetland to a down-slope critical field; or **3)** enhance groundwater recharge.

d. Wetlands providing water quality improvements through infiltration. Water stored in wetlands is filtered as it infiltrates to groundwater and increases base flow in streams.

Prior converted and farmed wetlands are also considered high priority. **Prior converted** wetlands are those that have been drained, dredged, filled, leveled, or otherwise manipulated (including removal of woody vegetation) before December 23, 1985, for the purpose of making the production of an agricultural commodity possible. **Farmed wetlands** include potholes and seasonally flooded or ponded wetlands that were not fully converted prior to December 1985 and are cropped in dry years.

Sites that do not meet the conditions of a priority site yet offer significant water quality benefits may also be considered for restoration. These water quality benefits may include providing storage of storm event runoff and flood flows that significantly improve the watershed hydrology. These wetlands may also delay, absorb, filter, or purify contaminated runoff before it enters watershed streams or lakes.

Sites where existing physical characteristics or conditions are such that the potential for restoration would not be environmentally viable or economically feasible are not eligible for restoration cost sharing.

County LWCD staff, DNR, US Fish and Wildlife, or NRCS wetland restoration experts will assist landowners in plan development, including assistance in obtaining permits. Permits may be needed from three sources:

- Federal (Army Corps of Engineers) Clean Water Act §404 - Prior converted wetlands are exempt from this permit.
- State (DNR) Clean Water Act §401 Water Quality Certification, Chapter 30 and 31, Stats.
- Local (County or Municipal Zoning Office).

Table 5-10. Wetland Inventory Summary

Subwatershed	Wetland		Prior Converted Wetland		Farmed Wetland		Converted Wetland		Abandoned Farmland Wetland		Hydric Soils		Total	
	number of		number of		number of		number of		number of		number of		sites	acres
	sites	acres	sites	acres	sites	acres	sites	acres	sites	acres	sites	acres		
Upper Kinnickinnic	52	912	14	164	11	37	1	1	2	18	0	0	82	1,150
Twin Lakes	28	453	2	95	2	10	1	6	1	1	0	0	35	566
Middle Kinnickinnic	45	1,269	16	161	5	29	2	3	6	8	0	0	80	1,478
South Fork	6	82	4	34	0	0	0	0	0	0	6	31	16	147
River Falls (City)	3	41	2	49	0	0	0	0	0	0	8	122	13	212
River Falls (RF)	11	139	6	69	1	3	0	0	1	1	0	0	20	213
Lower Kinnickinnic	1	2	4	359	0	0	0	0	0	0	6	75	11	436
Upper St. Croix	7	19	3	10	1	1	0	0	0	0	0	0	11	30
Lower St. Croix	0	0	0	0	0	0	0	0	0	0	1	7	1	7
Totals	153	2,917	51	941	20	80	4	10	10	28	21	235	269	4,239

Source: St. Croix and Pierce Co. LWCD

Groundwater Pollutant Inventory

Description
Domestic wells draw water from the glacially deposited sand and gravel aquifer, and sandstone aquifers. Most domestic wells are between 100 and 200 feet deep (Borman, 1976). All of the aquifers are interconnected within the watershed. This means that contaminants at the surface have the potential of reaching domestic and municipal wells.

This section addresses primarily rural groundwater concerns. Concerns related to stormwater and primarily urban land uses are discussed in the urban section that follows in this chapter.

Inventory Results
Well sampling was extensive during the Kinnickinnic River Priority Watershed inventory. A total of 166 private well samples analyzed for nitrates, and 126 wells were analyzed for atrazine. Results of this sampling show that land use activities are affecting groundwater quality in the Kinnickinnic River Watershed. Map 5-1, found earlier in this chapter, shows the locations of wells sampled.

Concentrations of contaminants in samples determine the health classification of a well, as shown below:

Enforcement Standard (ES) Health Advisory Level: The concentration of a substance at which a facility regulated by COM, DATCP, DOT or DNR must take action to reduce the concentration of the substance in groundwater.
Preventive Action Limit (PAL): A lower concentration of a contaminant than the Enforcement Standard. The PAL serves to inform DNR of potential groundwater contamination problems, establish the level at which efforts to control the contamination should begin, a provide a basis for design codes and management criteria.

Nitrates: Of the 166 wells sampled for nitrates, 19% had concentrations less than the PAL (less than 2.0 mg/l), 57% has concentrations exceeding the PAL but less than the ES (between 2.0 and 10.0 mg/l), and 25% had concentrations exceeding the ES (greater than 10.0 mg/l), as shown in Table 5-11. Concentrations in all well samples ranged from not detected to 48.3 mg/L. No pattern of groundwater contamination can be linked to specific sources.

Atrazine: Wells were sampled using a method identified as a "triazine screen". A study recently completed by DATCP showed that while the triazine screen may give an accurate indication of atrazine levels in private wells, levels of it's breakdown components (called metabolites) are not detected very well (Postle, in print). These metabolites are thought to have the same adverse health effects as atrazine. The study showed that for samples with a "not detected" result for the triazine screen, there is a low probability that metabolite levels alone may

exceed the ES (greater than 3.0 ppb). Where detections of atrazine are below the PAL (0.3 ppb), using the triazine screen, it is possible that the concentration of metabolites exceeds the ES, and a follow-up analysis for atrazine plus metabolites is recommended, using gas chromatography (GC). If the triazine analysis shows levels of pesticide above the PAL, a follow-up analysis is also recommended. The Task Force Lab associated with the University of Wisconsin in Stevens Point plans to offer atrazine plus metabolite analysis to private citizens in September, 1998. The DNR advises people with well sample analysis for triazine above the ES to find alternate sources of water.

One hundred twenty-six private wells were analyzed for atrazine. Atrazine levels in all well samples ranged from 3.5 ppb to not detected. Twenty-eight percent had no detectable levels of atrazine. An additional 44% had detectable levels of atrazine, but were below the PAL, for a total of 72% of the wells sampled below the PAL (Table 5-13). Twenty-seven percent were greater than the PAL but below the ES. Samples from 2 wells (2%) exceeded the ES . One well which had a sample result exceeding the ES was resampled by the Department of Agriculture, Trade and Consumer Protection (DATCP) using a more accurate analysis (GC/MS) and was found to contain 2.22 ppb atrazine and no metabolites. No action will be taken for this the well. An investigation of the other well is pending by DATCP. No pattern of groundwater contamination can be linked to specific sources.

No samples were collected for coliform bacteria or hazardous substances such as volatile organic compounds.

DNR's Bureau for Remediation and Redevelopment Tracking System lists Superfund sites, solid and hazardous waste disposal sites, leaking underground storage tank sites and reported spill sites. Sites identified as a potential threat to groundwater quality in the Kinnickinnic River Watershed are listed in Appendix C.

Table 5-11. Nitrate Well Sampling Results: Kinnickinnic River Watershed

Subwatershed	Number of Nitrate Samples		Number of Nitrate Samples		Number of Nitrate Samples		Total Samples
	less than 2.0 mg/l	%	between 2.0 and 10.0 mg/l	%	greater than 10.0 mg/l	%	
Upper Kinnickinnic	4	11%	19	50%	15	39%	38
Twin Lakes	2	18%	8	73%	1	9%	11
Middle Kinnickinnic	6	16%	28	74%	4	11%	38
South Fork	10	43%	8	35%	5	22%	23
River Falls	7	28%	13	52%	5	20%	25
Lower Kinnickinnic	1	6%	10	63%	5	31%	16
Upper St. Croix	1	8%	7	58%	4	33%	12
Lower St. Croix	0	0%	1	33%	2	67%	3
Totals	31	19%	94	57%	41	25%	166

Source: DNR

Table 5-12. Atrazine Well Sampling Results

Subwatershed	Samples No Detect		Samples less than 0.3 ppb		Samples between 0.3 and 3.0 ppb		Samples greater than 3.0 ppb		Total Samples
	#	%	#	%	#	%	#	%	
Upper Kinnickinnic	0	0%	8	36%	12	55%	2	9%	22
Twin Lakes	4	50%	4	50%	0	0%	0	0%	4
Middle Kinnickinnic	8	32%	13	52%	4	16%	0	0%	17
South Fork	13	57%	7	30%	3	13%	0	0%	10
River Falls	5	24%	11	52%	5	24%	0	0%	16
Lower Kinnickinnic	1	7%	8	53%	6	40%	0	0%	14
Upper St. Croix	4	40%	3	30%	3	30%	0	0%	6
Lower St. Croix	0	0%	1	50%	1	50%	0	0%	2
Totals	35	28%	55	44%	34	27%	2	2%	**126**

Source: DNR

Groundwater Protection Objectives
It is an objective of project staff to increase public awareness and understanding of threats to groundwater quality, and to provide assistance to landowners in implementing practices to protect groundwater.

Cost Share Eligibility and Implementation Strategy
A number of agricultural practices, including nutrient and pesticide management, spring protection, and wetlands restoration will benefit groundwater. In addition, proper well abandonment of any unused well is eligible for cost sharing.

Other government programs may provide assistance with replacement of contaminated wells and replacement of some failing septic systems. These programs are discussed in more detail in Chapter 7 of this plan.

Urban Nonpoint Sources Inventories

Total Suspended Solids (TSS) and Toxic Pollutants

Stormwater Runoff

Impacts on Surface Water: Stormwater is most commonly conveyed to streams through a combination of storm sewers, roadside ditches, grassed swales and ponds. The types and amounts of pollutants transported by runoff depend on the way that pollutant-bearing surfaces are connected to the storm drainage system. For example, commercial parking areas and arterial streets deliver the highest concentrations of lead, asbestos, cadmium and street sediment, because they are drained by storm sewers which typically transport runoff rapidly with no pretreatment or filtering before delivery to streams.

Infiltration of stormwater into the soil and ground layers on a suitable site can effectively reduce nonpoint pollution. Properly designed grassed swales generally reduce runoff volume, and sod vegetation serves to remove some pollutants from runoff before it flows into streams and storm sewer systems. Infiltration can also help stabilize the hydrology of urban streams by replenishing groundwater, much of which ultimately discharges to surface water. Infiltration can reduce bank erosion and the need for expensive, highly engineered drainage structures such as concrete lined channels.

There are practices that increase on-site infiltration such as porous pavements, redirecting roof down spout to grassed areas, and directing runoff water to infiltration trenches. These practices are generally most applicable to small source areas such as rooftops and parking lots. Grassed swale drainage systems can also be used to reduce runoff and erosion. These practices are generally low cost, and can be incorporated into many site designs prior to construction, or inexpensively installed on existing sites. Although more expensive, infiltration basins can be located at the end of drainage outlets serving larger drainage areas or used with wet detention ponds to supplement pollutant removal effectiveness or reduce pond size.

Impacts on Groundwater: The surface water temperature monitoring of the Kinnickinnic River for the surface water appraisal showed that base flow temperature increased 4 degrees centigrade below the City of River Falls, in part due to urban stormwater run-off. While infiltration of stormwater is recommended, common stormwater pollutants have the potential to contaminate groundwater.

The DNR recommends that stormwater be pretreated and monitored prior to infiltration in order to prevent costly groundwater monitoring well installation and remediation, which would be required if contaminants exceed the enforcement standard. Only one monitoring point, located at the infiltration basin inflow, would be necessary. Quarterly sampling is recommended. Pretreatment options are described in the DNR Stormwater Manual Volume 2. In most cases, a well maintained grass filter strip will remove most contaminants.

Inventory Methods
There are four urban communities in the watershed: the Villages of Hammond and Roberts and the Cities of Prescott and River Falls. Current and projected (20 year) urban land uses and acreage were estimated, using responses to a questionnaire sent to city or village staff for Hammond, Roberts and Prescott. The Village of Roberts also provided a copy of their "Long-range Land Use Plan (1992).

City of River Falls: For the City of River Falls, current and projected land uses, acreage and pollutant loads were obtained from the *City of River Falls Water Management Plan for the Kinnickinnic River and its Tributaries* (1995). This plan was prepared by Short, Elliott, Hendrickson Inc. (SEH) in cooperation with the City of River Falls, Wisconsin Department of Natural Resources, University of Wisconsin - River Falls and Trout Unlimited.

In this plan, total suspended solids (TSS) loads for River Falls were calculated using the model P-8. Regression equations were then used to calculate loads for total phosphorus, total kjeldahl nitrogen, copper, lead, and zinc (SEH, 1995). Pollutant concentrations were measured in the runoff from storm events at representative residential (three events), industrial (one event) and commercial (three events) sites. Results were used to calibrate the P-8 model.

The City of River Falls Water Management Plan (WMP) encompassed a 65-square mile area including and surrounding the city. Areas with TSS loads of less than 45 pounds/acre/year were defined as rural in the WMP, and were not included in urban pollutant load calculations.

Villages of Hammond and Roberts, City of Prescott: The Source Loading and Management Model (SLAMM) was used to estimate annual mass TSS loads to surface waters. The regression equations developed for the City of River Falls were then applied to the calculated TSS load to obtain loads for total phosphorus, copper and lead. These equations were chosen because they had been calibrated to this region, and were judged to give the best results for this area. Tables 5-13 and 5-14 show the estimated urban pollutant loads for 1997 and 2017.

Urban Toxic Pollutants: Four pollutants (sediment, copper, phosphorus and lead) were chosen to characterize the type and severity of urban nonpoint pollution. The monitoring and modeling data presented represent a preliminary screening of stormwater runoff quality and pollutant loadings from the study area. Without additional monitoring to verify storm event mean pollutant concentration values, estimated loadings can only be considered best available estimates. Although the study area for development of pollutant loadings was within the City of River Falls, this statement applies to all municipalities, as their estimated loads were calculated using the linear regression equations in the River Falls Water Management Plan (SEH, 1995).

Inventory Results
Table 5-13 shows the inventoried TSS load from current development, based on modeling results as described above. Table 5-14 shows the anticipated TSS load for "build-out" (2017) conditions, based on anticipated growth for each municipality. It is assumed that future

development would deliver TSS to streams at the same average rate as existing development, if only current stormwater management practices are applied.

Table 5-13. 1997 Urban Acres and Stormwater Runoff Pollutant Loads

Municipality and (Subwatershed)	Urban Acres	Urban Pollutants			
		Sediment (Tons/Yr)	Copper (lbs/yr)	Phosphorus (lbs/Yr)	Lead (lbs/yr)
V. of Hammond (UK)	810	53	18	243	26
V. of Roberts (TL)	181	23	8	105	11
City of River Falls (SF & RF)	3,106	368	126	1,687	178
City of Prescott (LSC)	1,294	178	61	815	86
TOTAL	5,391	622	213	2,850	301

Source: City of River Falls Water Management Plan and DNR SLAMM modeling

Table 5-14. 2017 Urban Acres and Stormwater Runoff Pollutant Loads

Municipality and Subwatershed	Urban Acres	Urban Pollutants			
		Sediment (Tons/Yr)	Copper (lbs/yr)	Phosphorus (lbs/Yr)	Lead (lbs/yr)
V. of Hammond (UK)	886	111	38	508	54
V. of Roberts (TL)	418	117	40	536	57
City of River Falls (SF & RF)	4,760	753	257	3,448	364
City of Prescott (LSC)	1,518	242	83	1,108	117
TOTAL	7,582	1,223	418	5,600	592

Source: City of River Falls Water Management Plan and DNR SLAMM modeling

Pollutant Reduction Objectives

The stormwater runoff pollutant control objective is to reduce by 35%, the TSS load to lakes and streams that would occur by 2017, if the current level of stormwater runoff control effectiveness is applied to new development. This goal can be achieved by a combination of retrofitting developed drainage areas with stormwater controls, and planning new development to maximize infiltration of runoff on-site. The following reductions will be needed:

- A 60% reduction in the *potential* future loads that are estimated will come from currently undeveloped areas by 2017. Many low-cost and very effective on-site measures to maximize infiltration can be applied to new development during the planning phase. Appendix B, as discussed in Chapter 3 of this plan, identifies stream protection strategies that can be used to meet this objective.

- A 10% reduction in runoff pollutant loads from developed urban areas. To meet this objective, constructing new detention ponds or infiltration areas, or enhancing the effectiveness of existing ones may be feasible. In many cases, there is no available land, or costs are too prohibitive for this approach. The City of River Falls Water Management Plan assesses stormwater control alternatives for drainage areas, and will be utilized in meeting this objective.

Table 5-15 shows the estimated reduction objectives for each municipality.

Table 5-15. Stormwater TSS reduction objectives for urban and developing areas:
10% reduction objective for existing urban development
60% reduction objective for new development.

Mnnicipality	Total "Buildout" tons/yr with no new BMPs (a)	Urban Tons/yr controlled by BMPs (b)	"New" Tons/yr controlled by BMPs (c)	Total Tons/yr controlled by BMPs	Overall % reduction of urban loads
Hammond (UK)	111	5	35	40	36%
Roberts (TL)	117	2	56	58	50%
River Falls (SF & RF)	753	37	231	268	36%
Prescott (LSC)	242	18	38	56	23%
TOTAL	1223	62	360	422	35%

(a) This is the buildout uncontrolled load if the level of stormwater control for existing development is applied to new development , or "no new BMPs are applied".
(b) This is the load from existing urban areas that must be controlled by BMP's (10% reduction objective).
(c) This is the portion of the load that would come from "uncontrolled" new development that must be controlled by BMPs (60% reduction objective).

Urban Toxic Pollutants: The recommended level of treatment for urban stormwater is always a difficult to determine. To help address this question, a methodology based on copper toxicity was developed in the WMP. Using this approach, a recommended minimum TSS removal efficiency for urban stormwater treatment has been determined specifically for River Falls.

Toxicity research conducted as part of the Nationwide Urban Runoff Program (NURP)(EPA, 1983) identified copper as the element most commonly found in urban runoff which is most toxic to aquatic organisms. The toxicity of copper is linked closely to water hardness. Review of water quality data for the Kinnickinnic River indicates an average hardness of 220 ppm. At this level of hardness, the chronic toxicity criterion for copper is 24 micrograms per liter. Using this concentration as the discharge standard, the recommended minimum TSS removal efficiency for stormwater treatment areas is estimated to be 85% (SEH, 1995, pages 46-47).

Implementation Strategy
The implementation strategy for urban and growth areas is discussed in detail in Chapter 3 of this plan. Priority will be given to cost-effective non-structural and structural activities such as:

- Planning for new development that maximize infiltration, including minimizing roadways, rooftops, driveways and parking areas; protecting sensitive areas; and establishing buffer corridors
- Implementing urban best management practices, such as street sweeping, regulating pet wastes, leaf and grass clipping collection
- Educational efforts, such as storm drain stenciling
- Stormwater management planning and ordinance development
- On-site low-cost infiltration techniques and devices such as directing downspouts to vegetated areas; crown driveways to direct drainage to grass; perimeter infiltration for parking lots; grassed swales along roadways

Where more control than can be obtained with on-site infiltration is needed, retention ponds or infiltration basins may be appropriate. The needed capacity for these structures should be minimized by making maximum use of on-site infiltration options. Where detention ponds are necessary, special design considerations should be incorporated to minimize thermal pollution impact. Feasibility studies may be needed to select site specific infiltration and wet detention practices consistent with this watershed plan. The cost and complexity of studies will vary, depending on the availability of land for locating practices and the compatibility of the existing storm sewer networks with locating structures.

The City of River Falls Water Management Plan (SEH, 1995) will facilitate implementation, and will be referred to in determining stormwater management priorities and cost effectiveness. In 1998, River Falls adopted a stormwater utility for the purposes of water quantity and water quality control. A stormwater utility allows for a self-sustaining method of financing stormwater control. An annual revenue of approximately $250,000 is anticipated. This could provide for treatment of between 10 and 25 impervious acres annually.

Assistance available to communities under the priority watershed project to develop nonpoint source controls in established urban areas is presented in Chapter Six.

Construction Site Erosion

Description
Construction sites are areas of new development or redevelopment, in any phase of construction, that involve disturbing the soil through grading or excavation. Construction site erosion is a major water quality concern in the watershed. Uncontrolled construction site erosion can devastate aquatic communities in streams or lakes receiving sediment-laden runoff. The reduced capacity of stormwater conveyance systems resulting from sedimentation can cause localized flooding. Importantly, water quality improvements occurring through implementation of nonpoint source control practices for existing urban areas can be negated by construction site

erosion pollution sources. Predicting rates of construction site erosion is difficult. However, erosion rates exceeding 75 tons/acre/year can occur. This rate of erosion is greater than that occurring on the most severely eroding croplands or from existing commercial and industrial areas. Often the proximity of construction sites to storm sewers or other drainage ways serving urban areas results in nearly all of the sediment being delivered to streams.

Inventory Results

An average of 185 permits per year for new construction have been issued in the watershed over the past three years. Half of these permits have been issued in or near the City of River Falls.

Current sediment loads delivered to surface waters from construction site erosion were conservatively estimated for the subwatersheds. An average erosion rate of 20 tons/year and a delivery rate of 20% were used. This is equivalent to an average annual sediment delivery of four tons per site (Table 5-16). These erosion and sediment delivery rates are based on observed land development patterns and generalized climatic conditions. It is estimated that construction erosion will contribute about 740 tons of sediment annually to streams in the project area.

Pollutant Reduction Objective

A 70 percent reduction objective for construction related sediments was identified for the Kinnickinnic River Watershed. This objective will be attained by development and/or enforcement of construction site erosion control ordinances.

Table 5-16. Estimated construction site erosion sediment delivery to streams or lakes and estimated tons reduced at 70% reduction goal.

Subwatershed	Average Building Permits/Year	Estimated T/year delivered to surface waters[1]	Tons reduced at 70% reduction goal
UK	10	40	28
MK	15	60	42
TL	20	80	56
SF	15	60	42
RF	80	320	224
LK	15	60	42
USC	10	40	28
LSC	20	80	56
TOTAL	185	740	519

[1] Based on average estimated sediment delivery rate of 4 tons/site/year. Source: DNR

Cost Share Eligibility and Implementation Strategy

It is highly recommended that local units of government either together, or independently, apply for a Local Assistance Grant through the Priority Watershed program to hire a municipal

engineer to review construction site erosion control plans and enforce the construction site erosion control ordinance.

Construction Site Erosion Ordinances: The City of **River Falls** has ordinance requirements for controlling construction site erosion and sedimentation. Their Stormwater Management Ordinance (including erosion control) was revised in 1997 and adoption is anticipated in 1999. **Prescott** and **Hammond** also have local erosion control ordinances. **Roberts** does not have a local erosion control ordinance. In addition, developers are governed by state regulations (Ch. 144 Wis. Stats.) set forth by the Department of Commerce (COM) for erosion control on sites with one and two family dwellings; and the DNR Wisconsin Pollutant Discharge Elimination System (WPDES) permit regulations apply to sites greater than five acres.

Chapter 236 of the Wisconsin Statutes gives cities, villages, towns, and counties authority to control erosion from developing subdivisions and smaller land divisions. This chapter establishes the minimum standards and procedures for land division in Wisconsin. The chapter enables local governments that have an established planning agency to adopt subdivision ordinances that are more restrictive than the state standards. Many government units have included runoff and erosion control provisions in their ordinances, and typically require a developer to submit a detailed plan specifying control measure for minimizing erosion and runoff during and after development. Typically, before a final plat is filed the person who reviewed the erosion and runoff control plan visits the development site and certifies that the measures have been installed in accordance with the plan.

It is recommended that all communities periodically review their ordinances for adequacy and effectiveness of implementation, as discussed earlier in this chapter. The Village of Roberts should enact a construction site erosion control ordinance. Recommended actions for local units of government include:

- Review (and modify where needed) existing ordinances to assure effective responses to concerns of citizens, inspection staff and developers, and effective penalties for non-compliance.
- Evaluate staffing and training needs for effective ordinance administration and enforcement.
- Evaluate and modify permit fee schedules to assure support for effective enforcement activities.
- Assure that developers and contractors understand ordinances and have adequate access to technical information through seminars or other educational activities and materials.
- Provide specific guidelines to erosion control inspectors to assure effective documentation of ordinance violations, consistent issuance of citations and effective legal action.

Because of gaps in state agency regulations, construction erosion control is best accomplished through local erosion control ordinances, locally administered building codes, practice standards and application guidelines, an effective administrative program and effective enforcement. Training programs may be needed for staff administering ordinances and developers who are

responsible for installing and maintaining the erosion control practices. An erosion control information and education strategy is described in Chapter Eight.

Streambank Erosion

Description and Inventory
Urban streambank erosion is of medium concern for portions of the City of River Falls and adjacent urbanizing areas. Streambank erosion is a high priority concern for portions of the South Fork and Rocky Branch. This erosion is caused primarily by upstream modifications and the changing stream hydrology, which is characterized as "flashy" and having increasing volumes and peak flows. This exposes and erodes the banks, destroying the natural conditions needed for healthy aquatic communities. Also, the channel is scoured during heavy rainfall events, displacing in-stream cover such as rocks and logs and flushing away aquatic life as well.

Implementation and Cost Share Eligibility
If concrete channels, dams and other in-stream structures deteriorate or are removed, newly exposed streambanks may begin to erode. When this occurs, the DNR and the appropriate unit of government will jointly evaluate the severity of the erosion and develop a management recommendation. Eligibility of these sites for technical and financial assistance will be consistent with the criteria in Table 5-8. Easements are also encouraged as a means of controlling streambank erosion, as discussed in Chapter 6 of this plan.

Thermal Pollution

Description
Urbanization generally results in increased impervious surfaces, such as rooftops, streets and parking lots. The thermal properties of these materials can lead to localized climatic changes, or what is currently termed "heat-island effect", particularly in summer months. Stormwater runoff from large summertime storms in urban areas has been known to cause considerable temperature changes in the receiving waters. A study in Long Island, New York found that stream temperatures downstream of urban developments increased by 8 to 10 °C compared to undeveloped regions. In addition, these changes in the landscape have often led to dramatic changes in stormwater hydrology and water quality. Numerous studies have also highlighted the impact of these alterations on receiving stream habitat and biodiversity.

Though this thermal enrichment issue is critical to the overall health of streams across the country, little research has been conducted to fully understand this phenomenon. In addition, no continuous urban runoff model exists today which can simulate the transfer of heat from impervious surfaces to runoff water. Previous researchers have proposed simple regression equations relating stream temperature increases to percent imperviousness in a basin, with limited success.

A DNR study is currently underway to develop a thermal model, which coupled to an existing urban hydrologic model, can simulate the heat load from the City of River Falls to the Kinnickinnic River. The model will use a heat budget approach, in which all heat inputs and outputs (e.g. solar radiation,
evaporation, convective loss) will be accounted for at each time step and surface type. The mathematical expressions used in the model come from other related work, such as the study of road surface expansion, building heating and cooling concerns, etc.

Meteorological inputs drive the model and include short-wave radiation, wind speed, air temperature, humidity, and rainfall. Calibration and verification will be performed using field temperature data collected from a storm sewer outlet in River Falls. Once this heat model is adequately calibrated, the output can be used as input to an existing stream model, to determine the thermal effect of the runoff water on the stream's temperature regime.

The U. S. Army Corps of Engineers stream temperature model, CE-QUAL-RIV1, will be used to simulate water temperatures in the section of the Kinnickinnic River which flows through the City of River Falls. Temperatures will be modeled at a number of points along the river's length. Heat contributed by runoff water to the stream will be simulated by the thermal runoff model discussed above. Surface heating of the impoundments will also be simulated. Once the model is calibrated and verified, various growth scenarios can be run to look at relative thermal impacts on the stream from these possible developments. Because of the spatial structure of the model, placement of new development can be examined in hopes of minimizing future thermal impacts.

The development of this model will have wide-ranging applications. Water quality planners will be able to use this tool to examine thermal impacts of both small (e.g. a single parking lot) and large-scale developments (e.g. new sewered subdivision). Water quality staff may be able to work with local zoning and land use planning officials to decide the extent and placement of future growth. Being a continuous model, multiple years can be simulated to generate information on probability of exceedances of thermal thresholds. Future work may also examine thermal implication of BMP's.

In the River Falls area, thermal and river modeling will allow detailed site and drainage area analysis of development and management alternatives on thermal loading and stormwater runoff.

Pollutant Reduction Objectives

The thermal objective is to prevent an increase in the thermal impacts of development on the Kinnickinnic River and its tributaries. To achieve this objective, all land in the watershed that has not yet exceeded 15% imperviousness should be managed to maintain an "effective imperviousness" of no greater than 15%.

Many of the strategies previously described for control of stormwater pollutants will also help to minimize thermal pollutants. When the thermal modeling study is complete, it can be used to identify cost effective thermal management strategies.

Pollution Prevention Practices

Description

Pollution prevention practices remove pollution at its source and prevent the need for further treatment. Practices include street sweeping, yard waste collection, recycling programs, and a variety of behavioral changes.

Street sweeping removes some of the particulate pollutants from street and parking lot surfaces before they can be transported to surface waters. Repeated street sweeping of commercial and industrial areas in the early spring removes winter accumulation of sand and street dirt; fall sweeping removes leaves. Minimizing use of lawn care pesticides and fertilizers helps prevent enrichment of surface waters with nutrients that promote algae growth.

Inventory Results

A questionnaire was distributed to municipalities to identify current pollution prevention practices. Table 5-17 summarizes the pollution prevention practices in use by communities in the Kinnickinnic River Watershed.

Table 5-17. Community Pollution Prevention Practices Summary

Municipality	Street Sweeping	Leaf, Grass & Brush Collection	Snow Salt Policy	Fertilizer and Pesticide Policy	Public Works Prevention Policy	Pet Waste Ordinance	Education Activities
	how often	how often	y/n	y/n	y/n	y/n	y/n
Hammond	2/yr	no, but publ. compost site	yes	no	yes	yes	no
Roberts	1/yr (spring)	1/week (spr - fall)	yes	no	no	no	no
River Falls	1/week	1/week	yes	no	yes	yes	yes
Prescott	2/mo	no, but publ. compost site	no	no	no	yes	no

Source: Survey forms completed by the municipalities

Implementation Strategy

Recommended actions for local units of government and/or urban residents include:

- Minimize the use of galvanized roof materials and gutters, a primary source of zinc in urban runoff. Revise municipal building codes where possible.
- Enforce local pet waste ordinances and familiarize pet owners with good pollution prevention practices.
- Control the timing and reduce the amount and type of fertilizer and pesticide applications in all areas. Market phosphorus-free fertilizer.

- Dispose of automobile waste fluids such as radiator water and engine oil appropriately, keeping them out of the storm sewer system. Set up municipal recycling programs for antifreeze and waste oil. Create partnerships with car dealerships and auto maintenance shops in the watershed project area.
- Remove street dirt, leaves and debris from catch basins, streets and parking lot surfaces through municipal street maintenance and leaf collection programs.
- Control construction site erosion.
- Minimize use of street de-icing compounds.

Public Water Supplies

Description
Contaminant problems affecting municipal wells are often similar to those affecting rural wells, as described earlier in this chapter.

Inventory
The municipalities of Hammond, Prescott, River Falls and Roberts have public water supply systems. The Village of Hammond has two municipal wells. Well number 1 was installed in 1938 and is 440 feet deep. It draws water from the Prairie du Chien dolomite and Trempealeau sandstone. Well number 2 was constructed in 1978 and is 373 feet deep. It draws water from the Trempealeau sandstone. The Village is in the process of developing a Wellhead Protection Plan, with completion anticipated for late in 1998.

The City of Prescott has three wells. Well number 2 was constructed in 1955 and is 400 feet deep. It draws water from the Jordan-St. Lawrence and Franconia sandstones. Well number 3 is 286 feet deep and draws water from the Jordan sandstone. It was installed in 1969. A third well, well number 4, was installed in the fall of 1997. Well number 4 is 375 feet deep, cased to 285 feet and draws water from the Jordan sandstone. A Wellhead Protection Plan was submitted to the DNR for approval, and will be implemented about June, 1999, after completion of the well house for well number 4. Well number 1 referred to a small well field on the banks of the St. Croix River which has been properly abandoned by filling each with concrete.

The City of River Falls has four wells. Well number 2 was constructed in 1948, is 401 feet deep and draws water from the Prairie du Chien and Trempealeau formations. Well number 3 was installed in 1953, is 379 feet deep and draws water from the Prairie du Chien and Trempealeau formations. Well number 4 was installed in 1967 and is 415 feet deep. It draws water from the Prairie du Chien and Trempealeau formations. Well number 5, installed in 1979, is 400 feet deep and also draws water from the Prairie du Chien and Trempealeau formations. The original water system was installed in 1894; other wells were constructed in 1898, 1902 and 1920. These wells have all been abandoned. From 1921 until 1949 a spring was used as a water supply source. No Wellhead Protection Plan has been written for existing wells.

River Falls recently investigated two potential sites for installing a fifth well on the north end of River Falls and southeast of the City. A feasibility study was completed for the southeast site, including components of a Wellhead Protection plan. However, recent increases in pumping capacities for two existing wells have delayed or halted this plan.

The Village of Roberts has two wells. Well number 1 was installed in 1954, is 302 feet deep and draws water from the Prairie du Chien formation. Well number 2 was installed in 1969 and is 303 feet deep and also draws water from the Prairie du Chien formation. The Village of Roberts has no Wellhead Protection Plan.

Cost Share Eligibility and Implementation Strategy

Wellhead Protection: The groundwater strategy for municipal groundwater should include wellhead protection planning for Roberts and for existing wells in River Falls. Hammond and Prescott should move forward with adopting or implementing their groundwater protection plans as soon as possible.

The elements required within the scope of a wellhead protection plan will include such activities as special studies, monitoring wells, contingency plans, public education, zoning proposals, easements, and proposed regulations or ordinances. Wellhead protection planning activities for new or yet to be constructed wells are not eligible for funding through the watershed project and would not be considered for grant funding. For those projects that are eligible, the Kinnickinnic River Watershed Plan allows for a 50% cost share to eligible well owners that develop contracts with the DNR for completing wellhead protection plans.

Whenever wellhead protection planning is implemented in this project the planning procedure must be consistent with DNR guidelines. These guidelines are available from the Groundwater Section of the Department's Bureau of Drinking Water and Groundwater. Wellhead plans can include the following kinds of activities, but are not restricted to these activities:

1. Hydrologic studies
2. Land use management alternatives
3. Contingency plans
4. Easement acquisition
5. Monitoring well installations
6. Delineation of potential contaminant sources
7. Public education and information activities
8. Development of ordinances

Other Pollution Sources

Many pollution sources contributing to surface water quality degradation in the watershed are typically not addressed by the priority watershed project. Control of these pollution sources occurs through other state and county regulatory programs, as described below.

Industrial Point Sources

Discharges of wastewater from permitted municipal and industrial sources are important considerations for improving and protecting surface water resources. Chapter 147, Wis. Stats., requires any person discharging pollutants into the waters of the state to obtain a Wisconsin Discharge Elimination System (WPDES) Permit issued by the DNR.

There are no industrial point source discharges in the Kinnickinnic River Watershed.

Municipal Waste Water Treatment Plants (WWTP)

The Prescott activated sludge wastewater treatment facility was upgraded in 1994. The facility has a hydraulic capacity of 0.509 MGD, and is presently operating at about 0.320 MGD. Unit processes consist of screening, grit removal, an anoxic/anaerobic selector tank for biological phosphorus removal, activated sludge aeration, clarification and ultraviolet disinfection. Sludge is dewatered and hauled to the West Central Wisconsin Biosolids Facility. Effluent is discharged to the Mississippi River, and the wastewater treatment facility was constructed with a septage receiving station. The facility is in substantial compliance with the conditions of its WPDES permit and is staffed with qualified operators.

The River Falls oxidation ditch wastewater treatment facility was upgraded in 1980. The facility has a hydraulic capacity of 1.8 MGD, and is presently operating at about 1.0 MGD. Unit processes consist of screening, oxidation ditch aeration, clarification, disinfection with chlorine, and dechlorination with sulfur dioxide. Biological phosphorus removal will be constructed and operational by March 31, 2000. Sludge is hauled to the West Central Wisconsin Biosolids Facility. Effluent is discharged to the Kinnickinnic River, and River Falls accepts septage at its primary lift station. The facility is in substantial compliance with the conditions of its WPDES permit and is staffed with qualified operators.

The Hammond aerated pond wastewater treatment facility was upgraded in 1987. The facility has a hydraulic capacity of 0.154 MGD, and is presently operating at about 0.085 MGD. The facility consists of two aerated ponds, a polishing pond, and an artificial wetland, with the effluent discharged indirectly to groundwater through two rapid infiltration basins. A groundwater monitoring system containing six wells is being used to evaluate the impacts of the effluent on groundwater. The facility does not accept septage, and plans are presently being prepared to upgrade the facility. The facility is staffed by a qualified operator.

The Roberts rotating biological contractor wastewater treatment facility was upgraded in 1984. The facility has a hydraulic capacity of 0.135 MGD, and is presently operating at about 0.07 MGD. The facility consists of a bar screen, primary clarification, a single three-stage rotating biological contractor, final clarification and post aeration. Sludge is hauled to the West Central

Wisconsin Biosolids Facility. Effluent is discharged to East Twin Lake. Roberts does not accept septage, and is in substantial compliance with the conditions of its WPDES permit. The facility is staffed by qualified operators.

Private Sewage Systems

Septic systems consist of a septic tank and a soil absorption field. Septic systems fail due to soil type, location of system, and poor design or maintenance, such as tanks which go unemptied. Pollutants from septic system discharges are nitrates, bacteria, viruses and hazardous materials from household products. The suitability of soils for on-site sewerage systems vary widely in the Kinnickinnic River Watershed. In addition, the separation distance to groundwater varies widely throughout the watershed.

Leaking Underground Storage Tank (LUST) and Other Contaminated Sites

Previously identified potential groundwater quality problems in the Kinnickinnic River Watershed are listed in Appendix C. These sites are listed in the DNR's Bureau for Remediation and Redevelopment Tracking System, which lists Superfund sites, solid and hazardous waste disposal sites, leaking underground storage tank sites, and reported spill sites.

There are approximately 50 listed LUST sites, 5 Environmental Repair Fund sites, and 13 additional spill sites reported in the Kinnickinnic River Watershed.

CHAPTER SIX
Implementation

This chapter describes the means for implementing the management actions for nonpoint source pollution control described in the previous chapter. For rural areas, it identifies best management practices that are eligible for cost-sharing and cost-share rates, the process that county staff will use for implementing best management practices, and identifies costs associated with rural implementation.

For urban and growth areas, this chapter describes basic elements of urban nonpoint source management that are expected of local units of government, in order to be eligible for cost-sharing for more "site-specific" or extensive practices. It also identifies urban practices that are eligible for cost-sharing, and cost-share rates, and identifies costs associated with urban implementation. This chapter is organized in the following manner:

- Rural Implementation Program
  - Agricultural best management practices eligible for cost-sharing and cost-share rates
  - The cost-share agreement administration
  - Schedules for implementing the project, including the critical sites notification schedule
  - The critical site designation appeal process
  - The estimated project budget for cost-sharing, staffing, and other support
- Urban Implementation Program
  - Core or "basic" community-wide management program
  - Segmented or "site-specific" elements of the urban management program
  - The estimated budget for cost-sharing, staffing and other support
- Priority Watershed partner roles and responsibilities
- Summary of Project costs
- Grant disbursement and project management schedule

Rural Implementation Program

BMP's Eligible For Cost-Sharing And Their Rates

Best management practices control nonpoint sources of pollution and are identified in NR 120. Design and installation of all BMPs must meet the conditions listed in NR 120. Generally these practices use standard specifications included in the NRCS Field Office Technical Guide. In some cases additional specifications may apply. The applicable specifications for each BMP can be found in NR 120.14.

If the installation of BMPs destroys significant wildlife habitat, NR 120 requires that habitat will be recreated to replace the habitat lost. The DNR District Private Lands Wildlife Specialist or a designee will assist the LCD in determining the significance of wildlife habitat and the methods used to recreate the habitat. Every effort shall be made during the planning, design, and installation of BMPs to prevent or minimize the loss of existing wildlife habitat. Wildlife habitat restoration components of the practice are cost-shared at 70 percent.

The practices eligible for cost-sharing and the cost share rates for each BMP are listed in Tables 6-1 and 6-2 below; the BMPs listed in Table 6-1 can either be cost-shared at 50% or at the flat rates listed.

Table 6-1. Rural Practices with Flat Rates for State Cost-Share Funding

BEST MANAGEMENT PRACTICE	MAXIMUM FLAT RATE
Contour Farming	$ 9.00/ac[1]
Contour Strip-cropping	$ 13.50/ac[1]
Field Strip-cropping	$ 7.50/ac[1]
High Residue Management	$ 18.50/ac[2]
Cropland Protection Cover	$25.00/ac[2]

[1] Wildlife habitat restoration components of this practice are cost-shared at 70%.
[2] Up to three years.

Following is a brief description of the most commonly used BMPs. More detailed descriptions can be found in NR 120.14 and NR 120.186.

Contour Farming. The farming of sloped land so that all operations from seed bed preparation to harvest are done on the contour.

Contour Strip-cropping. Growing alternating strips of row crops and grasses or legumes on the contour.

Field Diversions. A channel constructed across the slope with a supporting ridge on the lower side, to divert excess water to safe outlet in other areas.

Terraces. A system of ridges and channels with suitable spacing and constructed on the contour with a suitable grade to prevent erosion in the channel.

Grassed Waterways. A natural or constructed channel shaped, graded and established with suitable cover as needed to prevent erosion by runoff waters.

High Residue Management. A system which leaves at least 30 percent of the ground covered with crop residue after crops are planted.

Nutrient Management. The management and crediting of nutrients from all sources, including legumes, manure, and soil reserves for the application of manure and commercial fertilizers. Management includes the rate, method and timing of the application of all sources of nutrients to minimize the amount of nutrients entering surface and groundwater. This practice includes manure nutrient testing, routine soil testing, and residual nitrogen soil testing.

Pesticide Management. The management of the handling, disposal and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater. This practice includes integrated pest management scouting and planning.

Cropland Protection Cover (Green Manure). Cropland protection cover are close-growing grasses, legumes or small grain grown for seasonal soil erosion protection and soil improvement.

Intensive Grazing Management (Rotational Grazing). Intensive grazing management is the division of pastures into multiple cells that receive a short but intensive grazing period followed by a period of recovery of the vegetative cover. Rotational grazing systems can correct existing pasturing practices that result in degradation and should replace the practice of summer dry-lots when this practice results in water quality degradation.

Critical Area Stabilization. The planting of suitable vegetation on nonpoint source sites and other treatment necessary to stabilize eroding lands.

Grade Stabilization Structure. A structure used to reduce the grade in a channel to protect the channel from erosion or to prevent the formation or advance of gullies.

Agricultural Sediment Basins. A structure designed to reduce the transport of sediment of other pollutants eroded from agricultural fields to surface waters and wetlands.

Shoreline and Streambank Stabilization. The stabilization and protection of stream and lake banks against erosion and the protection of fish habitat and water quality from livestock access.

Shoreline Buffers. A permanently vegetated area immediately adjacent to lakes, streams, channels and wetlands designed and constructed to manage critical nonpoint sources or to filter pollutants from nonpoint sources.

Lake Sediment Treatment. Lake sediment treatment is a chemical, physical, or biological treatment of polluted lake sediments. Sources of pollution to the lake must be controlled prior to treatment of lake sediments. Treatment does not include dredging.

Barnyard Runoff Management. Structural measures to redirect surface runoff around the barnyard, and collect, convey or temporarily store runoff from the barnyard.

Barnyard Abandonment or Relocation. Relocation of an animal lot from a critical site such as a floodway to a suitable site to minimize the amount of pollutants from the lot to surface or groundwater.

Manure Storage Facility. A structure for the storage of manure for a period of time that is needed to reduce the impact of manure as a nonpoint source of pollution. Livestock operations where this practice applies are those where manure is winter spread on fields that have a high potential for runoff to lakes, streams and groundwater. The facility is needed to store and properly spread manure according to a management plan.

Manure Storage Facility Abandonment. Manure storage system abandonment is the proper abandonment of leaking and improperly sited manure storage systems, including: a system with bottom at or below groundwater level; a system whose pit fills with groundwater; a system whose pit leads into the bedrock; a system which has documented reports of discharging manure into surface or groundwater due to structural failure; and a system where there is evidence of structural failure. The practice includes proper removal and disposal of wastes, liner materials, and saturated soil as well as shaping, filling, and seeding of the area.

Milking Center Waste Control Systems. A milking center waste control system is a piece of equipment, practice or combination of practices installed in a milking center for purposes of reducing the quantity or pollution potential of the wastes.

Roofs for Barnyard Runoff Management and Manure Storage Facilities. Roofs for barnyard runoff management and manure storage facilities are a roof and supporting structure constructed specifically to prevent rain and snow from contacting manure.

Livestock Exclusion from Woodlots. The exclusion of livestock from woodlots to protect the woodlots from grazing by fencing or other means.

Cattle Mounds. Cattle mounds are earthen mounds used in conjunction with feeding and dry lot operations and are intended to provide a dry and stable surface area for cattle.

Structural Urban Best Management Practices. These practices are source area measures, transport systems and end-of-pipe measures designed to control storm water runoff rates,

volumes and discharge quality. These practices will reduce the amount of pollutants carried in runoff and flows destructive to stream habitat. These measures include such practices as infiltration trenches, porous pavement, oil water separators, sediment chambers, sand filtration units, grassed swales, infiltration basins and detention/retention basins.

Land Acquisition - The purchase of land or the interest in land which is contributing or will contribute nonpoint source pollution or for the construction of an urban structural practice.

Well Abandonment - Chapters NR 811 and NR 812, Wisconsin Administrative Codes, require proper abandonment, by permanent filling of unused wells. *Eligibility criteria:* For any unused well in the watershed.

Wetland Restoration. The construction of berms or destruction of the function of tile lines or drainage ditches to create conditions suitable for wetland vegetation.

Land Easements. Easements are legally binding restrictions on land titles. Easements are purchased to provide permanent vegetative cover. Nonpoint source program funds may be used to purchase land easements in order to support specified best management practices. These practices, all of which involve the establishment of permanent vegetative cover, include:

- Shoreline Buffers: vegetative areas which minimize nonpoint source impacts and other direct impacts to streams;
- Critical Area Stabilization: stabilization efforts needed on sites that either erode at an excessive rate, or have high sediment delivery rates to surface water;
- Wetland Restoration: areas where wetlands are intentionally restored or enhanced in order to improve their ecological values, such as natural filters of surface water.

Easements may also be considered for protecting municipal wellheads if it can be established that vegetative cover will correct an existing groundwater quality threat.

Although easements are not considered a best management practice, they can help achieve desired levels of nonpoint source pollution control in specific conditions. Easements are used to support best management practices, enhance landowner cooperation and more accurately compensate landowners for loss or altered usage of property. The benefits of using easements in conjunction with a management practice are: 1) riparian easements can provide fish and wildlife habitat along with the pollutant reduction function; 2) easements are generally perpetual, so the protection is longer term than a management practice by itself; and 3) an easement may allow for limited public access (depending on the situation). However, the primary justification of an easement must be for water quality improvement. Easements should be considered in the following situations:

1. To exclude livestock from grazed wetlands or along eroding streambanks within the watershed. Easements are strongly recommended whenever:
   - there is any grazing of wetlands.
   - livestock density is so great that areas of unvegetated soil are within 60 feet of streams or intermittent streams.
   - streambanks are severely trampled and eroding and length is equal to critical criteria for streambank habitat.
   - channel erosion is exacerbated by livestock grazing, such that unvegetated streambanks are two feet or more in height.

2. When elimination of row cropping and the establishment of permanent vegetative cover will stabilize a critical area. Easements are strongly recommended whenever:
   - Row cropping is occurring within 60 feet or less of streams or intermittent streams.
   - Row cropping is being practiced on steep or eroding slopes.

3. To support eligible wetland restorations. Easements are strongly recommended for priority wetland restorations.

4. When a barnyard or animal feedlot is located within the flood plain and: a) a permanent easement is the least-cost alternative to provide adequate pollution reduction or b) a permanent easement provides a greater level of pollution reduction than on-site engineering options at a price that is cost-effective when compared to the level of pollution reduction and the price of the available engineering options. Easements are strongly recommended whenever:
   - Engineering options would require intensive management in order to continue to provide adequate pollution reduction.
   - Surrounding land use is largely agricultural, and it is anticipated that it will remain so for two decades or more.

Table 6-2. Maximum State Cost-Share Rates for Best Management Practices

BEST MANAGEMENT PRACTICE	STATE COST-SHARE RATE
Nutrient and Pesticide Management	50%
Pesticide Handling Spill Control Basins	70%
Livestock Exclusion from Woodlots	50%
Intensive Grazing Management	50% [1]
Manure Storage Facilities	70% and 50% [2]
Manure Storage Facility Abandonment	70%
Field Diversions and Terraces	70%
Grassed Waterways	70%
Critical Area Stabilization	70% [3]
Grade Stabilization Structures	70%
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70% [3]
Shoreline Buffers	70% [3]
Wetland Restoration	70% [3]
Barnyard Runoff Management	70%
Barnyard Abandonment or Relocation	70%
Roofs for Barnyard Runoff Management and Manure Storage Facilities	70%
Structural Urban BMPs	70% [4]
Milking Center Waste Control	70%
Cattle Mounds	70%
Land Acquisition	70% 5
Lake Sediment Treatment	70%
Well Abandonment	70%

1 To a maximum of $2,000 per watering system

2 Manure storage is cost-shared at 70% for the first $20,000 of cost and at 50% for the remaining cost, not to exceed $35,000.

3 Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See Chapter Two for an explanation of where easements may apply.

4 The maximum cost-share rate for land acquisition, storm sewer rerouting, and removal of structures necessary to install structural urban BMPs is 50%

5 Cost-sharing is available to acquire land for the construction of an urban structural practice or to acquire land which is contributing or will contribute nonpoint source pollution.

Interim Best Management Practices

Under some circumstances, practices may be recommended that are not included on the BMP list. Administrative Rule NR 120.15 provides for alternative practices where necessary to meet the water resource objectives identified in the watershed plan. The Department may identify in the nonpoint source grant agreement the design criteria and standards and specifications where appropriate, cost share conditions, and cost share rates for each alternative best management practice.

Practices Not Cost-Shared

Practices not cost-shared, but which shall be included on the cost share agreement if necessary to control the nonpoint sources, are listed below (as listed in NR 120.17):

- That portion of a practice to be funded through other programs.
- Practices previously installed and necessary to support cost-shared practices.
- Changes in crop rotations.
- Changes in location of unconfined manure stacks involving no capital cost.
- Non-stationary manure spreading equipment.
- Practices needed for land use changes during the cost-share agreement period.
- Other practices necessary to achieve the objectives of the watershed project.
- Minimum levels of street sweeping and leaf collecting.
- Operation and maintenance of cost-shared BMPs.
- Practices already installed, with the exception of repairs to the practices which were rendered ineffective due to circumstances beyond the control of the landowner.
- Practices required to control sources which were adequately controlled at the time the cost-share agreement was signed, but which are producing an increased amount of pollutant loading to the surface or groundwater, counter to the water resource objectives of the watershed plan, due to the landowner's change in land management.
- Practices whose purpose is to accelerate or increase drainage of land or wetlands, except where drainage is required as a component of a BMP.
- Practices normally and routinely used in growing crops and required for growing crops or feeding livestock.
- Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of Wis. Statutes, except urban nonpoint sources that must be controlled to obtain a WPDES permit if control

of the sources is identified in the priority watershed plan and the sources are not required to obtain coverage under a WPDES stormwater permit for discharges associated with an industrial activity, as defined under ch. NR 216.

- Livestock operations which: have applied for and are eligible for WPDES permits, have been issued WPDES permits, have greater than 1,000 animal units, or are greater than 1,000 animal units and have been issued a notice of discharge.
- Septic system controls or maintenance.
- Dredging activities.
- Silviculture activities except as necessary for site stabilization.
- Practices to control spills from commercial bulk storage of pesticides, fertilizers, petroleum and similar materials.
- Activities and structures intended solely for flood control.
- Activities required as part of a license for a solid waste management site.
- Activities funded through state or federal grants for wastewater treatment plants.
- Active mining activities.
- Pollution control measures needed during building and utility construction and stormwater management practices for new developments.
- Pollution control measures needed during construction of highways and bridges.
- Other practices or activities determined by DNR not to meet the objectives of the program.

Cost-Share Agreement Administration

Cost-share funding is available to landowners and local units of government for a percent of the costs of installing BMPs to meet project objectives. This funding is distributed to landowners by the LCD from a Nonpoint Source grant provided by the DNR. The LCD receives additional grant money from the DNR to support its staff and other administrative responsibilities. Cost-share agreements are binding contracts between landowners and the LCD. To qualify for cost-sharing funds, landowners must meet eligibility criteria defined in the previous chapter. Cost-share agreements (CSAs) may be signed within ten years after formal approval of the watershed plan and are filed as part of the property deed. Agreements may be amended throughout the ten-year project period. Extensions of the sign-up period must be initiated by the LCD and approved in writing by the DNR.

Practices included on cost-share agreements must be installed within the schedule agreed to on the cost-share agreement. Practices must be maintained for a minimum of ten years from the date of installing the final practice listed within the cost-share agreement.

Local, state, or federal permits may be needed prior to installation of some BMPs. Areas in which a permit is generally required include zoned wetlands and the shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the watershed project or not. The cost-share recipient is responsible for acquiring the needed permits prior to installation of practices.

Local units of government are responsible for enforcing compliance of cost-share agreements to which they are a party. Where DNR serves as party to an agreement with a unit of government, the DNR will take responsibility for monitoring compliance. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan for the practice for the appropriate length of time.

Cost Containment

Chapter NR 120 requires that cost containment procedures be identified in this plan to control the costs of installing BMPs. The cost containment procedure to be used by St. Croix and Pierce Counties is described below. The bidding procedure and average cost and flat rate lists can be obtained from the county LCD.

Cost-share payments will be based on actual installation costs. If actual installation costs exceed the amount of cost-sharing determined by the bidding procedure, the amount paid to the grantee may be increased with approval from the Land Conservation Committee. Appropriate documentation regarding the need for changes will be submitted to the DNR. The cost containment procedure to be used is described in the County's bidding procedure. Copies of the bidding procedure can be obtained from the county LWCD. If the procedure changes, the DNR should be notified.

Rural Implementation Schedule

Landowner Contact Schedule

- During the first 6 months of the implementation period, all landowners with sites defined as "eligible" or "critical" nonpoint sources will receive correspondence from the county LCD explaining the project and how they can become involved.

- County LCD staff will continue to make contacts with eligible landowners until the landowners have made a definite decision regarding participation in the program.

- County staff will contact all eligible landowners not signing cost-share agreements by personal letter six months prior to the end of the cost-share sign-up period to encourage participation.

Sediment Delivery Inventory Completion Schedule

- Approximately 50 percent of the watershed's upland fields remain to be inventoried as of plan approval. Each year, the LCD staff will complete the inventory on 25 percent of the remaining uplands. At this rate, the inventory will be completed within four years of plan approval.

- As part of the annual inventory work, LCD staff expect to identify fields that meet the criteria for critical sites. The LCD staff propose to adhere to the following cycle each year and report to the DNR as explained in the critical site notification process below.

Critical Site Notification Process

Project staff will begin to contact the *highest-ranked critical sites* for verification immediately after plan approval, and report these highest-ranked critical sites to the Department within six-months. *Highest-ranked critical sites* are those that contribute the top 25 percent of the inventoried critical site load.

Each site identified as a critical site during the project inventory must be revisited to verify critical site status. At the time of a critical site verification, all inventory work on that farm must be completed, so that all critical sites are identifed, and the landowner receives only one notice of critical sites.

Within six month of plan approval, the county must report the highest-ranked critical sites to the appropriate DNR Regional office. The plan approval date is the same as the date on which the project receives the Nonpoint Source grant. The department may allow up to three 90-day extensions beyond the six-month period to allow the counties sufficient time to verify that sites meet the critical site criteria. If an extension is needed, the county must make a request to DNR in writing, including the reasons for the extension.

Following receipt of the critical sites verification report from the county, the DNR has 60 days to send critical site notification letters to the landowners.

Landowners interested in receiving cost-share assistance for the installation of Best Management Practices will need to sign a cost-share agreement with the St. Croix or Pierce County LWCD.

The notification letters will be sent out by DNR regional staff and will include the following information:

- The 36-month period in which landowners are eligible for the full level of state cost-sharing, after which the cost-share rate decreases by 50 percent.

- The potential consequences that a landowner faces if no action is taken. The DNR has the authority to issue a WPDES permit following a Notice of Discharge for critical sites caused by animal waste (Wis. Admin. Code Ch. NR 243). For all other critical sites, DNR

has the authority to issue an order requiring the landowner to take necessary actions to protect water quality (Sections 281.20 (1)(3) or (5), Wis. Stats.)

- The right to appeal the designation of a critical site through a written request to the County Land Conservation Committee within 60 days of receipt of the notification letter. See also "Appeal Process" section.

At the time of notification, critical site landowners have 3 years to sign a cost-share agreement at the rates given in NR 120. After 3 years the available cost-share rates are cut in half.

After completing the first critical sites notification cycle, as described above, the annual cycle for critical site notification is described in NR 120.09(1), and will be as follows:

- April-July: Conduct site visits and verification work.
- August 1: Send report to DNR implementation coordinator.
- November 1: DNR sends notification to critical site landowners.

The county LWCD staff will complete the verification of remaining critical sites at a rate of 25% per year. Critical site notification will be completed by December 2003.

Critical Site Appeals Process

The owner or operator of a site designated as a critical site may appeal the critical site designation to the Land Conservation Committee (LCC) of the county in which the site is located. If the site is located in more than one county, the appeal goes to the LCC of the county which contains the largest portion of the site. The site owner or operator (appellant) must write to the LCC and ask for an informal hearing. The appeal request must be received by the LCC within 60 days of the day that the notification letter was received by the owner or operator.

After receiving an appeal request, the Land Conservation Committee:

- provides the appellant with a hearing and gives reasonable notice of the hearing to the appellant, the DNR and the DATCP
- conducts an informal hearing in a place that is convenient for the appellant.

The appellant and project staff will present information about the site so that LCC members may make a decision. Representatives of DNR and DATCP may attend the hearing.

Although most *formal* hearings follow the procedures outlined in Chapter 68.11(2), Wis. Stats., the Critical Sites appeals hearings are explicitly exempted from the procedures of Chapter 68.11.

The DNR is *required* to submit a report and recommendation to the LCC within 60 days after the hearing. The DATCP has the *option* to submit a report and recommendation within 60 days.

The LCC must provide a decision, in writing, within 45 days of a) receiving either the DNR and DATCP reports and recommendations, b) notification by the DNR and DATCP that no report or recommendations will be submitted, or c) at the conclusion of the 60-day period following the hearing.

The LCC may support or overturn the designation of the site as a critical site. The LCC must consider whether or not the critical site designation is consistent with the critical site criteria established in the project's priority watershed plan, and whether governmental representatives seriously erred in their verification of the site conditions or management of the site. Loss of profit is not grounds for support of an appeal. Violations by, or appeals granted to, other appellants do not justify support of an appeal.

The owner or operator of a site designated as a critical site may request a review of the LCC decision by filing a written request with the Land and Water Conservation Board within 60 days after receiving the decision of the county LCC.

The owner or operator of a site designated as a critical site may request a contested case hearing under Chapter 227 to review the decision of the Land and Water Conservation Board by filing a written request with the DNR within 60 days after receiving an adverse decision by the LWCB.

Rural Cost-Share Budget and Staffing Needs

Costs of Installing BMPs

The quantity and type of management practices that are required to meet the water quality objectives of this project are listed in table 4-3. The capital cost of installing the BMPs are listed for a 100 percent landowner participation rate. Units of measurement and cost per unit for the various BMPs are also included.

The capital cost of installing the Best Management Practices is approximately $2.9 million, assuming 100 percent participation. At 75 percent participation the capital cost is $2.2 million (Table 6-3).

- State funds necessary to cost-share this level of control would be approximately $1.6 million.

- The local share provided by landowners and other cost-share recipients would be approximately $640,000.

Easement Costs

Chapter Five identifies where nonpoint source program funds can be used to purchase easements. The estimated cost of purchasing easements on eligible lands is shown in table 6-3. At 75 percent participation, the estimated purchase price of easements on eligible lands would be $100,000. Easements are funded at the 100 percent and will be purchased by St. Croix and Pierce Counties and/or the State of Wisconsin.

Table 6-3. Estimated Rural Cost-Share Budget Needed to Meet Water Quality Goals.
(page 1 of 2)

BMP	number	cost/ unit ($)	total cost	seventy-five percent participation			
				state share	local share	hrs/ unit	total hours
Upland Control							
Change in Crop Rotation	14,000 ac	NA	0	0	0	0.1	1,050
Contour Cropping	2,000 ac	9	18,000	13,500	0	0.3	450
Contour Strip Cropping	8,500 ac	13.5	114,750	86,063	0	0.5	3,188
High Residue Management (2)	10,000 ac	18.5	185,000	138,750	0	0.1	750
Cropland Protection Cover (2) (Green Manure)	1,500 ac	25	37,500	28,125	0	0	45
Intensive Grazing Management (Rotational Grazing)	15 ea	4,000	60,000	22,500	22,500	15	169
Critical Area Stabilization	150 ac	1,500	225,000	118,125	50,625	0.5	56
Grass Waterways	200 ac	3,000	600,000	315,000	135,000	22	3,300
Field Diversions and Terraces	10,000 ft	3	30,000	15,750	6,750	0	300
Grade Stabilization	40 ea	4,000	160,000	84,000	36,000	50	1,500
Agricultural Sediment Basin	10 ea	10,000	100,000	52,500	22,500	90	675
Shoreline Buffers	150 ac	400	60,000	31,500	13,500	2	225
Nutrient Management (2)	40,000 ac	6	240,000	90,000	90,000	0.1	3,000
Nutrient and Pest Management (2)	10,000 ac	10	100,000	37,500	37,500	0.1	750
Spill Control Basin	6 ea	10,000	60,000	31,500	13,500	40	180
Wetland Restoration	30 ea	2,000	60,000	31,500	13,500	34	765
Livestock Exclusion, Woods	33,000 ft	1	33,000	12,375	12,375	0	248
Upland subtotal			**2,083,250**	**1,108,688**	**453,750**		**16,651**

BMP	number	cost/ unit ($)	total cost	seventy-five percent participation			
				state share	local share	hrs/ unit	total hours
Barnyard Runoff Control and Manure Storage							
Complete System	5 ea	25,000	125,000	65,625	28,125	95	356
Roof Gutters	20 ea	1,500	30,000	15,750	6,750	2	30
Clean Water Diversion	20 ea	2,500	50,000	26,250	11,250	21	315
Roofs	0 ea	25,000	0	0	0	0	0
Barnyard Relocation	3 ea	16,500	49,500	25,988	11,138	100	225
Manure Storage Facility (3)	5 ea	40,000	200,000	90,000	60,000	100	375
Manure Storage Facility Abandonment	5 ea	10,000	50,000	26,250	11,250	20	75
Cattle Mounds	6 ea	1,500	9,000	4,725	2,025	15	68
Milking Center Waste Control	5 ea	7,000	35,000	18,375	7,875	20	75
Barnyard subtotal			**548,500**	**272,963**	**138,413**		**1,519**
Streambank Erosion Control							
Shape and Seeding	3,100 ft	10	31,000	16,275	6,975	0.1	233
Fencing	1,500 ft	1	1,500	788	338	0.1	68
Rock Riprap	1,200 ft	30	36,000	18,900	8,100	0.2	180
Bio-Bank Stabilization	1,000 ft	25	25,000	13,125	5,625	0.5	375
Crossing	10 ea	2,000	20,000	10,500	4,500	18	135
Remote Watering Systems	5 ea	2,000	10,000	5,250	2,250	15	56
Streambank subtotal			**123,500**	**64,838**	**27,788**		**1,047**
Miscellaneous							
Well Abandonment	200 ea	500	100,000	52,500	22,500	20	3,000
Subtotal			**2,855,250**	**1,498,989**	**642,451**		
Easements	100 ac	1,000	100,000	100,000	0	8	600
Total			**2,955,250**	**1,598,989**	**642,451**		**22,817**

(1) Local share consists of labor and equipment costs. Also see flat rates in table 4-1.
(2) Nutrient and Pest Management is cost-shared per acre over a three year period. Number of acres shown represents three times the eligible acres.
(3) Manure storage is cost-shared at 70% for the first $20,000 of cost and at 50% for the remaining cost, not to exceed $35,000.

Source: Wisconsin DNR, DATCP, and St. Croix and Pierce Counties

Staff Needs and Costs

Table 6-4 lists the total estimated staff needed to implement the project assuming a 75 percent level of participation by eligible landowners. Approximately 69,270 staff hours are required to implement this plan. Currently, 2.9 positions are being funded on the Kinnickinnic River Watershed Project. The LWCD and agencies will determine the need for additional staff based on an annual workload analysis.

The estimated cost for staff at the 75 percent participation rate is $1.7 million (Table 6-9). In the past, state Local Assistance Grants have fully supported staff costs. It is probable that a portion of these costs will be paid for locally in the future. For example, the draft financing plan approved by the Land and Water Conservation Board recommends a 30% local share for staff costs by the year 2004.

Table 6-4. Estimated St. Croix and Pierce County Staff Needs to Meet Water Quality Goals in the Watershed for Ten Years of Project Implementation.

Activity	Staff Hours	
	St. Croix Co.	Pierce Co.
Project and Financial Management	2,320	1,140
Information and Education Program	4,640	2,290
Pre-Contact Office Inventory; Landowner Contracts and Progress Tracking	6,970	3,430
Conservation Planning and CSA Development	9,280	4,570
Plan Revisions and Monitoring	2,320	1,140
Practice Design and Installation	18,570	9,140
Upland Sediment Control	7,428	3,656
Animal Waste Management	7,428	3,656
Streambank Erosion Control	1,857	914
Easements	1,857	914
Training	2,320	1,140
Total:	46,420	22,850
Estimated Staff Required per year	3.33	1.23
Hours	5,199	2,559

Source: DNR; DATCP and the St. Croix and Pierce County LWCDs

Urban Implementation Program

The following discussion provides guidance on how the urban nonpoint source control program will be implemented. The term "urban" indicates that these activities will be undertaken by local units of government in developed or growth areas.

Core or "Basic" Community-Wide Management Program

The "basic" elements of the urban management program can be readily adopted by local units of government without further technical studies or substantial funding. Adopting a basic community-wide program is the first step in the implementation process. As such, communities will need to agree within the first three years of the project to implement the "basic" program. *This condition needs to be met in order to receive technical and financial assistance through the priority watershed project.* It does not apply to those instances where the municipality acts as a grantor, passing cost-share funds through to private landowners. Individual landowners within the municipality may receive funds before the municipality has agreed to conduct the "basic" program.

Elements of the "basic" program include:

- Confirm in writing an authorized representative for the local unit of government, who will continue to serve on the Kinnickinnic River PWS Steering Committee during the implementation period.
- Develop and implement a construction erosion control ordinance as outlined in the recommendations in Chapter Five, including enforcement of the erosion control provisions of the Uniform Dwelling Code.
- Promote on-site management measures as part of new developments that have storm water quality benefits. Two primary measures are reduction of impervious surfaces and promotion of on-site infiltration of storm water.
- Indicate an intention to pursue a community-wide storm water management plan that incorporates water quality protection.
- Develop and implement a community specific program of urban housekeeping practices to reduce urban nonpoint source pollution. The program can include a variety of activities and emphasize information and education efforts. Other measures that should be considered include evaluation of street sweeping practices for effectiveness in reducing pollutants reaching lakes and rivers, regulating pet wastes, changing the timing and scheduling of leaf collection, or other strategies to reduce polluted runoff.

Segmented or "Site-specific" Elements of the Urban Management Program

The "site-specific" elements of the urban nonpoint source program are those generally requiring detailed investigations prior to implementation. These may include construction of storm water control structures, source control practices such as filter strips or infiltration devices at parking

lots, other practices designed to reduce thermal pollution, and the development of wellhead protection plans. Detailed engineering studies will be required for some of these practices. Communities are eligible to receive cost sharing for these elements provided their community-wide program is being developed and implemented. Cost- sharing will be limited to site-specific proposals initiated within the implementation period of the project.

Implementing this portion of the urban management program will require local units of government to budget expenditures over the course of several years. Best management practices that can be implemented under this portion of the program include infiltration and filtration devices, detention ponds, and other structural means for reducing pollution. Site specific assessments should include evaluation of cost effectiveness and identification of ways to maximize effective perviousness. Wellhead protection planning, storm water management planning and storm water ordinance development are also eligible for funding.

Eligible components of "site-specific" proposals include:

- Conducting detailed engineering studies to determine the best means to implement community specific nonpoint source control measures in existing developed areas.
- Designing and installing structural best management practices for existing urban areas.
- Developing management studies for planned future urban growth, with a focus on minimizing imperviousness and maximizing on-site infiltration. These studies will identify the types and locations of structural urban best management practices.
- Adopting and enforcing a comprehensive storm water management ordinance encompassing current and planned future development.
- Adopting and implementing wellhead protection plans.
- Conducting as needed, detailed financing and implementation studies which determine the means to pay for administering an urban nonpoint program in each community.

Partner Roles and Responsibilities for the Urban Program

Local Units of Government

Eligible units of government, including cities, villages, towns and lake districts, can apply for local assistance and nonpoint source grants directly with the Department of Natural Resources. Local assistance grants support staff for planning and administrative services, such as:

- engineering feasibility studies,
- storm water or well head protection planning
- development, administration and enforcement of construction site erosion or storm water management ordinances
- information and education programs that support water quality protection
- technical assistance to landowners

To carry out these activities, local units of government must:

- Prepare and submit annual work plans for staff and activities.
- Apply for local assistance grants from DNR to support "basic" activities.
- Submit information needed for project evaluation to DNR, as discussed in Chapter 9.
- Participate in the annual watershed project review meeting.

Nonpoint source grants support design, and installation of best management practices. The local unit of government may develop cost-share agreements with individual landowners for the installation of BMPs. The individual landowner will pay the local portion of the installation cost, consistent with the cost-share guidelines. The municipality may also apply directly for nonpoint source grants to design and install BMPs. Local governmental units will provide the local share of the design and installation of BMPs and the operation and maintenance costs.

For cost-shared practices, the municipality is responsible for the following:

- Design, contract for the design, or approve the design of best management practices and verify proper practice installation, as specified in NR 120.14(22). Involve the DNR in pre-design and pre-construction conferences as outlined in NR 120.
- Submit contracts for cost shared activities to the DNR for review, and if contracts exceed $10,000, for review and approval of the DNR.
- Monitor the practice for compliance with provisions of the cost-share agreement.

Department of Natural Resources

The Department will provide administrative and financial support to local governmental units that apply for grants through the urban portion of the program. Urban grants will be awarded to local units of government to fulfill the goals and objectives outlined in Chapter Five. Several nonpoint source specialists are housed in the West Central Region and the Lower Chippewa River Basin Geographic Management Unit (GMU) to provide guidance to towns, cities, villages and lake districts in interpreting and implementing this plan. The DNR maintains a staff of storm water management engineers and technical specialists who are available to provide guidance and plan review directly to municipal staff. The DNR will also provide assistance in development of ordinances and other project implementation activities, review designs for urban BMPs, and approve storm water management plans.

University of Wisconsin-Extension

County Extension staff and the Extension Basin Educator for the Lower St. Croix River Basin may assist in the Kinnickinnic River Watershed project. These staff assist with educational outreach planning, citizen surveys and workshops. The University sponsors training courses in construction site erosion control, storm water management and other water quality areas. DNR provides financial assistance to local units of government for sending staff and administrators to appropriate training sessions.

St. Croix and Pierce County Land Conservation Departments

The LWCDs can assist in the urban and developing areas by:

- Helping to coordinate activities of cities, towns and villages
- Assisting local governmental units in the development of construction site erosion control and storm water management ordinances.
- Developing and implementing the recommended information and education program outlined in Chapter Eight of this plan.
- Providing assistance in the development of grant applications, cost-share agreements, project schedules, and progress tracking.

BMPs Eligible for Cost-Sharing and Cost-Share Rates

Structural urban best management practices are constructed measures designed to control storm water runoff rates, volumes and discharge quality. These practices control the amount of pollutants carried in runoff and the flows that can be destructive to stream habitat. They include, but are not limited to, such practices as infiltration devices, oil/water separators, sediment chambers, sand filtration units, grassed swales, and detention/retention basins. These practices are identified in NR 120, and are the most effective activities available to reduce urban nonpoint sources of pollution. Eligible practices and cost-share rates for urban practices are shown in Table 6-5. Actual cost share rates will not exceed those shown, and will depend upon availability of state funds.

High Efficiency Street Sweeping

Under certain conditions, an accelerated "high efficiency" street sweeping program *may* be eligible for cost sharing as an urban best management practice. Eligible areas are existing urban areas identified as contributing high sediment or pollutant loads to sensitive surface waters, and where other structural practices such as detention basins or infiltration areas are not or cannot cost effectively be installed. Base levels of street sweeping, generally weekly or biweekly brushing, are not eligible for cost sharing. Accelerated street sweeping practices that might be cost shared include:

- Direct and indirect costs associated with street sweeping schedules and methods that include frequent brushing and vacuuming to increase the collection of fine particulate matter
- Acquisition or contracting for the use of approved high efficiency street sweepers
- Development and implementation of alternate side parking ordinances that make street sweeping more effective
- Information and education activities to support this practice

Cost sharing at 50% is available for a five year period. For an additional five years, the municipality must maintain, at its own expense, the accelerated street sweeping practices for which it received cost sharing. The municipality must also commit to implementing all other

recommended "basic" community-wide practices. Interested communities must develop a schedule and plan for base and accelerated street sweeping which must be approved by the DNR.

Table 6-5. Maximum State Cost-Share Rates for Urban Best Management Practices (rates may be less, depending on the availability of funds).

BEST MANAGEMENT PRACTICE	STATE COST-SHARE RATE (maximums)
Critical Area Stabilization	70%[1]
Grade Stabilization Structures	70%
Streambank Stabilization	70%
Shoreline Buffers	70%[1]
Wetland Restoration	70%[1]
Structural Urban Practices	70%[2,3]
High Efficiency Street Sweeping	50%, 5 years only[4]

1 Easements may be used in conjunction with these practices.

2 Applies only to practices to control pollutants from existing urban surfaces. Existing urban surfaces are considered to be those in existence prior to the date the DNR approves this watershed plan. Eligible land uses include commercial and industrial, parking lots, streets and other land uses resulting in polluted runoff. Modifications to existing ponds to control runoff from areas that have a portion of non- significant land uses may also be eligible, but a feasibility study would need to determine this.

3 Cost-share grants up to 50% can be made for associated costs including land acquisition, storm sewer re-routing and structure removal.

4 This is an interim best management practice not listed in NR 120, of the Wisconsin Administrative Code. Criteria for use of this practice must be developed and approved as described in this chapter.

Design Criteria and Performance Standards for Urban Practices

Design and installation of best management practices must meet the conditions listed in NR 120. Practice standards and specifications for critical area stabilization, grade stabilization structures, streambank stabilization, shoreline buffers and wetland restoration can be found in NR 120 and the Natural Resource Conservation Service's "Field Office Technical Guide".

NR 120.14(22) requires that the DNR participate in the process of selecting urban structural BMPs for site-specific application. *The DNR role includes participation in a pre-design process, reviewing preliminary practice designs, and review and approval of final practice designs.*

Performance standards included in the City of River Falls draft storm water ordinance should be used as a guide in designing practices. These standards are compatible with standards currently in the state draft storm water model ordinance. The following are taken from the City of River Falls draft storm water ordinance:

- Natural topography and land cover features such as natural swales, natural depressions, native soil infiltrating capacity and natural groundwater recharge areas shall be preserved and used, to the extent possible.

- Water quality improvements are required for all developments unless a development is a part of a City-approved regional pond drainage area.

- When the effective imperviousness of the contributing watershed to a pond or discharge point exceeds 15 percent, thermal mitigation elements may be required as described in the City of River Falls Water Management Plan. Mitigation may include land use controls to reduce levels of imperviousness, on-site and structural BMPs to maximize infiltration and minimize thermal gain of the river as a result of receiving storm water discharges, monitoring to quantify on-site conditions or impacts, or a combination of activities.

- Wet detention ponds in existing and planned urban areas should be designed to control 85 percent of the incoming suspended sediment load, as described in the City of River Falls Water Management Plan, pages 46 - 47. This would result in a 90% non-exceedance frequency for the chronic toxicity criteria for copper (24 micrograms/liter).

- Pretreatment measures such as a sediment trap, a wet detention pond, or a grass filter strip should be included in the practice design for infiltration devices. Providing pretreatment for these devices will greatly reduce the frequency of clogging and maintain infiltration for longer periods of time before maintenance is necessary. Water quality monitoring that is sufficient to identify threats to groundwater should be conducted at the infiltration basin inflow.

- Filtration devices should be designed off-line to control the first half-inch of runoff from contributing areas. These should be located to control runoff primarily from the significant land uses for existing development.

- Infiltration devices in existing urban areas should contribute to reducing thermal impacts to streams, and moderating water level fluctuations. Infiltration devices should maintain peak flows at pre-development levels for the 2-year, 24-hour storm event.

Easements and Land Acquisition

Easements may be used to support wetland restoration, critical area stabilization and shoreline buffers in urban areas in order to reduce the water quality impacts of storm water runoff. Use of easements to support practices must be reviewed on a case-by-case basis by the DNR. The same general rules set forth for the use of easements in rural areas, as described earlier in this chapter, also apply to urban stream reaches.

An eligible unit of government may obtain a grant to acquire land or an interest in land if (a) the land is used for construction of an urban structural practice, or (b) the land is contributing or will

contribute nonpoint source pollution. The requirements are listed in NR 120.186. The maximum allowable state cost-share rate for acquisition of property is 50% of the acquisition cost of the property. The maximum allowable state cost-share rate for appraisals for the acquisition of property is 100% of the cost of the appraisal.

Urban Cost-Share Budget and Staffing Needs

Local Staff Assistance Funding Needs

Communities may apply for local assistance grants for staff to implement the "basic" community-wide management program. Local assistance grants must identify the hours and assigned activities for all staff. Storm water management planning may require a contract and the use of consultants, as well as staff time to manage the plan and coordinate activities between local governmental units.

Table 6-6 shows the types of local management activities that are funded through local assistance grants. These grants may be used to support additional staff hired or contracted for by local units of government. Support for most activities is cost-shared at 50-100%, since local governments cover only certain staff support costs. These cost-share rates are maximums. *Many of these activities may only be cost-shared at a 70% rate or less, due to the lack of availability of funds.*

It is highly recommended that local governmental units within identified growth areas hire a staff person to handle coordination of construction site erosion control and storm water activities. This position could be highly effective in assuring the consistent development and implementation of storm water and erosion control ordinances. Townships should work together to apply for a grant to support this position.

There are an estimated 26,200 staff hours needed to achieve project goals, with 9,120 eligible for local assistance grant funding, and 17,080 supported locally. It is estimated that $160,000 in state funds and $310,000 in local funds will be needed for staff to implement the urban plan recommendations. Table 6-7 indicates specific staffing needs, on an hourly basis, to achieve the urban water quality goals.

Table 6-6. Urban Activities Eligible for State Local Assistance Grants.

ACTIVITY	STATE COST SHARE RATES (maximums)
Development of Construction Erosion Control Ordinances	100%
Development of Storm Water Management Plans	100%
Development of Storm Water Management Ordinances	100%
Development of Wellhead Protection Plans	100%
Engineering Feasibility Studies for Existing Urban Areas	100%
Design and Engineering for Structural Best Management Practices for Existing Urban Areas[1]	100%
Staff for Enforcing Construction Erosion and Storm Water Management Ordinances[2,3]	50%
Additional Staff Needed for Accelerated Street Sweeping[4]	50%, 5 years only[4]
Development of Financing and Administration Strategies for Storm water Management[1]	100%
Information and Education Activities	100%

1 Funding available only for components dealing with water quality.

2 Funding limited to three years. Level of staffing based on a work plan submitted by local units of government and approved by the DNR.

3 DNR covers only that portion of the local staff support that cannot be met through local permit fees. Formula used is total cost of enforcement minus fees collected up to 50% of the total costs of enforcement. The intent is that a community will develop a fee structure so as to cover all costs by the time DNR funding ends.

4 This is an interim best management practice not listed in NR 120, of the Wisconsin Administrative Code. Criteria for use of this practice must be developed and approved as described earlier in this chapter.

Note: *Many of these activities may only be cost-shared at a 70% rate or less, due to the availability of funds.*

Table 6-7. Estimated Urban Staffing Needs for Municipalities

ACTIVITY	ANNUAL HOURS	TOTAL ANNUAL HOURS	TOTAL PROJECT HOURS	HOURS ELIGIBLE FOR GRANT FUNDING
Plan reviews for storm water and erosion control measures	1040 hrs/yr, for urban growth areas surrounding River Falls	1,040	10,400	3,120
Erosion Control Inspection	800 hrs/yr (River Falls) 100 hrs/yr (Hammond, Roberts) 400 hrs/yr (Prescott)	1,400	14,000	4,200
Conduct Training, Seminars, Public Meetings & Presentations	40 hours/yr (based on two 20 hour presentations/yr.)	40	400	400
Administration	80 hrs/yr (River Falls) 20 hrs/yr (Hammond, Roberts, Prescott)	140	1,400	1,400
TOTAL		2,620	26,200	9,120

Source: DNR

Estimated Costs of Urban Practices

Storm water Management BMPs

Existing Urban Areas: Costs of structural BMPs for storm water management on *existing* urban areas are based on addition of structures to control 10 percent of existing urban pollutant loads, from areas yielding high pollutant loads, such as commercial and industrial development. There are currently about 5,391 acres in urban areas of the watershed, and with an average of 23% imperviousness, there are about 1,240 existing impervious acres. With a 10% reduction goal, 124 impervious acres must be treated. The cost of treating each impervious acre is estimated to average $17,500, and total treatment costs will be about $2,170,000. The state share at a 70% cost share rate is estimated to be $1,519,000, and the local share, $651,000 (Table 6-8). *See Appendix D for a detailed discussion of the cost basis used to develop these numbers.*

To be eligible for cost sharing, communities must implement the core elements of an urban program. This includes indicating an intention to pursue a community-wide storm water management plan that incorporates water quality protection.

New Development: Costs of structural BMPs for storm water management on *newly developing* urban areas are based on addition of structures to control 60 percent of new urban pollutant loads.

There an estimated 2,191 acres of new development that will occur in the watershed by 2017, and with an average imperviousness of 23%, there will be about 504 acres of new impervious surface. With a 60% reduction goal, 302 impervious acres must be treated. The cost of treating each impervious acre is estimated to average $10,000, and total treatment costs will be about $3,020,000. **The $3,020,000 would not be cost share eligible.** The "pass-on" cost from t he developer to the parcels would be $10,000 per acre, or $3,300 per lot. This is not necessarily a new cost, for the City has existing ordinances that already require storm water treatment. See Appendix D for a detailed discussion of the cost basis used to develop these numbers.

Storm water Management Plans and Ordinances

Storm water management problems and needs are best addressed through preparation of comprehensive storm water management plans, including performance standards for storm water management measures for all land development activities. Storm water management planning can be funded through this program for existing and future development. Storm water management ordinances and appropriate enforcement mechanisms manage the long-term, post-construction storm water discharges from land development activities.

If a community has not undertaken storm water planning, a storm water management ordinance sets forth generic storm water management standards. The DNR has developed a state model storm water ordinance which is currently in draft form, and is available to communities.

The City of River Falls adopted the "City of River Falls Water Management Plan" in 1995. A draft Storm water ordinance awaits final development and adoption. A Storm water Utility was adopted and implemented in 1998.

Storm water planning is highly recommended for the communities of Hammond, Roberts and Prescott. There will be an estimated 7,500 future urban acres in the watershed. Of these, 4,800 acres are in the City of River Falls, and covered under the City's Water Management Plan . The remaining 2,700 anticipated urban acres will need storm water planning. With an average cost of $10 per acre, storm water planning costs are estimated at $27,000. Ordinance development costs are estimated to be $10,000 for each of the three communities, for a total of $30,000 (Table 6-8).

Construction Site Erosion Control Ordinance Development

Developing and enforcing a construction site erosion control ordinance consistent with the state model ordinance is a required core activity for grant eligibility. Administrative procedures and staff needs to ensure enforcement must also be identified. Costs for developing and implementing erosion control ordinances are estimated to be $10,000 per community. The maximum allowable cost share rate is 100%, but due to program budget constraints, the rate will most likely be 70%. The state share is estimated at $21,000, and the local share at $9,000 (Table 6-8).

Construction Site BMPs

There are an estimated 110 acres under construction annually. An annual cost of $27,400 for BMPs is estimated, based on an average cost of $250 per acre. Total BMP costs for the life of the project are estimated at $548,000 (Table 6-8). These costs are borne by the developer.

Wellhead Protection

Development of wellhead protection plans is highly recommended for the communities of Roberts and River Falls. Wellhead protection planning activities for new or yet to be constructed wells are not eligible for funding through the watershed project. Wellhead protection planning for existing municipal wells is eligible for cost sharing, for those that develop contracts with the DNR for completing wellhead protection plans. Costs of developing wellhead protection plans that meet criteria described in Chapter Five, for Roberts and River Falls is estimated to be $60,000. The local and state shares would each be $30,000 (Table 6-8).

Urban Cost-Share Budget

Table 6-8 summarizes the estimated cost of implementing the urban portion of the Kinnickinnic River Priority Watershed Project, to attain the water quality goals. The total urban project cost is estimated to be $3.5 million. The state share is $1.2 million, and the local share, $2.3 million.

Table 6-8. Estimated Urban Costs and Cost-Share Budget Needed To Meet Water Quality Goals.

PROJECT ELEMENT	ANTICIPATED COST SHARE RATE	STATE SHARE	LOCAL SHARE	TOTAL COST
Demonstration Practices[1]	70%	$11,900	$5,100	$17,000
Storm water Management BMPs - Developed Urban Areas	70%	$1,519,000	$651,000	$2,170,000
Storm water Management BMPs - Planned Urban Areas	0%	$0	$3,020,000	$3,020,000
Storm water Planning and Ordinance Dev. - River Falls[1]	70%	$31,270	$13,400	$44,670
Storm water Planning - Hammond, Roberts, Prescott	70%	$18,900	$8,100	$27,000
Storm water Ordinance Dev. - Hammond, Roberts, Prescott	70%	$21,000	$9,000	$30,000
Thermal monitoring and Modeling River Falls[1]	100%	$33,845	$0	$33,845
Construction Site Erosion Control Ordinance Development [2]	70%	$21,000	$9,000	$30,000
Construction Site BMPs	0%	$0	$548,000	$548,000
Wellhead Protection Planning	50%	$30,000	$30,000	$60,000
SUBTOTAL		$1,686,915	$4,293,600	$5,980,515
Estimated Staffing(see table 4-8)				
Urban Staffing		$160,000	$310,000	$470,000
TOTAL		$1,846,915	$4,603,600	$6,450,515

[1] Funds already expended during planning phase as part of storm water planning for River Falls.

[2] Hammond, Roberts and Prescott only. Already completed in River Falls as a part of storm water ordinance development.

* **NOTE:** The maximum allowable cost share rates, as listed in Administrative Rule NR 120 are shown in parentheses. Due to program funding limitations, calculations shown in this table are based on anticipated cost share rates. If funds become available, higher cost share rates may apply.

Source: DNR

Alternative Funding Sources

A substantial portion of the estimated costs of implementing this plan's urban management recommendations is for the construction of storm water management practices in existing and planned urban areas to control thermal impacts and pollutants generated by a wide variety of activities. It is clear that the nonpoint program will not be able to fund all the work needed to meet the goal in the project's time frame. The purpose of this analysis is to determine where the nonpoint dollars should best be spent. The priorities of the program are to encourage the adoption of construction site erosion control ordinances and/or their continued enforcement, to develop storm water management plans and/or storm water management ordinances to reduce the pollutant contribution from new development, to develop wellhead protection plans to protect groundwater sources and to look for low-cost/low- technology solutions. When funding is available for structures (ponds and infiltration areas), priority will be based on cost-effectiveness and areas identified as high priority.

This plan endorses continued investigation into source control alternatives as well as development of alternatives for internalizing local pollution control costs. Alternatives such as the creation of local utility districts to finance the local share of these estimated costs should be investigated by the respective local governmental units. The DNR will help finance studies through the priority watershed program.

A variety of potential sources of funding are described in the *City of River Falls Water Management Plan* (SEH, 1995, p. 268).

Activities and Pollution Sources Not Eligible for State Funding Assistance

Priority watershed cost-share funds can not be used to control sources of pollution and land management activities specifically excluded in NR 120.17. The following is a partial list of ineligible activities most often inquired about for cost-sharing in urban areas.

- Operation and maintenance of cost-shared best management practices (BMPs).
- Construction site erosion control practices.
- Structural BMPs for new urban development. New urban development is defined as that for which construction activity commences after the DNR approves this plan.
- BMPs installed prior to signing cost-share agreements.
- Most activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program.
- On-site septic system controls or maintenance.
- Dredging activities.
- Activities and structures intended primarily for flood control.
- Base levels of street sweeping, as discussed earlier in this chapter (will be defined on a case-by-case basis).

Status of Existing Urban Grants

In 1996, the city of River Falls received a local assistance grant and spent $18,470 for development of a Storm water and Erosion Control ordinance. This ordinance has been drafted, but awaits approval of the City Council. They have also adopted and implemented a Storm water Utility Fee, which will yield an estimated $180,000 annually for administration and practices. In addition, they received $33,845 for stream monitoring and thermal and river modeling. This grant is intended to fund development of modeling that will allow site specific evaluation of thermal impacts of development. The total grant award to the city of River Falls for 1996 through 1988 is $65,190. The city is preparing an amendment request for line item transfers that will allow them to use their remaining $12,800 for completing and administering their storm water and erosion control ordinance.

The city of River Falls has also received $11,957 for demonstration projects. A total of $10,601 was spent for streambank erosion control, including informational signs at the site. An additional $1,356 was spent on a unique best management practice that allowed temporary diversion of parking lot runoff to the city's waste water treatment plant when annual fund-raising car washes are held. This low cost practice prevents direct delivery of car wash runoff to the Kinnickinnic River.

Other communities have not yet applied for or received urban grants.

Summary of Total Project Costs

Table 6-9 below summarizes the overall implementation costs of the Kinnickinnic River Priority Watershed Project, to attain water quality goals. The total project cost is estimated to be $7.9 million.
The state share is $4.8 million, and the local share is $5.6 million.

Table 6-9. State Share of Total Project Costs at 75 percent Landowner Participation

Item	Rural Costs		Urban and Developing Area Costs	
	State Share	Local Share[1]	State Share	Local Share [1]
Cost-Share Funds: Practices	$1,498,989	$642,541	$1,686,915	$4,293,609
Cost-Share Funds: Easements	$100,000	$0	$0	$0
Local Assistance Staff Support	$1,255,000	$418,333	$160,000	$310,000
Information and Education Direct	$30,000	$0	*	*
Other Direct (travel, supplies, etc.)	$5,000	$0	*	*
Engineering Assistance	$10,000	$0	*	*
Professional Services	$10,000	$0	*	*
TOTAL	$2,908,989	$1,060,874	$1,846,915	$4,603,609
TOTAL STATE SHARE	$4,755,904			
TOTAL PROJECT COSTS	$10,420,387			

* Included with staffing
Source: DNR, DATCP, and St. Croix and Pierce County Land Conservation Departments
[1] Costs borne by landowner, or in-kind contributions from local unit of government

Grant Disbursement and Project Management Schedule

Implementation of this Priority Watershed project shall begin upon both approval of this plan and receipt of the Nonpoint Source grant. The plan must be approved by the DNR, the St. Croix and Pierce County Boards, and the Wisconsin Land and Water Conservation Board.

The project implementation period is ten years. During the first five years of implementation, cost-share agreements with eligible landowners may be signed. Practices listed on any cost-sharing agreement must be installed before the end of the implementation phase. The implementation phase of this project is scheduled to conclude in 2009.

The initial Nonpoint Source grant will cover the cost of practices over the entire ten year implementation phase. The amount of the Nonpoint Source grant is calculated at 75 percent participation by eligible landowners; see Table 6-3 for a detailed explanation. This grant may be amended due to changes needed for time of performance, funding levels, or scope of work.

Local Assistance grants will be disbursed annually to St. Croix and Pierce Counties to cover the costs of personnel, operating expenses, and equipment. The DNR will evaluate an annual workload analysis and grant application submitted by St. Croix and Pierce Counties.

CHAPTER SEVEN
Integrated Resource Management Program

This chapter describes existing state, federal and local resource management programs and local resource protection groups which provide benefits for water quality and/or fish and wildlife resources in the Kinnickinnic River Watershed. Watershed staff will work to coordinate the efforts of these programs to provide the best possible management of land and water resources in the watershed. This comprehensive approach will facilitate consideration of the various goals and objectives for all the programs in which the landowner participates. Each of these activities is described below.

Fisheries and Wildlife Management

Watershed best management practices (BMPs), such as shoreline protection, shoreline habitat restoration, critical area stabilization, intensive grazing management, wetland restoration, and easements, should be implemented in a manner that enhances the project goal of protecting Kinnickinnic River's cold water fishery and associated wetlands and wildlife habitat.

DNR Fish Management and Wildlife Management personnel, U.S. Fish and Wildlife Service personnel or private consultants will be consulted for input in the design of shoreline, wetland and grassland BMPs to maximize benefits to the fish and wildlife communities. In cooperation with counties, DNR staff will also review placement of agricultural detention or infiltration basins They will also provide technical assistance when the installation of BMPs may adversely impact wildlife habitat by proposing measures to minimize the impact, or seeking alternatives that enhance wildlife habitat. In addition, there are state and federal fish and wildlife habitat programs that can complement or provide water quality protection by reducing run-off, increasing infiltration and protecting wetlands and shorelines. Opportunities for coordinating activities that will meet both water quality and habitat objectives will be explored and promoted.

Shoreline erosion control should be accomplished using bioengineering wherever feasible. Native plantings of terrestrial shoreline and emergent aquatic vegetation for habitat enhancement, including herbaceous and/or woody vegetation, depending on habitat goals for the site, should be used and promoted.

Wetland Restoration and Enhancement

Restorable wetlands in the Kinnickinnic River Watershed will be identified in consultation with DNR Fisheries and Wildlife Management personnel. Protection, enhancement and restoration of wetlands and springs in headwaters areas, and near intermittent streams that supply the Kinnickinnic River, are very high priorities. These areas contribute to important cold water base flow to the river. These areas can be protected through easement acquisition and development of vegetative buffers. Buffers are needed to protect wetland functions. If buffers are wide enough and of suitable herbaceous cover, they can provide important nesting and breeding habitat for waterfowl, reptiles and others. Wetlands that are important wildlife habitats will be identified in consultation with DNR Wildlife Management and Water Management personnel. Shoreline buffer easements may be acquired adjacent to these wetlands to offer better protection from sedimentation and other nonpoint source pollution. There may be options for utilizing federal funding sources through the Farm Bill's Wildlife Habitat Incentive Program (WHIP), Wetlands Reserve Program (WRP), or other programs, and these options should be investigated with DNR, NRCS or U.S. Fish and Wildlife Service (USFWS) staff as opportunities for restoration and enhancement arise.

Grassland Restoration

Because the majority of St. Croix County was grassland habitat prior to European settlement, the DNR and USFWS are very involved in upland grass restoration, focusing on native prairie restoration. These grassland plantings are generally conversions of farmed fields or enhancements of pastures, and as such, can benefit watersheds by trapping nutrients and sediments and enhancing infiltration. Modified grazing systems can also have beneficial wildlife impacts by allowing more bird nests to hatch successfully. Where possible, upland grassland management plans will be coordinated to meet both habitat and water quality goals.

Land Acquisition

Both the DNR and USFWS have land acquisition (fee and easement) authority which may be used for wetland and upland grassland protection within the watershed. If important sites and interested landowners are identified, and if the sites meet the acquisition criteria of the agencies, they may be referred to the DNR or FWS for possible acquisition.

Western Prairie Habitat Restoration Area (HRA)

An HRA has been approved by the Natural Resources Board for portions of St. Croix and Polk Counties which includes the Kinnickinnic River Watershed north of River Falls. This HRA has a goal of restoring and protecting wetland and grassland habitat as described above, and will increase the DNR's land acquisition authority.

Conservation Reserve Enhancement Program (CREP)
The Conservation Reserve Enhancement Program (CREP) is a joint, state-federal land retirement conservation program targeted to address state and nationally significant agriculture-related environmental effects. This voluntary program uses financial incentives to encourage farmers and ranchers to enroll in contracts of 10 to 15 years in duration to remove lands from agricultural production.

Groundwater Management

Wells provide a direct conduit for pollutants to reach groundwater resources. Preventing well contamination and sealing abandoned wells are important steps for protecting these resources. If not properly sealed, abandoned wells can directly channel contaminated surface water or shallow groundwater into deeper drinking water aquifers, bypassing the normal purifying action that takes place as surface water slowly percolates downward.

Project staff will encourage all landowners to properly seal abandoned wells. Information on the proper abandonment procedures will be provided to landowners when abandoned wells are located.

Well Abandonment
The Agricultural Conservation Program (ACP), administered by the Consolidated Farm Services Agency (CFSA), and the Environmental Quality Improvement Program (EQIP), provide cost-share assistance to farm operators to properly seal abandoned wells to protect groundwater resources.

Wisconsin Well Compensation Grants
Wisconsin's Well Compensation grant program provides financial assistance to replace or treat private wells contaminated with heavy metals, pesticides, solvents or gasoline. Wells must exceed state or federal drinking water standards. Replacement of wells contaminated with bacteria or nitrate are not eligible for cost-sharing, with the exception of livestock wells contaminated with more than 40 ppm of nitrate. DNR district water supply personnel should be consulted for more information concerning income limits and other eligibility requirements.

Wisconsin Fund
The Private Sewage System Replacement & Rehabilitation Grant Program (Wisconsin Fund) provides financial incentives to protect and improve groundwater quality in Wisconsin. The Wisconsin Fund provides funds to update private sewage systems installed before 1978. To be eligible the septic system must have been inspected by the County Sanitarian and determined to be failing by discharging waste to the groundwater or surface water. Only permanent residences qualify, and there are income restrictions. Applications for Wisconsin Fund assistance are made through the County Zoning and Planning Department.

Forestry Programs

Private forest lands account for approximately 12,000 acres within the Kinnickinnic River Watershed and contribute to the quality of water resources and fish and wildlife resources in the watershed. Financial assistance is available for forest management and soil and water resource protection through the Stewardship Incentive Program (SIP), the Managed Forest Law Program (MFL) and other forest stewardship programs. Additional information can be found in DNR publication FR-093-95, Wisconsin Forestry Best Management Practices For Water Quality, developed by DNR Bureau of Forestry.

Stewardship Incentive Program

The Stewardship Incentive Program (SIP) was developed to stimulate enhanced management of forest lands by cost-sharing approved management practices. SIP provides cost share funding of up to 75% for practices that provide soil and water protection. The SIP program applies to non-industrial private forest land of 10 acres or more on forested or forest related (i.e., prairie, wetlands) lands. Practices that are cost-shared by SIP include: development of a landowner forest stewardship plan; site preparation and tree planting; timber stand improvement; windbreak and hedge row establishment; soil and water protection and improvement; riparian and wetland protection and improvement; fisheries habitat enhancement; wildlife habitat enhancement; and forest recreation enhancement.

Managed Forest Law

The goal of the Managed Forest Law (MFL) program is to encourage long-term sound forest management. MFL is a tax incentive program for industrial and non-industrial private woodland owners who manage their woodlands for forest products while also managing for water quality protection, wildlife habitat and public recreation. In return for following an approved management plan, property taxes are set at a lower rate than normal. At a later time when the landowner receives an income from a timber harvest, some of the deferred tax is collected in the form of a yield tax. Management plans are based on the landowners' objectives. These plans may address harvesting, planting, thinning, release and soil erosion on a mandatory basis while addressing other practices such as wildlife and aesthetic activities on a voluntary basis. Additional information about financial assistance for forest management can be obtained by contacting the local DNR forester.

Inland Lakes Program

Wisconsin Lakes Management Program

Wisconsin's 15,000 inland lakes are under increasing pressure from the activities of people who live, work and recreate near them. Land use changes in lake watersheds has resulted in the nutrient enrichment of many Wisconsin lakes, leading to nuisance growth of aquatic plants and algae, sedimentation and the loss of native plant communities. The Wisconsin Lakes Management Program is a cooperative program between the Wisconsin DNR, UW-Extension, the Wisconsin Association of Lakes (WAL), and lake organizations to assist local governments

and the inland lake management organizations in the long-term management and protection of their lakes. The Wisconsin Lakes Management Program provides technical assistance, information and education to lake groups and lake residents, and planning, protection, and implementation grants to qualified lake organizations and local units of government.

Organized Lake Groups
Lake groups range from informal groups of concerned property owners to lake districts which have the power to levy taxes against property owners for the operation of lake management programs. Most of the DNR grant programs designed to help lake residents become better lake stewards require that the lake organizations meet certain minimum standards relating to membership, dues and by-laws. At a minimum, a lake group must be a legal lake association incorporated under Chapter 181 Wisconsin Statutes.

Lake Management Planning Grant Program
The Wisconsin Lake Management Planning Grant Program was developed to provide financial assistance to qualified lake organizations or local governments to collect and analyze data concerning the physical, chemical and biological health of their lakes. Grant money can also be used to investigate watershed conditions, review ordinances and conduct social surveys to gauge local concerns and perceptions as they relate to lake use and water quality. The end product of most lake management planning grants is a comprehensive lake management plan which addresses local concerns and analyzes alternatives for lake and watershed management. The DNR pays 75% of the cost of the planning project, not to exceed $10,000 during each two-year state budget period. The grant recipient pays the remaining 25% of the project cost.

Water Quality Trend Monitoring
Lake management planning grants are available through the Wisconsin DNR to conduct water quality trend monitoring on Wisconsin lakes. In many cases, previous Environmental Protection Agency (EPA) and DNR funding research projects may have provided a wealth of baseline water quality information on lakes and their tributaries. Continuing water quality trend monitoring is an important step in evaluating the effectiveness of watershed management techniques and adjusting lake management activities.

Lake Protection Grant Program
Through the Lake Protection Grant Program qualified lake organizations can apply for funds to carry out a variety of lake protection projects. The state-share is 75%. Eligible projects include the purchase of lands critical to a lake ecosystem, restoration of important wetlands and the development of regulations and ordinances designed to protect and enhance lake water quality. Funding is limited to $200,000 per grant. Qualified lake organizations will be encouraged to apply for lake protection grant funding where applicable.

Endangered and Threatened Resources

Information on threatened and endangered resources is obtained from the Bureau of Endangered Resources of the DNR. Endangered resources include rare species and natural communities. It

should be noted that comprehensive endangered resource surveys have not been completed for the entire Kinnickinnic River Watershed. The lack of additional occurrence records does not preclude the possibility that other endangered resources are present in the watershed. In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. There may be other records of rare species and natural communities which are in the process of being added to the database and so are not listed in this document.

Wisconsin Endangered Species

An endangered species is one whose continued existence as a viable component of this state's wild animals or wild plants is determined by the DNR to be in jeopardy on the basis of scientific evidence. Wisconsin endangered species within the watershed are:

Anemone caroliniana, carolina anemone
Astragalus crassicarpus, ground-plum
Catabrosa auatica, brook grass
Hiodon aosoides, goldeye
Lanius ldovicianus, loggerhead shrike
Lespedeza leptostachya, prairie bush-clover
Liatris punctata var nebraskana, dotted blazing star
Notropis amnis, pallid shiner
Podiceps grisegena, red-necked grebe
Scutellaria parvula var parvula, small skullcap

Wisconsin Threatened Species

A threatened species is one which, if not protected, has a strong probability or becoming endangered. Wisconsin threatened species within the watershed are:

Besseya bullii, kitten tails
Buteo lineatus, red-shouldered hawk
Cirsium hillii, hill's thistle
Moxostoma carinatum, river redhorse
Speyeria idalia, regal fritillary
Trillium nivale, snow trillium

Wisconsin Special Concern Species

A special concern species is one for which some problem of abundance or distribution is suspected in Wisconsin, but not yet proven. The purpose of this category is to focus attention on certain species **before** they become endangered or threatened. Wisconsin special concern species that have been listed within the watershed by the DNR Bureau of Endangered Resources include:

Anguilla rostrata, american eel
Calylophus serrulatus, yellow evening primrose
Crotalaria sagittalis, arrow-headed rattle-box
Crotalus horridus, timber rattlesnake
Cypripedium reginae, showy lady's-slipper
Dalea villosa, silky prairie-clover
Fundulus daphanus, banded killifish
Glycyrrhiza lpidota, wild licorice

Neurocordulia molesta, smoky shadowfly
Neurocordulia yamaskanensis, stygian shadowfly
Nothocalais cuspidata, prairie false-dandelion
Notropis texanus, weed shiner
Nycticorax nycticorax, black-crowned night-heron
Onosmodium molle, marbleseed
Orobanche ludoviciana, louisiana broomrape
Panicum wilcoxianum, wilcox panic grass
Platanthera hookeri, hooker orchis
Polanisia jamesii, james cristatella
Psoralea esculenta, pomme-de-prairie
Rubus uniformis, uniform bramble
Senecio congestus, marsh ragwort
Talinum rugospermum, prairie fame-flower

Other species of concern, particularly grassland species, are likely to exist, but have not yet been listed by the BER. If specific location or other information is needed about these species or natural communities, contact the Bureau of Endangered Resources, DNR. **Please note** that the specific location of endangered resources is sensitive information. Exact locations **are not** released or reproduced in any publicly disseminated documents.

Natural Areas
Natural areas are sites that contain high quality examples of natural communities.
Natural areas identified in the Kinnickinnic River Priority Watershed include the Kinnickinnic River State Park, a federal Waterfowl Production Areas at Twin Lakes, portions of the Kinnickinnic River State Fishery Area, and portions of the Lower St. Croix Riverway. High quality natural communities that lie within these areas include:

Dry Cliff
Dry Prairie
Emergent Aquatic
Floodplain Forest
Lake--Shallow, Hard, Seepage
Lake--Shallow, Soft, Seepage
Mesic Prairie
Moist Cliff
Northern Dry-Mesic Forest
Pine Relict
Southern Dry-Mesic Forest
Southern Dry Forest
Stream--Slow, Hard, Warm

Coordinating Regulations, Permits, and Zoning

Best management practices that address shoreline erosion such as riprap or vegetative shoreline stabilization will require permits from the DNR. Any BMP which effects wetland form or function may require permits from the DNR, the St. Croix or Polk County Zoning offices and the US Army Corps of Engineers.

In an attempt to protect the use, enjoyment and water quality of our lakes and streams the state, federal and local government regulates some activities on riparian properties. Activities that disturb or remove the natural vegetation surrounding our lakes and streams reduces the buffering capacity of the area and often drastically increases erosion, sedimentation and nutrient runoff. Many lake front property owners, particularly those who are purchasing waterfront property for the first time, are not aware of these regulations or the need for them.

Coordination With State and Federal Agricultural Conservation Programs

The Kinnickinnic River Watershed Project will be coordinated with the conservation features of the Wisconsin Farmland Preservation Program (FPP) administered by the Department of Agriculture, Trade and Consumer Protection (DATCP), and the Federal Food Security Act (FSA) administered by the Farm Service Agency and the Natural Resource Conservation Service. Federal programs available which may have water quality implications include the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP), the Wetland Reserve Program (WRP), the Wildlife Habitat Incentives Program (WHIP), and the Environmental Quality Incentive Program (EQIP). These programs generally involve cost-sharing to landowners for beneficial land management practices. Project staff should seek to utilize these or similar funding sources to accomplish project goals, as they become available.

Coordination With Local Groups and Organizations

Many local groups and organizations have an interest in the Kinnickinnic River Priority Watershed Project. Project staff will seek assistance, when appropriate, from these groups during implementation. Area groups and organizations include:

Kinnickinnic River PWS Steering Committee
Mainstreet Groups
Boy and Girl Scouts
Future Farmers of America
UW-Extension Master Gardeners
Trout Unlimited
Ducks Unlimited
Kinnickinnic River Land Trust
Pheasants Forever
Wisconsin Waterfowl Foundation
Whitetail Unlimited
Sportsmen's Alliance

Rod and Gun Clubs
Environmental Clubs in schools
Schools - Elementary, Secondary
University of Wisconsin-River Falls
University of Wisconsin-Extension
Town and County Boards, and City and Village Councils
Citizens for Responsible Zoning and Landowner Rights, Inc.
Private Individuals

Archaeological Sites: Coordination with State and Federal Historic Preservation Laws

Projects using state and federal funding, assistance, licenses and permits are required by law to consider the effects of their actions on archaeological and historical sites and historical structures. The watershed project is a joint cooperative effort between federal, state, and county agencies as well as the private landowners who volunteer to participate in the program. As a result, the federal Historic Preservation Act of 1966, as amended, and the state historic preservation statute, s. 44.40, Wis. Stats., have been blended to produce a cultural resource management program which is both compatible to preserving cultural sites and implementing the watershed project.

Cultural resource recorded in the Kinnickinnic River Watershed include 29 archaeological sites, 17 historic cemeteries and 55 historic structures (excluding those in the City of Prescott). The number of archaeological sites is less than expected for an area of this size, and likely reflects the relative lack of archaeological research conducted so far. All but 10 of the sites are located along the Kinnickinnic River northeast of River Falls, in an area that was the focus of research by the Institute of Minnesota Archaeology. The only other notable survey is one conducted in preparation for development of Kinnickinnic State Park. Undoubtedly many sites await discovery. The locations most likely to contain unreported Native American sites are on the bluffs overlooking the St. Croix River, along the Kinnickinnic River, and around Twin Lakes.

Among the known sites, there are four with mounds, including Prescott Mounds (17 mounds, mostly destroyed), the Kinnickinnic State Park Mounds (two linears), and the Hanson-Kinnickinnic site (one mound). All of these mounds are presumed to be Woodland in age.

In addition, there are 7 sites believed to be campsites or villages. One of these has a Late Paleo-Indian component. Another has produced Archaic and Woodland remains, and two are recorded as probably Woodland. the remaining 3 are of unknown age. The rest of the sites include a cache of bifaces, five small lithic scatters that could represent campsites or workshops, eleven isolated finds where only a single artifact was recovered, and a site containing late-19th or early-20th century Euro-American refuse. These areas will need special consideration if structural best management practices are being considered, in order to assure that archaeological resources are preserved.

A set of USGS quadrangle maps, identifying known archaeological sites, has been prepared for the Kinnickinnic River Watershed, using records kept by the State Historical Society of Wisconsin. The maps are provided for planning priority watershed projects, and are to be treated as confidential, and not subject to the open records provisions of state law. The purpose of this is to protect sites from looting.

Before finalizing a cost-share agreement with a landowner, project staff will review the maps showing known archaeological and historic sites. If a known site occurs in the vicinity of a proposed best management practice (BMP), this does not necessarily mean the BMP needs to be moved or altered. In some cases, the specific location of the BMP will not actually be near enough to the location of the known site to warrant further review. Project staff should visit the area and conduct a "pre-review" to ensure that the *specific* location of the proposed BMP will not disturb the known archaeologic or historic site.

If it is too difficult to determine through a pre-review, or if it appears that the known site would indeed be disturbed, a formal Archaeological or Historic Site Review of the area may be necessary. The survey will assess the potential of the practice to significantly impact the site. In certain instances a survey may reveal a significant archaeological site which precludes the installation of a particular BMP at that specific site. Cost-share agreements will contain language which nullifies or partially nullifies the cost-share agreement based on the final results of the archaeological survey. Any costs incurred as part of a site review will not be passed on to the landowner.

CHAPTER EIGHT
Information and Education Program

Information and Education Program Objectives

The Information and Education Program objective is to support improving and protecting water resources in the Kinnickinnic River Watershed through outreach and educational activities.

Information and education is seen as one leg of a three-legged project implementation approach:

- Obtain positive change through increased awareness, knowledge, and skills;
- Obtain positive change through providing technical and financial assistance; and,
- Obtain positive change through regulations.

In this approach, information and education is first among equals. Those who live, work, and recreate in the Kinnickinnic River watershed will not request project assistance, follow project recommendations, or willingly submit to regulations unless they first are aware of the problems and understand how to apply the solutions. An informed and educated public is required for the project to be successful.

Audiences and Educational Topics

Below listed in outline form are the audiences being targeted for information and educational program delivery. Next to each audience group are educational topics specific to that group that need to be delivered if project goals are to be met. Audiences and educational topics are listed alphabetically, and not in order of importance.

All Audiences (including local and state elected officials):
Water resources awareness
Project purpose, activities, and progress

Builders & Developers:
Construction site erosion control
Environmental friendly development design
Land use planning
Storm water management

Farmers:

Barnyard runoff management
Buffer strips
Crop residue management
Contour strips
Handling and disposal of hazardous materials
Gully and sink hole control
Nutrient and pesticide management
Waterway installation and maintenance

Industry & Institutional:

Handling and disposal of hazardous materials
Spill response
Storm water management

Local government:

Construction site erosion control
Environmental friendly development design
Handling and disposal of hazardous materials
Land use planning
Nutrient and pesticide management
Ordinance development and coordination
Spill response
Storm water management

Rural residents:

Construction site erosion control
Construction site planning to lessen impacts on water resources
Drinking water, abandoned well, and septic system management
Handling and disposal of hazardous materials
Nutrient and pesticide management
Shoreland protection

Urban residents:

Construction site erosion control awareness
Handling and disposal of hazardous materials
Land use planning awareness
Nutrient and pesticide management
Storm water management awareness

Youth (K - College):

Individual and community responses to water quality protection
Land use / water quality connection
Stream monitoring and data analysis
Water resources awareness

Anticipated Educational Outreach Methods

Adults: Eight-step outreach approach (see below)
Kinni Karetaker recognition program
Educational meetings, workshops, and demonstrations
Point of use materials, e.g., New home builders info packet.
Use of print and electronic media

Youth: Kinni Karetaker recognition program
Project WET teacher training
Groundwater flow models in the schools
Water education resource center (for loans of boot, nets, test kits, etc.)

The "Kinni Karetakers" program is designed to promote involvement of individuals and groups in activities that improve and protect the rivers, streams and groundwater found in the Kinnickinnic River Watershed. It includes resources, suggested activities and incentives for participation for schools, youth groups and adults. See Appendix D .

Eight-step outreach approach

For major adult educational topics, the following series of sequential and integrated activities will be followed:

1. Obtain or develop short fact sheet on an educational issue.
2. Place fact sheet on the project's Internet site.
3. Send fact sheet out in a mailing to target groups.
4. Within a week of the mailing, write a newspaper column on the issue.
5. During the same time period, do radio spots on the issue.
6. When appropriate, arrange a demonstration for the issue. Use Steps 2 - 5 to announce the demonstration.
7. Make personal contacts to key individuals.
8. Evaluation, follow-up, repeat if necessary.

Annual Implementation Plan Development

Annual information and education implementation plans will be developed that chart out what activities are to be done, when they are going to done, who will do them, and at what cost to the project. Annual implementation plans are to be prepared in the last quarter of the year and project two years out, e.g., at the end of 1998, implementation plans for 1999 and 2000 will be developed.

Annual implementation plans will be based on the target audiences, educational topics, and educational outreach methods outlined above. They also will be based on past experience, available resources, and emerging issues and opportunities.

The Project Manager is responsible for developing annual implementation plan and seeing that it is implemented (Table 8-1).

Table 8-1. 1999 Annual Information and Education Implementation Plan

Activity	Schedule	Target Audience	Assignments	Materials & Costs
One-on-one project area contacts Share information specific to the audience's interest and involvement	On-going	Farmers Local Gov't	Tim Popple, Kinni Proj. Dan Burgess, Kinni Proj. Assistance - Steering C. LCD, UWEX	Handout packet - $ 50
Presentations to interest groups Share general project and water quality protection information	On-going	Farmer groups Profess. groups Recreation groups	Tim Popple, Kinni Proj. John Haack, UWEX	Handouts - $ 50 Film costs - $ 100 Slide show dev. - $ 100
County Fairs Display project information at these annual event	July 1999	All	Tim Popple, Kinni Proj. Assistance - Steering C. LCD, UWEX	Handouts - $ 50 Display - $ 200
Stream Buffer Demonstration Demonstrate riparian buffer strip. Follow "Eight Step" approach.	Install 1999 Showcase 2000	Farmers Rural residential	Tim Popple, Kinni Proj. Dan Burgess, Kinni Proj. Assistance - Steering C., DNR, NRCS, UWEX	Signs - $ 200
Sink Hole Control Demonstration Demonstrate sink hole growth control and protect ground water. Follow "Eight Step" approach.	Install 1999 Showcase 2000	Farmers Rural residential	Tim Popple, Kinni Proj. Dan Burgess, Kinni Proj. Assistance - Steering C., DNR, NRCS, UWEX	Signs - $ 200
Nutrient Management Demos and Field Day Demonstrate nutrient crediting and manure mgt. on five farms	3/99 - 11/99 Field day 10/99	Farmers	Tim Popple, Kinni Proj. Paul Kivlin, UWEX	Signs - $ 200 Food - $ 50
Construction Site Erosion Control Workshop Schedule one of 1999 state-wide workshops to be in River Falls.	3/99	Builders and Dev. Local Gov't	John Haack, UWEX	Self supported by registration fees

Activity	Schedule	Target Audience	Assignments	Materials & Costs
"Growing Green" Workshop A workshop that discusses the impact growth has on community services and environmental quality.	9/99	Local Gov't Builders and Dev.	Jim Janke, UWEX Ed Hass, UWEX Tim Popple, Kinni Proj. Steering Committee	Self supported by registration fees
Newsletter Share Project progress and water education information	2/99 8/99	All	Tim Popple, Kinni Proj. Assistance - UWEX	Postage - $ 300
Project WWW Site Share Project information on the Internet	1/99	All (with Internet access)	Tim Popple, Kinni Proj. Steering Committee, Volunteer	Contract labor - $ 400
Eight-Step Educational Outreach Prog. Use to evaluate project educational needs	monthly	All	Tim Popple, Dan Burgess, Kyle Kulow, Kinni. Proj.	Mailings - $100
Generate Basic Summary of KNC Plan Provide an understanding of the plan to the public	1999	All	Watershed Project Staff	Handouts - $200
Project WET Training For project area teachers	10/99	Youth via teachers and leaders	Tim Popple, Kinni Proj. John Haack, UWEX Project WET Trainers	Project WET Books 40 X $15 = $600
Kinni Keeper Program Recognition program for those who take water protection action	Start Fall 1998 On-going	Youth Civic Groups Businesses Individuals	Tim Popple, Kinni Proj. Steering Committee	Certificates - $400
TOTALS				**$ 3,200**

Agency/Program:

DNR - Department of Natural Resources
LCD - County Land and Water Conservation District
NRCS - Natural Resources Conservation Service
Steering C. - Kinnickinnic River PWS Steering Committee
UWEX - University of Wisconsin - Extension

CHAPTER NINE
Project Evaluation

This chapter summarizes the plan for evaluating the progress and effectiveness of the Kinnickinnic River Priority Watershed Project. The evaluation plan includes these components:

- Administrative review
- Pollution reduction evaluation
- Water resource monitoring

Information on the first two components should be collected by the St. Croix and Pierce County Land and Water Conservation Departments (LWCDs) and reported on a regular basis to the DNR and the DATCP. The project staff and the DNR generally meet early in the year throughout the implementation phase to review and evaluate the accomplishments of the preceding year. Additional information on the numbers and types of practices on cost-share agreements, funds encumbered on cost-share agreements, and funds expended will be provided by the DNR's Bureau of Community Financial Assistance.

A final report on the Kinnickinnic River Priority Watershed Project will be prepared by project staff for public distribution within 18 months of the end of the grant period. This report will include information on landowner participation, project management, grant management, technical assistance, and any Signs of Success sites completed within the watershed. It will be developed to evaluate progress, provide documentation on attainment of water quality and pollutant load reduction objectives, and evaluate best management practice (BMP) effectiveness.

Administrative Review

The administrative review will focus on the progress of St. Croix and Pierce Counties and other units of government in implementing the project. The project will be evaluated with respect to accomplishments, financial expenditures, and staff time spent on project activities.

Accomplishment Reporting and Annual Review

The St. Croix and Pierce County LWCDs should provide the following data to the DNR and the DATCP annually:

- Pollutant load reductions

- Planned and completed BMPs
- Planned and completed conservation systems
- Status of nutrient management planning in the watershed project
- Status of verification of critical sites
- Status of implementing the contact strategy and schedule of notification for landowners with critical sites
- Assessment of public opinion and knowledge utilizing the "Citizen Opinion and Practices Survey" described below
- Status of easement acquisition and development
- Information and education accomplishments, including demonstrations
- Program participation status including number of municipal grantees and frequency and type of contacts with rural cost-share eligible landowners
- Accomplishments attained through coordination with other programs, including leveraged staff time, labor and dollars.
- Status of project administration including data management, staff training, and BMP monitoring
- Status of project accomplishment tracking mechanisms, including an evaluation of accuracy and completeness

Likewise, participating local units of government implementing the nonpoint source management program in urban and growth areas should meet periodically with DNR staff to review progress. The DNR and local units of government will jointly evaluate the implementation program. Urban grantees should provide, where feasible and based on grants received, the following data annually:

- Construction site erosion control ordinances or amendments adopted
- Number of permits monitored for erosion control ordinance compliance
- Status of storm water management ordinances, planning and enforcement
- Urban housekeeping accomplishments, such as street sweeping, leaf and brush collection, and storm sewer and catch basin cleaning
- Status of storm water planning and implementation for new development
- Status of storm water management feasibility studies and implementation for existing urban areas
- Information and education activities
- Implementation of urban "housekeeping" program activities

Citizen Opinion and Practices Survey

County LWCD staff, in cooperation with the University of Wisconsin - Extension, are conducting an extensive inventory of homeowner practices that impact water quality, both in farmstead and residential settings. This benchmark data is being collected, and a reinventory will be conducted in approximately five years. This study will provide an assessment of the effectiveness of the project's information and education program. Extension staff will be primarily responsible for analysis, and results will be reported by county LWCD staff.

State Nonpoint Source Program Accomplishment Reporting

Accomplishment data are summarized in the *Joint Program Evaluation Report of the Nonpoint Source Water Pollution Abatement Program and the Soil and Water Resource Management Programs* prepared by DATCP and DNR. Accomplishment data are also presented and discussed annually at the state Land and Water Conservation Board meeting and at watershed review meetings held annually for projects in implementation.

Details of the reporting requirements are contained in DNR Publication WR-223-97, "An Evaluation Plan for the Soil and Water Resource Management Program and the Nonpoint Source Water Pollution Abatement Program" which is reviewed every two years by DATCP and DNR and revised as necessary.

The Field Offices Computing System (FOCS) is a computer data management system that has been developed by the U.S. Natural Resources Conservation Service (NRCS). The NRCS, the DNR and the DATCP have used FOCS to meet the accomplishment reporting requirements of all three agencies. This or another acceptable data management system will be used by St. Croix and Pierce County LWCDs to collect data for administrative accomplishments, and will provide the information to the DNR and the DATCP for program evaluation.

Financial Expenditures

St. Croix and Pierce County LWCDs and other participating units of government should provide the following financial data to the DNR and the DATCP annually:

- Number of landowner cost-share agreements signed
- Amount of money encumbered in cost-share agreements and amendments
- Number of landowner reimbursement payments made for the installation of best management practices (BMPs), and the amount of money paid
- Staff expenditures (salary, travel, equipment, materials and supplies)
- Other project expenditures (information and education, professional services, easements, etc.)
- Interest earned and spent
- Administrative expenditures (single purpose audits, deed recording, etc.)
- Accomplishments attained through coordination with other programs, including leveraged staff time, labor and dollars.

Time Spent On Project Activities

The LWCD will annually provide time summaries to DNR for each employee, by project. They should also provide summaries of time spent on project activities but funded from other programs, such as EQIP, CRP, SIP, and CREP.

Participating local units of government should also provide summaries of staff time spent on project activities.

Nonpoint Source Pollutant Load Reduction

Key sources of pollution and reduction goals were identified in Chapter Five of this plan. Pollutant load reduction goals were established for sediment from uplands, streambanks, gullies, dry runs and construction sites, and for phosphorus from winter spreading of manure, barnyards, and cropland.

Cropland Sources
St. Croix and Pierce County LWCDs may use WINHUSLE (Wisconsin Nonpoint Source) computer model in FOCS, or another acceptable system to estimate sediment loads. The inventoried load from cropland is 16,824 tons of sediment per year, and the reduction goal is 25%. The reduction goal for phosphorus is also 25%. The number of tons per year of sediment controlled from critical sites should also be reported.

Streambank Sources
Watershed staff should estimate changes in streambank sediment erosion. A tally will be kept of landowners contacted, the amount of streambank sediment (in tons per year) being generated at the time of contact, and changes in erosion levels estimated after installing BMPs. The inventoried load is 600 tons of soil per year, and the reduction goal is 60%. Tons per year controlled from critical sites should also be reported.

Dry Run Sources
Watershed staff should estimate changes in dry run sediment erosion. A tally will be kept of landowners contacted, the amount of dry run sediment (in tons per year) being generated at the time of contact, and changes in erosion levels estimated after installing BMPs. The inventoried load is 988 tons of soil per year. The reduction goal is 30%. Tons per year controlled from critical sites will also be reported.

Barnyard Runoff
Watershed staff should use the BARNY model to estimate phosphorus and COD reductions. The inventoried load from 99 barnyards is 235,222 lbs of combined oxygen demand (COD) per year with a reduction goal of 35%. Pounds per year of COD controlled from critical sites will also be reported.

Nutrient and Pest Management (NPM)
Watershed staff should estimate the number of acres enrolled in nutrient and pest management planning. A tally will be kept of the landowners contacted, and the change in numbers of acres enrolled in NPM. There are approximately 405 operators (94,000 acres) eligible. The overall participation goal is 60%. A record should also be kept of the number of acres enrolled at the optional higher standards of no manure applications within 100 feet or a waterway, and immediate incorporation within 200 feet of a waterway.

Actions that reduce nutrient loads from non-farm sources should also be tracked. This should include:

- Pet waste ordinances enacted
- Estimates of change in usage of phosphorus-free fertilizers (number of stores that market it and estimates of amounts sold)
- Estimates of change in usage of pesticides, utilizing the Citizen Opinion and Practices Survey
- Estimates of amounts reduced through new storm water management practices

Wetland Restorations
Watershed staff should track the number of acres of wetlands restored. The goal is to restore 10% (425 acres) of the wetlands inventoried.

Groundwater
Watershed staff should track the number of well abandonments, sinkhole protection, easements or other practices that are implemented to provide groundwater protection.

The status of wellhead protection planning and implementation should also be reported.

Construction Sites
Participating local units of government and county staff should report annually to the DNR on the number of construction sites served by adequate erosion control practices, number of construction sites receiving appropriate permits, and any amendments to construction site erosion control ordinances that affect sediment loads associated with these sources. The reduction goal for sediment from construction sites is 70%, or 518 tons/year of an estimated 740 tons/year. Construction site sediment loads will be controlled through effective erosion control ordinance enforcement.

Storm water Pollutants
County staff and participating local units of government should track and report annually to the DNR on any activities that may result in changes in pollutant load from non-agricultural sources. The overall reduction goal for total suspended solids (TSS) and pollutants in storm water is 35%. This should be achieved by a 10% reduction in loads from existing urban development, and a 60% reduction in potential future pollutant loads from non-agricultural uses, relative to loads that would have occurred without the use of BMPs. Recommended information to be reported should include:

- Acres of baseline (1997 and WMP survey year) urban development by land use, including a) acres covered by storm-water management plans for controlling water quality and b) acres not covered by storm-water management plans for controlling water quality

- Acres of new (post- 1997 and WMP survey year) urban development, by land use, including a) acres covered by storm-water management plans for controlling water

quality and b) acres not covered by storm-water management plans for controlling water quality

The following information should be provided, where feasible and based on grants received, to allow evaluation of changes in imperviousness relative to baseline (1997 survey year and River Falls Water Management Plan) data. Recommended annual data for subwatersheds and drainage areas includes:

- Acres of baseline (1997 and WMP survey data) absolute imperviousness
- Acres of new imperviousness
- Relative reduction in acres of imperviousness that was achieved through site planning
- Effective acres of imperviousness

The Kinnickinnic River watershed steering committee, project staff and local units of government may need to work in cooperation with other partners in order to obtain this information. Partners may include University of Wisconsin-River Falls, University of Wisconsin Extension, Regional Planning Commissions, Trout Unlimited, Kinnickinnic River Land Trust and many others.

Water Resource Monitoring

The *Kinnickinnic River Priority Watershed Surface Water Resources Appraisal Report* (DNR, 1998) describes in detail the methods used and data collected in order to evaluate the current (baseline) water resource conditions in the Kinnickinnic River watershed. Partners of the watershed project should commit to collecting data necessary to allow for a periodic comparison of water resource conditions to baseline conditions. Assuming limited resources, monitoring efforts should be focused on sites where land use changes, including best management practices, are likely to impact water quality conditions. Recommendations include:

- Currently, there are five continuous temperature monitors deployed in the vicinity of River Falls, and continuation of this monitoring should be a high priority.

- Fish and stream habitat surveys are also recommended as cost effective and fairly sensitive to land use changes.

- Macroinvertebrates are good indicators of water chemistry changes, but not likely to reflect subtle changes in temperature regimes. Although macroinvertebrate sampling is therefore not a high priority for monitoring, there may be good opportunities for high school or college students to monitor as part of classroom or research projects.

- Staff and partners should establish a timetable for periodic evaluation of monitoring data, then utilize the results to help guide periodic plan evaluation and revisions. Biannual evaluation of monitoring data and plan review is recommended.

The River Falls Water Management Plan (WMP) recommends a monitoring program and identifies objectives, monitoring needs and partner roles. The recommendations of the WMP should be implemented to the extent possible. Specifically, the Monitoring Action Plan (Table 16 of the WMP) should be reviewed annually to assess progress toward meeting these goals.

St Croix Riverway Monitoring

The St. Croix Interagency Basin Team, consisting of Federal and State agency members, is working cooperatively on water resource issues affecting the St. Croix River Basin. The Kinnickinnic River has been identified as a significant source of nutrients to the St. Croix River. The St. Croix Interagency Basin Team is undertaking a basin modeling effort to set goals and objectives for the St. Croix River. Monitoring stations are being established at several locations, including a site at the County Hwy F bridge, near the mouth of the Kinnickinnic River. Data collected will include continuous flow monitoring and seasonal and annual loading for phosphorus, nitrogen and sediments. Data will be reported as unit areas loads (lbs or tons per acre of watershed). Additional modeling may include identifying unit area loads for specific land uses. At this time, the monitoring station will be in operation for approximately one year, in 1998-1999. If this monitoring is repeated at a later time, it could potentially be useful in evaluating changes in water quality in the Kinnickinnic River.

Project staff and the steering committee should seek support for future monitoring efforts, and utilize this information to evaluate whole watershed water quality changes.

Department Monitoring Activities

Limited funds and the intensive staffing needed to properly evaluate water quality changes prohibits monitoring each watershed individually. Instead, two types of evaluation monitoring are being conducted on a state-wide basis: Whole Stream Monitoring and Signs of Success. The goal of the monitoring activities is to determine the progress the Nonpoint Source Program is making towards improving the quality of Wisconsin's water resources. Monitoring activities were developed to answer questions listed below about the water resource objectives and the pollution reduction goals. However, with Priority Watershed Projects currently funded at levels well below what would be needed to install enough BMPs to reach pollutant load reduction goals, these questions may prove difficult to answer:

- Can simple environmental indicators be used to provide some early evidence that the practices might achieve the water resource objectives and pollutant reduction goals?
- Do the levels and types of best management practices recommended in the watershed plans achieve the pollutant reduction goals and water resource objectives?
- Will participation levels below 100% achieve the water resource objectives or the pollutant reduction goals?
- Do pollutant load reduction goals need to be adjusted to achieve the water resource objectives?

A team of experts from state and federal agencies, and the University of Wisconsin was formed to develop and direct the evaluation monitoring activities at the Whole Stream Monitoring and Signs of Success sites.

Whole Stream Monitoring Sites

Criteria were developed to select and monitor twelve streams around the state. The stream sites represent the five major types of fisheries found in agricultural and urban parts of priority watersheds, and they also represent three of the five eco-regions in the state. The five fishery types are: high gradient cold water sport fishery, high gradient warm water sport fishery, high gradient warm water forage fishery, low gradient warm water forage fishery, and low gradient cold water sport fishery. A storm sewer outfall is also being monitored. The three eco-region types represented are the Southeastern Wisconsin till plains, the Driftless area, and the North Central Hardwood Forest.

All but one of the stream sites drains a small area (about ten square miles or less). The schedule involves two years of monitoring before any best management practices are installed, five years of monitoring during the practice installation phase, 2 years of monitoring during the response period, and two years of monitoring during the post-practice installation phase, for a total of eleven years of monitoring.

State-of-the-art chemical and physical monitoring is underway at all the stream sites. State-of-the-art biological monitoring will be performed at eight of the twelve streams. Results of the monitoring will be used to determine how well the best management practices achieve the pollution reduction goals and objectives. Improving the fish community is the most important water resource objective for all the streams.

Signs of Success

Signs of Success (SOS) is short-term monitoring designed to provide some early evidence that better land management does make a difference. One site is being sought for each watershed project. Signs of Success will focus on one practice such as barnyard runoff controls, manure storage, or streambank fencing that is expected to have an early effect on the adjacent stream.

Monitoring will take place over a two-year period; the year before and the year after a practice is installed. Expected positive improvements will be on those sites where degraded habitat has occurred. Habitat sampling and photographs will be used to indicate the benefit of the practice. Limited chemical monitoring and fish sampling will be done at some sites.

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Appendix A
Brief History of Kinnickinnic River Use

A Brief History of the Kinnickinnic River Cold Water Fishery and Past Land Use Practices

Before 1850's	The Kinnickinnic River and South Fork were considered excellent native brook trout streams throughout the watershed (presettlement).
Late 1800's	Prairies and woodlands were severely altered by human settlement, logging 1800's and intensive farming.
1900-40	Mill and power dams, intensive farming and deforestation resulted in major erosion and deposition in the watershed. The river temperatures rise. Native coldwater fisheries are devastated.
1921	Clifton Hollow Dam no longer impounded the river. Negative impacts from the dam slowly disappear.
1932	Cascade Falls Dam no longer impounded the river. Negative impacts from the dam slowly disappear.
1935	Birth of the Conservation Era. The Soil Conservation Act was passed. This Federal policy was enacted to prevent and control soil erosion. It resulted in the formation of the Soil Conservation Service and County Land Conservation Departments. This act resulted in major improvements in the watershed but never addressed urban areas.
1936	City of River Falls upgraded the wastewater treatment facility. Wastewater effluent was discharged to the river. Capacity was 225,000 gallons per day. Water quality standards were poor at the time.
1938 UPPER RIVER	**First DNR fishery survey on the river showed the following:** Trout population was greatly reduced by habitat degradation, siltation, overgrazing and severe bank erosion. Stream is wider, sluggish and warmer. Stocking was necessary to support a trout fishery. Brown Trout were introduced to the river because they are more tolerant to warmer streams and degraded water quality. Summer temperatures reach low 70's.
MIDDLE RIVER	(City Limits) Three dams dominate the river. This area was not suited for trout or warmwater species. Water temperatures were in the high 70's, oxygen levels were often too low to support trout. City sewage was polluting the river.

LOWER RIVER	Warmwater and rough fish dominate, only a few brook trout were present in spring feeders. Oxygen was low due to high BOD from sewage. Sedimentation and gully washes were common. Fluctuating water levels from power dams impact stream. The stream lacks food, shelter and spawning habitat.
1940's	River Falls Rod and Gun Club began efforts to restore trout stream; seeking state help.
~1950	Prairie Mill Dam no longer impounds river. Negative impacts from the dam slowly disappear.
1950	State became involved in stream side conservation efforts. Worked with landowners on the upper river. Took out conservation leases, installed fences, cattle crossings, planted trees and installed trout habitat structures.
1951	City of River Falls wastewater treatment facility was overloaded. State recommends upgrade.
1955	City of River Falls submitted a plan to upgrade wastewater treatment facility.
1958	City of River Falls revised plan to upgrade wastewater treatment facility because of residential growth and Twin Cities Milk Producers.
1958	The Kinnickinnic River Fishery Area property boundary was approved. Through previous leases, perpetual easements, and fee title acquisition the state worked with cooperating landowners to restore the upper river. Eventually installed 25 miles of fence, 50 cattle crossings and numerous miles of instream habitat devises.
1963	DNR stream survey on lower river near Hwy. F showed warmwater species and a few trout.
1963	City of River Falls completed wastewater treatment facility upgrade. Capacity was 770,000 gallons per day and 1470 pounds of BOD per day. Chlorine was used as a disinfectant.
1970's	Due to stream conservation efforts beginning in the 1950's water temperatures upstream of River Falls dropped 10 degrees F during the warm season and habitat improved. Trout reproduction improved and stocking was discontinued.
1972	Congress passes the Clean Water Act. This Federal program provided funds to states and local governments to improve water quality.
1972	The state issued an order requiring the City of River Falls to upgrade wastewater treatment plant facility because of poor effluent quality.
1975	State requested dam operators to comply with state law. Hydrofacilities changed operations from peaking to run of river.

1977	Major fisheries survey showed great improvements to trout population throughout the entire river. Lower river was no longer dominated by warmwater species; brown trout were present in good numbers.
1978	United States Fish and Wildlife Service considered protecting the lower river under the Unique Wildlife Ecosystem Program. Effort fails due to lack of landowner support.
1981	City of River Falls completed wastewater treatment facility upgrade. Capacity was 1,800,000 gallons per day and 3152 pounds of BOD5.
1982	City of River Falls took action to control storm water. The city passed a Storm water Ordinance.
1985	The trout population was considered excellent throughout the stream. All populations were sustained through natural reproduction.
1990	River Falls added dechlorination facilities to the wastewater treatment facility.
1990's	Urban growth is on the rise in River Falls; bypass is built and a four lane highway linking the city to the interstate is scheduled for construction. Residential areas are developing along the Kinnickinnic River. Storm water, flooding and loss of spring activity threaten trout populations.
1990's	Signs of urbanization become evident. Bank erosion becomes evident near storm water outlets. Sedimentation from city industrial park enters river. Trout Unlimited and DNR document increased stream temperatures from storm water outfall. UW-River Falls study shows increases in suspended solids, chlorides and pH swings in a feeder stream during bypass construction. 1990 fishery survey shows brown trout year class failure.
1991	Governor Tommy Thompson and the Natural Resources board visit the Kinnickinnic River Fishery Area and the City of River Falls. Both groups viewed an example of the city's effort to protect the river from storm water.
1993	The Minnesota-Wisconsin Boundary Area Commission reports all three major tributaries entering the Lower St. Croix Riverway (Apple, Willow and Kinnickinnic) were impaired by nonpoint source water quality problems. These tributaries contribute sediment and nutrient loading to the St. Croix. Large-scale developments and incremental changes in land use threaten the ecological balance of the river and watershed.
1993	Kinnickinnic River Land Trust founded.
1993	River Falls wastewater treatment facility was operating at about 60 percent of its design capacity. Effluent quality was consistently within Wisconsin Pollution Discharge Elimination System Permit limits.

1993	UW-River Falls takes proactive approach to restore South Fork. A task force has been created to address improvements to the river corridor.
1993	State submits Stewardship plan to Natural Resources Board. Plan is designed to protect and restore streambanks and wetlands on the South Fork and Kinnickinnic River System. This is an acquisition fee title and easement program that deals with willing sellers and/or willing cooperators interested in stream conservation efforts.
1993	The City of River Falls, working with DNR, Trout Unlimited and surrounding townships, take a proactive stance to minimize storm water impacts to the river and citizenry by developing a comprehensive storm water management plan.
1994	The Storm water Management Plan is approved by the City of River Falls Planning Commission by a vote of 5 to 1. The plan will be presented to the City Council for final approval.
1995	Kinnickinnic River Watershed is designated as a Priority Watershed, and watershed planning is undertaken.

From Marty Engel, Department of Natural Resources Area Fish Manager, 1994.

Appendix B
Guidance for Watershed Stewardship

The following document was prepared by Kent Johnson, at the request of the St. Croix River Basin Water Quality Management Planning Team (St. Croix Basin Team).

Kent Johnson serves as an advisory team member of the St. Croix Basin Team, representing the Metropolitan Council, which encompass the seven counties surrounding the Minneapolis-St. Paul metropolitan area. He is also a member of the Kinnickinnic River Priority Watershed Project Steering Committee.

The St. Croix Basin Team was formed in 1993 for the purpose of developing and implementing a joint basin water quality management plan between the states of Wisconsin and Minnesota.

Membership of the St. Croix Basin Team includes representatives of the National Park Service, the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources. Additional advisory team members include the United States Geological Service, the Metropolitan Council, and the Minnesota-Wisconsin Boundary Area Commission, which serves as a facilitator.

Guidance for Watershed Stewardship
Lower St. Croix River

A Stream Protection Strategy*

Kent Johnson
Environmental Monitoring and Assessment Section
Metropolitan Council Environmental Services

December, 1998

* (From: Tom Schueler. 1995. *Site Planning for Urban Stream Protection.* Center for Watershed Protection. Ellicott City, Maryland)

Acknowledgments

Credit for the Stream Protection Strategy* and much of the supporting information in this guidance document goes to Tom Schueler of the Center for Watershed Protection in Ellicott City, Maryland. More detail on the stream protection strategy and the watershed approach to site planning can be found in Tom's publication: "Site Planning for Urban Stream Protection" (1995). Tom's innovative ideas about planning for growth in the context of stream and watershed protection can serve as a model for those seeking a sustainable balance between environment, economy, and human needs.

A Thought on Conservation and Stewardship:

"There must be some force behind conservation more universal than profit, less awkward than government, less ephemeral than sport; something that reaches into all time and places where humans live on land; something that brackets everything, from rivers to raindrops, from whales to hummingbirds, from land estates to window boxes. I can see only one such force: a respect for land as an organism; a voluntary decency in land-use exercised by every citizen and every landowner out of a sense of love for and obligation to that biota we call America. This is the meaning of conservation, and this is the task of conservation education."

- Aldo Leopold, from "*A Sand County Almanac*"

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Introduction

The Lower St. Croix River, a National Wild and Scenic Riverway, is significant for the following reasons:

- The riverway is an exceptional combination of high quality natural and historic resources, and scenic, aesthetic, and recreational values.
- These resources and values exist in a distinctive river valley setting with a strong regional identity and character.
- These resources and values exist within the expanding Twin Cities Metropolitan Area.

The management plan for the Lower St. Croix National Wild and Scenic Riverway is based on the following fundamental principles:

- The riverway must be managed cooperatively through federal, state, and local involvement.
- The river cannot be taken out of its watershed.

Water quality, one of the Lower St. Croix River's exceptional resources, is intimately linked to land use decisions within the entire St. Croix River watershed. At present, the Lower St. Croix River enjoys very good water quality, due largely to relatively undisturbed, natural conditions in the watershed.

Because of the St. Croix River's proximity to a rapidly-growing Twin Cities Metropolitan Area, however, river water quality is at risk. In 1997, the St. Croix River was named by American Rivers as one of the 20 most threatened rivers in America, because of concerns about the impacts of accelerated urban growth in the lower St. Croix watershed. Growth in the eastern Metropolitan Area and western Wisconsin promises large-scale land use changes in the watershed. Poor land use practices will result in deteriorating water quality in the Lower St. Croix River, while good land use practices will sustain water quality for generations to come.

Land use planning and water resource planning and management for the entire St. Croix River watershed (7,760 square miles) is a difficult and complex undertaking. Although federal and state agencies provide some direction, the magnitude of this task at a watershed scale is truly daunting.

Perhaps the best approach for protecting Lower St. Croix River water quality is to maintain stream water quality at a subwatershed level, through local involvement. A stream's scale, proximity, and vulnerability to land use changes make it an excellent choice for local water resources management. The preferred geographic units for local planning are the Lower St. Croix River subwatersheds, which drain individual streams. With authority for land use planning already vested in local entities, local governments and citizens have an excellent opportunity to promote stream protection at a subwatershed scale, provided stream protection is a community priority.

The Stream as the Primary Focus of Protection

A stream is a primary and important focus for protection because it integrates all aspects of the environment. When a watershed is transformed, the first impacts are often seen in the local stream. Beyond its intrinsic value as a sensitive environmental indicator, a stream is a very useful unit for local environmental management, for a number of reasons:

1. *Many communities have found that stream protection is a very clear, easily understood and well-supported local resource goal.*

The public intuitively understands the goal of stream protection. Quite simply, there is a stream in everyone's backyard. Once educated about their backyard streams, most residents place a high value on them. This can translate into the popular support needed to develop and maintain funding for stream protection.

2. *A stream exists on the same general scale as development.*

A stream is seldom located more than a quarter mile away from a development site. Consequently, it is possible to directly link the stream protection goal with the impacts generated by an individual development project. By contrast, it is much more difficult to relate impacts from individual development projects to broader regional water quality resources, such as the St. Croix River.

3. *Stream protection also provides reliable insurance that downstream water resource objectives can generally be achieved.*

Streams are the "narrowest door" in a watershed. If a community cannot protect the quality of its local stream, it cannot reasonably expect to maintain the quality of downstream lakes or the St. Croix River. Over time, the cumulative impact from hundreds of individual development sites will slowly degrade water quality at the regional scale. If streams are properly protected, a community can be more confident that downstream water quality will be maintained.

Advantages of a Stream Protection Strategy

Many communities have discovered that the stream protection strategy is a better alternative than conventional development regulations. Perhaps the greatest merit of this strategy is that it is resource-driven. The primary objective is very clear - the quality of a stream and its associated natural resource components is to be maintained or enhanced as the community develops and grows. The stream protection objective is tangible, measurable, and understandable to all the participants in the community development process.

The strategy is directly linked to the community development review process by making stream protection a priority during all stages of the development process, from the conception of how the landscape is to be altered, through the planning, design, and construction of individual projects, to the maintenance of the stream infrastructure after development is complete. Each step of the development process only proceeds when it can be reliably determined that the impacts of the development on the stream are minimal. As such, the strategy sets high performance criteria that explicitly recognize how difficult it is to maintain the quality of streams in the face of development pressure.

Another benefit of the stream protection strategy is that it typically requires an interdisciplinary approach during development review. Each development proposal must be assessed in terms of all of its short- and long-term impacts on the stream. Thus, plan reviewers must be skilled in many disciplines to craft a development plan that meets community needs, yet produces minimal change to the hydrology, morphology, water quality, habitat, and biodiversity of the stream.

The last advantage of the stream protection strategy is that it presents a clear and practical management approach toward community development. When administered properly, the strategy can greatly streamline the local review process, reduce administrative burdens on local government, and be fully responsive to the needs of developers for clear direction, timely review, and cost reduction.

The Role of Community Planning in Stream Protection

At first glance, many communities may feel that implementation of the stream protection strategy is a rather daunting challenge. In an era of fiscal austerity and local economic restraints, communities may reasonably question whether they possess enough staff, financial, and political resources to effectively implement such a strategy. While the stream protection strategy does require a strong local commitment, it is primarily a management approach to better organize *existing* staff, resources, and programs around a common objective.

The stream protection strategy also recognizes that many existing local development regulations actually work against the goal of stream protection. Therefore, the strategy is not intended to produce more rules and regulations to govern development. Rather, it seeks to reform and simplify existing ones, and substitute flexible performance criteria in the place of rigid and uniform standards.

Thus, the first step in implementing the stream protection strategy usually involves a critical analysis of existing subdivision codes and related development criteria. Nearly every community in America has a subdivision code that regulates the density and geometry of development, specifies road widths, parking, and drainage requirements, and defines resource protection areas. The subdivision code contains a series of restrictive and uniform standards that govern all aspects of development, and trigger a complex site planning process. These requirements provide little flexibility for architects, landscape architects, and engineers involved in the design and site planning for new developments. While the exact standards often vary, most subdivision codes contain rigid standards within each zoning category that mandate:

- equal sized or shaped lots
- minimum lot sizes
- frontage requirements
- fixed setbacks for front, back, and side yards
- road widths and needed right-of-ways
- road turnarounds
- sidewalks and pedestrian access
- residential and commercial parking space requirements
- prohibition of common or shared facilities, such as driveways and septic systems
- curb/gutters and storm drains
- stormwater quantity and/or quality practices
- grading to promote positive drainage

Subdivision codes have evolved to their present level of complexity over the last few decades in response to an increasingly diverse list of community concerns. Primary among these has been the need to accommodate the automobile, reduce liability, and provide emergency access. Other concerns include the need to respect privacy, reduce noise, allow for pedestrian movement, and prevent drainage problems. The underlying objective has been to standardize development practices so as to create more consistent subdivisions, to meet the goals of protecting public safety, enhancing community amenities, and preserving local property values.

It is not always clear, however, how well these complex codes are actually meeting these elusive community goals. However, it is abundantly clear that numerous aspects of subdivision code do not support better stream protection, insofar as they create needless

impervious cover or fail to provide the right of way needed to adequately protect the stream. Relatively simple code modifications often make both economic and environmental sense.

To this end, a Site Planning Roundtable sponsored by the Center for Watershed Protection has recently established twenty-two model development principles that provide design guidance for economically viable, yet environmentally sensitive development (Center for Watershed Protection, 1998a). These model development principles can provide planners, developers, and local officials with benchmarks to investigate how existing ordinances may be modified to reduce impervious cover, conserve natural areas, and prevent stormwater pollution, for better stream protection.

Using the model development principles as a starting point, communities are encouraged to re-evaluate their existing development criteria in the 12 checklist areas summarized above. In addition, recommended elements of a stream protection strategy (detailed below) can be implemented through better community planning, within the context of existing codes and criteria.

Elements of a Stream Protection Strategy:

1. Watershed-based Planning and Zoning

The future quality of the Lower St. Croix River and tributaries (streams) is fundamentally determined by the broad land use decisions made by watershed communities. It is essential that the impact of future community growth and development on water quality be seriously assessed during the community zoning or master planning process. The most appropriate planning unit for this assessment is the subwatershed. On the basis of the forecasted level of impervious cover, it is possible to devise effective and achievable strategies for river and stream protection.

Watershed planning and zoning directs proposed development to the least sensitive area, and attempts to control the amount and location of impervious cover. Some areas are designated as growth areas, while others are partly or fully protected from future development. Many communities wonder about the effect of such broad-based planning on property values and the local tax base. Recent studies, however, suggest that the effect of watershed planning is largely positive (Schueler, 1997).

As one example, land use plans that retain open space, rural landscapes, and recreational opportunities contribute to the quality of a community and region. A survey of chief executive officers has ranked quality of life as the third most important factor in locating a

new business. Citizens also rank protection of their water resources quite highly. As regional economies become increasingly competitive, a high quality-of-life ranking can provide a critical edge in attracting new businesses and residents.

The Center for Watershed Protection has recently published a rapid watershed planning handbook that features elements for effective watershed planning, presents watershed analysis tools and management options, and provides case studies of actual watershed plans (Center for Watershed Protection, 1998b).

2. Protect Sensitive Areas From Development

Key natural areas, such as streams, wetlands, floodplains, steep slopes, mature forests, critical habitat areas, and shorelines, should be protected from development through the adoption and enforcement of local ordinances. An ordinance should describe how these sensitive areas will be delineated, and how they are to be protected during site planning, construction, and post-construction stages. Other protection methods include land trusts, conservation easements, and land purchases (both public and private).

Communities have repeatedly found that property adjacent to protected wetlands, floodplains, shorelines, forests, and other natural features constitutes an excellent location for development. A sense of place is instilled by the presence of water, forest, and natural areas, and this preference is expressed in a greater willingness to pay to live near these habitats (Schueler, 1997).

As one example, two regional economic surveys have documented that conserving forests on residential and commercial sites enhances property values by an average of 6 to 15%, and increases the rate at which units are sold or leased. Other studies show that the presence of forests and natural areas measurably increases the residential property tax base, boosts property values by reducing irritating noise and dust levels and screening adjacent land uses, saves 20-25% in energy bills for heating and cooling homes and businesses, and reduces the volume of stormwater runoff.

3. Establish a River and Stream Buffer Network

To fully protect the Lower St. Croix River and tributaries, it is very advantageous to establish a riparian buffer adjacent to river and stream channels (MWCOG, 1995a). The buffer network can be regarded as a river or stream right-of-way, and is an integral element of a watershed. A riparian buffer provides shade, woody debris, leaf litter, streambank protection, pollutant removal, wildlife habitat, recreational opportunities, and a multitude of other functions and services to the river or stream .

A shoreline or stream buffer can create many market and non-market benefits for a community, particularly if it is managed as a greenway (Schueler, 1997). Nationally, buffers were thought to have a positive or neutral impact on adjacent property values in 32 of 39 communities surveyed. Buffers also reduce pollution from stormwater runoff, provide a critical stream right-of-way during floods and storms, sharply reduce the number of drainage complaints received by local public works departments, protect valuable wildlife habitat, and expand recreational opportunities, when managed as a greenway.

4. Modify Local Ordinances to Reduce Creation of Impervious Cover

A key objective in any community or watershed plan should be the reduction of impervious cover created by development. Less impervious cover translates into less stormwater runoff and lower pollutant loads (Schueler, 1994a). Planners and landscape architects can utilize a wide range of site planning tools to minimize impervious cover. In many cases, however, full utilization of these tools is limited by outdated local zoning regulations or inflexible subdivision codes. Indeed, existing subdivision codes often create needless impervious cover, in the form of wide streets, expansive parking lots, and large-lot subdivisions.

Reducing the amount of impervious cover created by subdivisions and parking lots at developments can lead to savings for municipalities and developers. Impervious cover can be minimized by modifying local subdivision codes to allow narrower or shorter roads, smaller parking lots, shorter driveways, and smaller turnarounds (Wells, 1994; Center for Watershed Protection, 1998a). These tools make both economic and environmental sense. Infrastructure- roads, sidewalks, storm sewers, utilities, etc.- normally constitutes over half the total cost of subdivision development (CH2M-Hill, 1993). Much of this infrastructure creates impervious surfaces. Thus, developers can realize significant cost savings by minimizing impervious cover. Some of the typical savings include:

- $5,000-$7,000 per space reduced in a commercial parking lot, considering lifetime costs for construction and maintenance;
- $150 for each linear foot of road that is shortened (pavement, curb and gutter, storm sewer, and utilities) (MWCOG, 1998a);
- $25-$50 for each linear foot of roadway that is narrowed (MWCOG, 1998a); and
- $10 for each linear foot of sidewalk that is eliminated.

In addition to these direct cost savings, developers will realize indirect savings. For example, costs for stormwater conveyance and treatment are a direct function of the amount of impervious cover. Thus, for each unit of impervious cover that is reduced, a developer can expect a proportionately smaller cost for stormwater conveyance and treatment.

Conservation Development

Conservation (or cluster) development provides an excellent opportunity to reduce impervious cover, while also protecting open space and natural resources, providing community recreational space, and substantially reducing development costs (Apfelbaum, et. al., 1997; MWCOG, 1998b; Schueler, 1994b). The concept underlying conservation development is to minimize lot sizes (but not necessarily reduce the total number of dwelling units) within a compact developed portion of a subdivision, while leaving the remaining portion prominently open. Housing can still consist of detached single family homes, as well as multi-family housing, or a mix of both. Conservation development creates protected open space that provides many market and non-market benefits. For example, some communities have found that conservation development:

- Can reduce subdivision impervious cover from 10-50% (depending on the original lot size and layout), thereby lowering the cost for both stormwater conveyance and treatment. This cost savings can be considerable, as the cost to treat stormwater from a single impervious acre can range from $2,000-$50,000. In addition, the ample open spaces within a conservation development provide a greater range of locations for more cost-effective stormwater management practices.
- Typically keeps from 40-80% of the total site area in permanent community open space. Much of the open area is managed as natural area, which often increases the future value of residential property in comparison to low-density subdivisions. This premium has ranged from 5-32% in communities in the Northeastern United States (Lacey and Arendt, 1990).
- Can reserve up to 15% of the site for active or passive recreation. When carefully designed, the recreation space can promote better pedestrian movement, a stronger sense of community space, and a park-like setting. Numerous studies have confirmed that homes situated near trails or parks sell for a higher price than more distant homes.
- Can reduce the capital cost of subdivision development by 10-33%, primarily by reducing the length of the infrastructure needed to serve the development (NAHB, 1986; Maryland Office of Planning, 1989, and Schueler, 1995).
- Can reduce the need to clear and grade 35-60% of the total subdivision area. Since the total cost to clear, grade, and install erosion control practices can range up to $5,000 per acre, reducing clearing can be a significant cost savings to developers (Schueler, 1995; MWCOG, 1995b).
- Provides a developer some "compensation" for lots that would otherwise have been lost due to wetland, floodplain, or other requirements. This, in turn, reduces the pressure to encroach on stream buffers and natural areas.

An indication of the potential savings associated with conservation development is provided by the Remlik Hall Farm example in Maryland (Chesapeake Bay Foundation, 1996). Cost estimates were derived for two development scenarios that result in equivalent yield to the developer. In the conventional scenario, the 490-acre farm is sub-

divided into 84 large-lot units; whereas in the conservation scenario, 52 higher-end units are located on smaller lots in three clusters. In the conservation scenario, over 85% of the site is retained in open space, as farmland, forest, and wetland, compared to 41% in the conventional scenario.

In addition to a reduction in impervious cover, a net development savings of over $600,000 was achieved for this conservation development. The total development cost for the conservation scenario is $594,550, compared to $1,229,030 for the conventional scenario. These large savings in development infrastructure (including engineering, sewer, and water) and road construction costs certainly contribute to a better bottom line. In addition, Arendt (1994) maintains that open space units sell both more rapidly and at a premium, thus increasing cash flow, which is always a prime concern for the developer.

5. Limit the Disturbance and Erosion of Soils

Perhaps the single most destructive stage during a development process occurs when vegetation is cleared and a site is graded to achieve a more buildable landscape. The potential impacts to a river or stream are particularly severe at this stage: vegetation and topsoil are removed, soils are exposed to erosion, steep slopes are cut, natural topography and drainage are altered, and sensitive areas are often disturbed (Paterson, 1994a; Schueler, 1994c). Reduction of the massive sediment pulse that inevitably occurs during construction can be achieved through a combination of clearing restrictions, erosion prevention, and sediment controls. Traditionally, many communities have focused on enforcing erosion and sediment control plans at construction sites (Paterson, 1994b), primarily through structural practices and temporary seeding. The value of non-structural practices for erosion control, such as clearing restrictions, construction sequencing, footprinting, and vegetation conservation, is increasingly being recognized (MWCOG, 1995b; Center for Watershed Protection, 1998a). Effective soil protection measures and practices should also be emphasized for agricultural and silvicultural activities in the watershed.

Current state and local requirements for erosion and sediment control (ESC) often do increase the cost of development. On a typical site, the cost to install and maintain erosion and sediment control practices can average $800-$1,500 per cleared acre per year, depending on the duration of construction and site conditions (SMBIA, 1990; Paterson et. al., 1993).

Application of other watershed protection tools, however, can help reduce the total cost for erosion and sediment control practices at a construction site. Open space conservation, buffers, and clustering can all sharply reduce the amount of clearing and grading needed at a site, thereby reducing the area that must be controlled by ESC practices.

ESC practices also provide direct and indirect benefits to both the builder and the adjacent property owner. By keeping soil on the site, a developer needs to spend less time and labor re-grading the site to meet final plan elevations, and less effort stabilizing eroded slopes. Careful phasing of construction within a subdivision can also lead to economies over the entire construction process.

6. Treat the Quantity and Quality of Stormwater Runoff

An important component of any community or watershed plan involves the use of stormwater best management practices (BMPs) to treat the quantity and quality of runoff generated by impervious surfaces (Center for Watershed Protection, 1998a). Stormwater BMPs include ponds, wetlands, filters (riparian buffers), swales, and infiltration systems that are designed to replicate predevelopment river and stream hydrology and water quality. While many recent advances have been made in stormwater BMP design, most can only partially mitigate the impacts of development on rivers and streams. While reduction of impervious cover should be the primary objective of watershed planning, stormwater BMPs can provide important complementary benefits. Stormwater BMPs are a simple solution to a complex problem, however, and cannot be expected to compensate for a lack of watershed planning, poor site design, or the absence of a river and stream buffer network. Indeed, a poorly designed or located stormwater BMP can create as many environmental problems as it was intended to solve. Stormwater BMPs require an ongoing commitment to maintenance, to ensure performance and longevity. Many communities have failed to recognize the long-term cost burden of stormwater BMP maintenance.

Stormwater BMPs are designed to remove pollutants, promote groundwater recharge, prevent streambank erosion, and control downstream flooding. Special BMP design considerations are necessary to mitigate the thermal impacts of stormwater on sensitive cold-water resources such as trout streams (Galli, 1990; Galli and Dubose, 1990; Yetman, 1991; Claytor, 199?; Johnson, 1995). Although stormwater BMPs can be quite effective, they are also among the most expensive watershed protection tools to construct and maintain. The most recent study indicates that the cost of treating the quality and quantity of stormwater runoff ranges from $2,000-$50,000 per impervious acre (Brown, 1997), emphasizing the importance of reducing impervious cover to the extent practical before applying BMPs. These construction costs do not include the cost of land used for stormwater treatment. In addition, stormwater BMPs must be maintained, and that cost burden often falls on landowners and local governments. Over a 20-25 year period, the full cost to maintain a stormwater BMP is roughly equal to its initial construction cost (Wiegand et. al., 1986).

Despite their high construction and maintenance costs, stormwater BMPs can confer several tangible economic benefits:

- Since stormwater ponds and wetlands can create a waterfront effect, stormwater management can be beneficial for developers. In a recent analysis of twenty real estate studies across the United States, the U.S. EPA (1995) found that developers could charge a per lot premium of $10,000 for homes situated next to well-designed stormwater ponds and wetlands. In addition, EPA found that office parks and apartments next to well-designed stormwater BMPs could be leased or rented at a considerable premium, and often at a much faster rate.
- In a comparison of Minnesota home prices, sale prices were nearly one-third higher for homes that had a view of a stormwater wetland, compared to homes without any "waterfront" influence (Clean Water Partnership, 1997).
- Some stormwater BMPs, such as grassed swales and bioretention areas, actually are less expensive to construct than enclosed storm drain systems, and provide better environmental results. Liptan and Kinsella-Brown (1996) documented residential and commercial case studies where the use of swales and bioretention areas reduced the cost and size of conventional storm drains needed to meet local drainage and stormwater management requirements. The more natural drainage systems eliminated the need for costly pipes, trenches, catchbasins, and access holes, while removing pollutants at the same time. Total reported savings for these projects ranged from $10,000 to $200,000.

7. Maintain Stream Protection Measures

A concerted effort is needed to inspect, maintain, and restore the river and stream protection measures listed above (**1-6**). This effort can involve:

- Maintenance of stormwater BMPs,
- Enforcement and maintenance of buffers,
- Enforcement and revision of soil erosion ordinances, and inspection of soil erosion control measures,
- Creation and revision of local ordinances and community/watershed plans, and
- River and stream restoration.

This step is often the weakest element of a stream protection strategy. It is also the most important, since river and stream protection measures must continue to function properly over many decades to achieve the desired level of protection.

8. Treat Wastewater

In many rural watersheds, new development occurs outside of water and sewer service areas, which means that wastewater must be treated on the site, usually by a septic system. To treat wastewater, septic systems must have an appropriate drainage area and soil type

to function properly. Costs associated with installing and maintaining septic systems and correcting system failures are as follows:

- The average cost of constructing a conventional septic system at a single family home situated on a large lot is about $4,500 (U.S. EPA, 1993), approximately equal to the unit cost of municipal wastewater treatment. The cost of a more innovative septic system (with a higher nutrient removal rate, a lower failure rate, or with better performance in poor soil) is 25-75% greater than a conventional system (Ohrel, 1995).
- The cost to maintain a properly functioning septic system on an individual lot is not inconsequential. The cost to inspect a septic system ranges from $50-$150 per visit, while each pumpout costs about $150-$250. The recommended pumpout frequency ranges from two to five years for a standard household tank. Over a decade, the total maintenance cost for a septic system can range from $1,000-$3,000 (Ohrel, 1995).
- There are also major costs to landowners when septic systems fail. A failed or failing septic system can decrease property values, delay the issuance of building permits, or hold up a purchase settlement (NSFC, 1995). In the event a septic system fails, homeowners can expect to pay from $3,000-$10,000 for replacement.

In rural watersheds, innovative approaches to wastewater treatment should be considered when new development is planned outside of municipal wastewater treatment service areas. Common or community septic systems, or alternatives such as constructed wetland treatment systems, should be utilized whenever possible. Alternatives to conventional septic systems are particularly compatible with conservation development, where "clustering" of homes and availability of open space favor such options as community septic systems or wetland treatment. Local utilities can also be established to operate these alternative systems for homeowners, if desired.

As an example of alternative wastewater treatment, Jackson Meadow, a conservation development in Marine-on-St. Croix, Minnesota, is proposing to use 2 two-stage, two-cell wetland treatment systems to serve 64 homes generating an average wastewater flow of 11,000 gallons per day. Using this innovative design, no wastewater will be exposed to the surface at any time during the treatment process, and no wastewater will be discharged to local surface waters.

Common or community water supply sources should also be considered for new developments in rural areas, rather than individual wells.

9. Establish an Effective Public Outreach and Education Program

To succeed, a river and stream protection effort needs broad-based support throughout the watershed. To generate and maintain this support, public outreach programs must be developed for watershed residents, emphasizing the value of the St. Croix River watershed and its natural resources, educating residents and businesses about the daily role they play

in protecting the quality of this watershed, and providing opportunities for the public to assist with protecting resource quality (appropriate lawn care practices, proper disposal of household hazardous wastes, storm drain stenciling, industrial and commercial pollution prevention programs, inspection of treatment systems, etc.).

10. Monitor River and Stream Quality

To provide feedback to watershed managers and residents on how well the stream protection strategy is achieving its objectives, ongoing water quality monitoring of the Lower St. Croix River and tributaries is needed. With a well-designed monitoring approach, spatial and temporal water quality trends can be documented, water quality issues can be identified and prioritized, water quality improvements can be measured as management programs are implemented, and the achievement of water quality goals can be demonstrated. A coordinated monitoring approach should be established, involving multiple partners (including citizens).

The Economics of Urban Sprawl vs. Stream and Watershed Protection

The Economics of Urban Sprawl

Low-density suburban development (popularly known as urban sprawl) has inexorably crept across the rural landscape, steadily transforming farms, forests, and fields into residential subdivisions, strip shopping centers, and roads. In just a few decades, growing communities can find that dozens of square miles of rural land have been transformed into impervious cover and turf. At the same time, residents discover that roads are congested, schools are overcrowded, and the sense of place that originally attracted them has greatly diminished.

Urban sprawl is also increasingly recognized as a primary factor reducing the quality of streams, lakes, and wetlands in many watersheds. A growing body of research (Schueler, 1994a) clearly documents that the creation of impervious cover accompanying new growth causes a predictable and profound decline in critical elements of aquatic ecosystems. The most disturbing component of this research is that impacts start to occur at a relatively low level of impervious cover - about ten percent. This level is roughly equivalent to the amount of impervious cover produced by large-lot residential development (one house per acre). In a state-wide study of Wisconsin streams, impacts on biological integrity became severe when urbanized land use in the watershed surpassed a threshold of 10-20% (Wang et.al., 1997). In addition to the rapid and striking decline in stream quality that can occur in a single generation of sprawl development, sprawl also degrades the quality of the rural landscape by fragmenting fields, forests, and wetland habitats, and drastically altering viewsheds.

Just as the environmental effects of sprawl development can be felt throughout ecological systems, the economic effects of sprawl are felt throughout the economy (Pelley, 1997). While these detrimental effects may be temporarily masked in a "hot" real estate market, the economic impacts will eventually emerge. Because sprawl has adverse impacts on traditional local industries such as agriculture, tourism, recreation, fisheries, and forestry, it can weaken economic diversity in the overall regional economy and reduce the multiplier effects of money generated by these businesses.

One common assumption about sprawl is that by promoting residential development, local tax revenues are increased, which ultimately lowers everyone's property taxes. Although new development certainly increases the local tax base of the community, new homes and businesses also increase the cost of municipal services such as roads, schools, water supply, wastewater treatment, stormwater collection and treatment, fire and police services, libraries, and parks and recreation. A number of economic studies (Vance and Larson, 1988; American Farmland Trust, 1992 and 1994; Hulsey, 1996) have shown that taxes from residential development do not pay the full cost of servicing it. On the average, the cost of servicing traditional residential development is about 116% of the tax revenue received. In contrast, the cost of servicing commercial development is only 32% of the tax revenue received. However, while commercial development can be an initial tax positive, it tends to attract residential development as people move to homes closer to job locations. The cost of servicing farmland, forest, and open space averages 37% of the tax revenue received. In other words, changing rural land uses to traditional residential development costs the community more than is raised in tax revenues.

Finally, communities may need to spend significant sums to repair or restore natural resources degraded by sprawl. Reactive natural resource restoration is expensive and time-consuming, with no guarantee that restoration goals can be achieved.

After several decades of study, it is apparent that sprawl development imposes significant short-term and long-term costs on local government, business, property owners, developers, and the environment. Communities are beginning to recognize that public investments should be spent to contain sprawl rather than promote it. Educating the public and elected officials about the economic and environmental consequences of sprawl is a first step toward better local choices about growth management.

The Economics of Stream and Watershed Protection

Watershed protection may be a fine idea, but how much does it cost? How does it change the bottom line for the region, the development community, landowners, and residents alike? This question is increasingly being posed to those advocating better watershed protection (Schueler, 1997).

Recognizing that people also need a place to call home, watershed protection cannot be anti-growth. Environmental sustainability must be supportive of a healthy economy and society. Conversely, watershed development does not have to be synonymous with the degradation of aquatic and other natural resources. When new growth is managed in a watershed context, homes and businesses can be located and designed to have the smallest possible impact on streams, lakes, wetlands, and other natural resources.

Planners have been proposing more compact growth patterns for many years. Regional plans for compact growth have been forged to respond to problems of sprawl by concentrating new growth around existing development centers or regions served by suburban transit. By strategically accommodating growth, compact development can preserve prime agricultural land and protect sensitive natural areas while also reducing costly construction of new infrastructure. Burchell and Listokin (1995) have defined planned growth as "an attempt to maximize development resources and limit costs by containing most growth within locations that are more efficient to service".

While few people celebrate sprawl, consumers seem to prefer a suburban lifestyle. However, this does not necessarily imply that they are satisfied with conventional large-lot subdivisions. Developers have found that well-designed cluster and traditional urban-style neighborhoods are very attractive to new home buyers. In addition, surveys have shown that residents are willing to pay a premium to live next to natural areas or park-like settings. As environmental awareness has grown among consumers, the market for environmentally friendly compact developments has expanded. Recent market surveys have tracked the ascendance of this preference for "green" or "conservation" development.

A number of economic studies (Duncan et al., 1989; Frank, 1989; Burchell, 1992) have detailed the differences between sprawl and compact growth patterns. These studies have compared costs for suburban sprawl versus more dense, mixed-use growth. While both growth patterns typically result in the same number of people and jobs, compact growth protects a greater share of farmland, forests, and natural areas. The economic studies show that compact development consumes about 45% less land, and costs 25% less for roads, 15% less for utilities, 5% less for housing, and 2% less for other fiscal impacts (Burchell and Listokin, 1995).

Many players in the local economy perceive that watershed protection can be costly, burdensome, and potentially a threat to economic vitality. Others counter that watershed protection is inextricably linked to a healthy economy. The elements of a stream protection strategy, highlighted above, are designed to protect water quality while increasing the value of existing and developable land. Also, despite lingering concern about escalating cost, recent studies have shown that the economic effect of these watershed protection tools is largely positive. Examples of the positive environmental and

economic benefits associated with some elements of a stream protection strategy are provided above. While economic research on many of the elements is somewhat sparse, much of the evidence indicates that these tools can have a positive or at least neutral economic effect, when applied properly.

The Role of Local Governments

Many players in the local economy are justifiably concerned about the economic consequences created by stream and watershed protection programs. Despite long-term benefits, stream and watershed protection efforts are both fiscally and politically challenging for local governments. How, then, can communities craft stream and watershed protection programs that achieve the broad and deep acceptance needed to overcome these challenges? Successful communities have found it important to:

- Invest early in stream and watershed education and outreach;
- Designate a single agency to champion stream and watershed protection and play a role in the development process;
- Include all stakeholders in a public process to set stream and watershed protection goals and define the scope of protection tools;
- Develop simple and practical performance criteria;
- Employ a unified and streamlined development review process;
- Be responsive to the needs of the development community for fair and timely review and "common sense" requirements;
- Provide incentives and remedies that protect the economic interests of existing landowners;
- Continually tout the economic and environmental benefits expected from stream and watershed protection;
- Institute a dedicated funding source to support stream and watershed protection, such as a stormwater utility.

The central role of local government leadership in stream and watershed protection cannot be overstated, nor can the economic implications be discounted.

Summary

The premise that carefully-managed stream protection tools can have a balanced, positive effect on the local economy is generally supported by the economic research to date. At first glance, it seems futile to calculate the intrinsic economic value of a high quality stream, a clear lake, or a forested floodplain. Calculating the "true" value of a high quality Lower St. Croix River watershed seems an even more daunting task. What is interesting about urbanizing watersheds, however, is that society measures the value it places on these resources every day, in terms of property values, real estate premiums, rental rates, stormwater utility fees, construction costs, and volunteer hours donated. While the true value of a stream may never be known, it is clear that society does not value them lightly.

The timeless real estate adage "location, location, location" underscores the importance of how people value land. Many people prefer to locate next to forests, wetlands, streams, lakes, and other natural features. More importantly, even those members of the community who do not live next to these features still recognize the important role they play in the quality of the environment and in their lives. Harnessing this sense of place is perhaps the most important element of a stream protection strategy for the Lower St. Croix River watershed.

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Appendix C
Sources of Potential Groundwater Quality Problems

Frequently detected contaminants in Wisconsin Storm water are listed below (from: Armstrong and Llena, 1992).

Group 1 - Pollutants exceeding Surface and Groundwater Criteria:

Lead [2]	Fluoranthene [3]	Bacteria [2]
Pyrene	Phenathrene	Benzo (ghi) Perylene
Benzo (a) Anthracene	Indeno (1,2,3) Pyrene	Benzo (b) Fluoranthene
Benzo (k) Fluoranthene	Fluorene	Anthracene
Acenapthlene	PCBs [3]	

Group 2 - Pollutants Exceeding Groundwater Enforcement Standards

Chromium	Bis (2-ehylhexyl) phthalate [3]
Chloride	

Pollutants exceeding enforcement standard for groundwater based on acute toxicity levels criteria not available

Group 3 - Pollutants Exceeding Groundwater Preventive Action Limits

Cadmium	Cyanazine	Arsenic
Metolachlor	Selenium	2,4-D
Antimony	Chlordane	Nitrate

Potential Groundwater Quality Problems

Previously identified potential groundwater quality problems in the Kinnickinnic River Watershed are listed below. These sites were listed in the DNR's Bureau for Remediation and Redevelopment Tracking System which lists Superfund sites, solid and hazardous waste disposal sites, leaking underground storage tank sites and reported spill sites.

Co	Name	Site Type	qq	q	section	twnshp	range
48	JACQUES SEED CO	ERP					
48	RIVER FALLS CTY LF	ERP	NW	NE	14	27	19
48	UFE INCORPORATED	ERP	NW	SW	31	28	18
48	RF UTILITIES GENERATING PLANT	ERP	NE	SW	1	27	19
48	RIVER FALLS - CEDAR ST BRIDGE	ERP	NE	NW	1	27	19
48	U W RIVER FALLS	LUST					
48	PRESZLER RESIDENCE	LUST	SE	SW	1	27	20
48	PRESCOTT CITY SHOP	LUST	NE	SW	10	26	20

Co	Name	Site Type	qq	q	section	twnshp	range
48	RIVER FALLS AIRPORT	LUST	SW	NW	7	27	18
48	RIVER FALLS CITY OF	LUST		NE	1	27	19
48	MOODYS INC	LUST					
48	U W RIVER FALLS	LUST					
48	U W RIVER FALLS	LUST					
48	CENEX LTD DBA CENEX SUPPLY	LUST					
48	CENEX SUPPLY	LUST	NE	NW	1	27	19
48	RIVER FALLS SHOP	LUST	SW	SW	16	27	18
48	PRESCOTT GAS STATION	LUST			10	26	20
48	HOLIDAY STATION STORE #008	LUST	SW	NE	1	27	
48	HAMILTON DELBERT RESIDENCE	LUST	SE	SE	4	27	
48	RIVER FALLS SCHOOL DIST BUS GARAGE	LUST					
48	SPILL AT RIVER HILLS ADDITION	LUST	SW	NW	1	27	19
48	SPILL AT 1 BLK W OF KINNI RIVER ON CLARK ST	LUST	NW	NE	1	27	19
48	SPILL AT HWY 10 NEAR THE PRESCOTT WATER TOWER	LUST	NW	NE	10	26	20
48	SPILL AT ST.CROIX RIVER-S OF KINNIKINIC ST PARK	LUST			23	27	20
48	SPILL AT 707 N MAIN - 66 STATION	LUST	SE	NE	36	28	19
48	SPILL AT S FORK KINNIKINNIC RIVER - 623 LAKE	LUST	SW	NW	6	27	18
48	WAYNE TRANSPORT	LUST					
48	SUPERSTORE	LUST					
56	FERN, DONALD	LUST	NW	NW	18	29	17
56	NORTHERN NATURAL GAS CO	LUST			13	29	18
56	WILKENS JERRY INC	LUST					
56	ST CROIX CNTY HWY DEPT	LUST					
56	HUDSON CITY GARAGE	LUST			24	29	19
56	CENEX - ROBERTS	LUST	NW	SW	22	29	18
56	ROBERTS ELEMENTARY SCHOOL	LUST	NE	SW	22	29	18
56	RUGO (RENTAL) WELL	LUST	NW	SE	36	28	19
56	ST CROIX CNTY HWY DEPT	LUST					
56	GULICH TRUCKING INC	LUST					
56	WI DOT SPIELHOUSE FLEA MART	LUST	SE	SE	25	28	19
56	WI DOT DETTMAN TRUCKING	LUST	SE	SE	25	28	19
56	WI DOT LYONS PROPERTY	LUST	SE	NW	25	28	19
56	ST CROIX CENTRAL SCHOOL DIST BUS	LUST	NW	SW	27	29	17
56	DAVES AUTO SERVICE	LUST					
56	DEISS SANITATION	LUST	SW	SW	31	28	18
56	ARROW BUILDING CENTER	LUST	SW	SE	24	28	19
56	MJ'S CIRCLE C CONVENIENCE STORE	LUST	SE	NE	36	28	19
56	SPA BAR (FORMER)	LUST	SW	SW	22	29	17
56	SPLINTER RESIDENCE	LUST	SE	NW	34	29	19
56	MOODYS SERVICE STATION (FORMER)	LUST	NE	SE	36	28	19
56	AUTO STOP 34	LUST					
56	MELGARD MONUMENT CO.	LUST	SE	NW	23	28	19
56	TROY, TOWN OF GARAGE	LUST	NE	SW	21	28	19
56	WI DOT LEE RESIDENCE	LUST	SE	SW	4	28	19
56	STENEMAN CONCRETE PRODUCTS INC	LUST	SE	NW	21	29	
56	STENEMAN CONCRETE PRODUCTS INC	LUST	SE	NW	21	29	
56	STENEMAN CONCRETE PRODUCTS INC	LUST	SE	NW	21	29	
56	MAIN STREET PIZZA & MOVIES (FORMER)	LUST	NW	SW	22	29	

Co	Name	Site Type	qq	q	section	twnshp	range
56	AUTO STOP HAMMOND	LUST	SE	SE	21	29	
56	SUPERAMERICA	LUST					
56	SPILL AT I94 W BND - HWY 12 EXIT RAMP	Spill	SW	SW	27	29	19
56	SPILL AT KINNEY RD AT I94 E BND MP 6	Spill	NE	NW	35	29	19
56	SPILL AT HWY 53 & CTY HW MM	Spill	NE	SW	36	28	19
56	SPILL AT DIVISION ST 85 YDS S OF HWY 65	Spill	NW	NW	22	29	18
56	SPILL AT 809 MAIN ST	Spill	NE	SE	36	28	19
56	SPILL AT S SHOULDER 90TH AVE 100' W CTY T	Spill	NE	NE	21	29	17
56	SPILL AT LAKE MALLALIEU	Spill	NE	NW	24	29	19
56	SPILL AT I94 MP 5 E BND DITCH	Spill	SW	SW	26	29	19
56	SPILL AT TWIN CITIES E TRUCK STOP - PARKING	Spill	SW	SW	27	29	19
56	SPILL AT TRUCK STOP	Spill	SW	SW	27	29	19
56	SPILL AT CNR OF DIVISION ST & CTH 12	Spill	NW	NE	22	29	18
56	SPILL AT MEDIAN AT MP 8	Spill	NE	NW	31	29	18
56	SPILL AT 101 S DIVISION	Spill	SE	NW	28	29	18

Appendix D
Cost Basis for Storm water Best Management Practices

Imperviousness in Existing Urban Areas: In a document provided to the DNR (spreadsheet dated July 21, 1998, from Mark Lobermeier of SEH, Inc), the existing impervious area within River Falls City limits, based on land use, is estimated to be 23%. In establishing its storm water utility, the City used the same levels of impervious cover to describe existing land use, based on the City of River Falls Water Management Plan (1995), as follows:

Single Family	30%
Two Family	38%
Multi-Family	65%
Rural Residential	5%
Industrial	72%
Commercial	85%
Public	50%
Parks	10%

Cost per impervious acre: Use of the P8 Water Quality Model yields an approximate relationship between the area of a treatment pond to meet National Urban Runoff Program Standards. One acre of pond, sized appropriately to remove 85% of the total suspended solids (TSS) and 60% of the total phosphorus (TP), would treat the runoff from about 16 acres of impervious surface. In the case of a retrofitted structural practice in an existing neighborhood, we assumed that one acre of land to be acquired will involve purchasing three homes (1/3 acre lots) as $100,000 each, or a cost of $300,000. If 80% of the acquired parcel is excavated to a depth of five feet to create a pond, the total excavation cost would be 6,500 cubic yards at the rate of $10 per cubic yard or $65,000. Adding engineering, landscaping and other miscellaneous costs, for a total of $15,000, brought the total cost of a structural retrofit to $380,000. The pond would treat the runoff from 16 acres of impervious surface, therefore the cost per impervious area treated would be $380,000 ÷ 16 acres or $25,000 per acre.

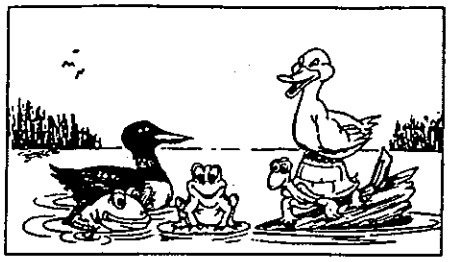
An alternative is to install a pre-cast treatment device into the drainage system within existing street rights of way. These devices will remove around 80% of the TSS but only 20-25% of the TP. One such structure, The Stormceptor® Series 7200 can treat up to 5.55 impervious acres. With an estimated installed price of $50,000 including restoration, the cost per acre is $50,000 ÷ 5.55 acres or about $10,000 per acre.

Following this methodology, the average cost is $25,000 + $10,000 = $35,000÷2 = $17,500 per impervious acre.

Appendix E
Kinni Karetakers Educational Program

The "Kinni Karetakers" is an educational program developed specifically for the Kinnickinnic River Priority Watershed, by watershed staff and an educational subgroup of the Kinnickinnic River Steering Committee. It provides curriculum guidance and activities for students at the elementary, secondary and college levels. It also provides activities for individual citizens, businesses and community groups. Kinni Karetakers provides continuity through the grade levels in learning watershed concepts, and draws upon a wide array of existing educational materials.

Kinni Karetakers



Who are Kinni Karetakers?
They are any person or group who actively helps to improve and protect the rivers, steams, lakes, and groundwater found in the Kinnickinnic River Watershed.

What do Kinni Karetakers do?
Three things: they learn, do, and share. They **learn** about water and the life that depends on it. They **do** activities that gathers information on water and helps to improve and protect it. And, they **share** what they know about water with others.

How does a person or group become a Kinni Karetaker?
If you are learning about water, doing things to protect it, and sharing what you know with others, you are already a Kinni Karetaker! If you want to be a *recognized* Kinni Karetaker, and receive a neat plaque suitable for display, you need to report on a number of learning, doing, and sharing activities.

What activities qualify?
Kinni Karetaker Activity Sheets for elementary, middle, high school, and college-aged groups are attached. Also attached are activity sheets for community groups, businesses, and individuals. Each sheet contains a listing of suggested learning, doing, and sharing activities. Kinni Karetakers are also encouraged to think up and do their own activities!

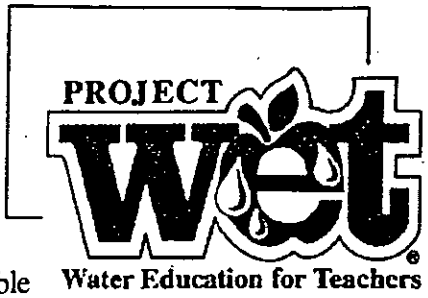
How many activities need to be done to be recognized?
Student groups are asked to do three learning, one doing, and one sharing activity. Individuals, community groups, and businesses are asked to do one learning, one doing, and one sharing activity.

Why Kinni Karetakers?
Because the Kinnickinnic River and its tributaries, surrounding lakes, and underlying groundwater will not remain healthy unless we take interest and action! Kinni Karetakers recognizes and honors those who act positively to protect our water, and serves as an encouragement for others to do the same.

For information on the Kinni Karetaker program:

Contact Tim Popple, Kinnickinnic River Watershed Project Manager, 684-2874 X130

Kinni Karetakers and *Project WET*:



Project WET (Water Education for Teachers) is an inter-disciplinary water education program designed as a supplement a school's environmental educational curriculum. Key to Project WET is the 500 page *Project WET K-12 Curriculum and Activity Guide*. Learning activities in the Kinni Karetaker program are built around Project WET. This provides teachers in grades K-12 a readily available and excellent guide for carrying out Kinni Karetaker activities.

A national program, Project WET is coordinated in Wisconsin by Libby McCann, University of Wisconsin Extension (715-346-3366). Certified Project WET trainers are available across the state to provide one-day Project WET workshops to formal (classroom) and non-formal teachers.

The Kinnickinnic River Watershed Project will be sponsoring Project WET for schools within its project area. Contact Tim Popple, 715-684-2874 X130, for more information.

Kinni Karetakers and *Water Action Volunteers (WAV)*:

Water Action Volunteers is a hands-on action guide to stream and lake protection projects for all ages. It is sponsored by the Department of Natural Resources and the University of Wisconsin - Extension and coordinated by Pam Packer, University of Wisconsin-Extension (608-264-8948).

Kinni Karetakers use the *Water Action Volunteer Activity Guide* as a source of "doing" activities.

Kinni Karetakers and Give Water a Hand:

Give Water A Hand is a national watershed education program designed to involve young people in local environmental service projects. In Wisconsin, Give Water a Hand is coordinated by Kadi Row, University of Wisconsin - Extension (800-928-3720).

Kinni Karetakers uses the *Give Water A Hand Action Guide* as a source of "doing" activities.

Other available water education resource materials:

The following pages list water education curriculum and teaching materials that may be useful in carrying out a Kinni Raver program.

Putting a Karetaker program together:

Kinnickinnic River Watershed Project staff will be more than happy to meet with interested groups and individuals to help develop a Kinni Karetaker program. They are a valuable resource in identifying available resources for carrying out specific activities. Contact Tim Popple, 715-684-2874 x130, for assistance.

Additional Water Education Curriculum / Teaching Materials

Adopt-A-Lake
Hands-on lake action projects for Wisconsin Youth

- Sponsor: University of Wisconsin Extension and WI Department of Natural Resources
- Cost: No charge
- Info: Libby McCann, 715-346-3366
  lmccann@uwspmail.uwsp.edu
  http://clean_water.uwex.edu/adoptalake/

Aquatic Resources and Angler Education
One day leader training for WI Junior and Master Angler Programs

- Sponsor: WI Department of Natural Resources
- Cost: Some costs depend on program
- Info: Steve Kinzel, 608-262-1536
  kinzel@admin.uwex.edu

The Comprehensive Water Education Book - K-6
Lessons based on a set water curriculum

- Sponsor: International Office of Water Education, Utah State University
- Cost: $8.75
- Info: 800-922-4693

Educating Young People about Water
Program planning and evaluation guides and video

- Three books: *A Guide to Goals and Resources*
  A Guide to Program Planning and Evaluation
  A Guide to Unique Program Strategies
- Video: *Planning for Fun and Success*
- Sponsor: University Extension Service, USDA
- Costs: Books $5 each, free via WWW site. Video $10.95
- Info: 800-276-0462
  elaine.andrews@ces.uwex.edu
  http://www.uwex.edu/erc/ywc/

MORE >>>

Field Manual for Water Quality Monitoring (10th Edition) - Mark Mitchell and William Stapp The standard text for school-based water quality monitoring programs in schools around the world.

- Sponsor: Global Rivers Environmental Education Network (GREEN Project)
- Cost: $19.95 (plus 10% shipping for orders under $110)
- Info: 313-761-8142
  green@green.org
  http://www.igc.apc.org/green/

Fishing for Fun and Learning

Activities to help grade 4-8 youth enjoy fishing as they develop love and respect for water resources.

- Sponsor: 4-H Youth Program, University of Wisconsin Extension
- Info: Stan Nichols, 608-262-6556
  sanichol@facstaff.uwex.edu

Give Water a Hand

Non-formal home/school/community/farm action guides

- Two books: *Youth Action Guide*
  Leader Guidebook
- Sponsor: University of Wisconsin in cooperation with partners
- Cost: $5
- Info: Kadi Row, 800-928-3720
  erc@uwex.edu
  http://www.uwex.edu/erc/

Project Aquatic WILD

Interdisciplinary hands-on aquatic wildlife K-12 classroom activities

- Book: *Project Aquatic WILD Activity Guide*
- Costs: Requires 6 hour workshop with average $15 - $25 cost
- Info: Chris Rietz, 608-267-2463
  rietzc@dnr.state.wi.us

Project WET (Water Education for Teachers)

Interdisciplinary water education school program supplement

- Book: *Project WET Curriculum and Activity Guide*
- Sponsor: The Watercourse - Montana State University
- Costs: Requires 6 hour workshop with average $15 - $25 cost
- Info: Wisconsin Project WET, 715-346-3366
  lmccann@uwspmail.uwsp.edu
  http://clean_water.uwex.edu/wet.html

MORE >>>

Self-Help Lake Monitoring

Training and equipment to volunteers who want to collect lake water data over time

- Sponsor: WI Department of Natural Resources
- Costs: No charge
- Info: Jo Tempte, 608-266-8117
  temtej@dnr.state.wi.us

Water Action Volunteers (WAV) Program

Hands-on stream and river action projects

- Book: *Water Action Volunteers*
- Sponsor: University of Wisconsin Extension and WI Department of Natural Resources
- Cost: No charge
- Info: 608-264-8948
  ppacker@facstaff.wisc.edu
  http://clean_water.uwex.edu/wav/index.html

WaterWatchers *Getting to Know Your Stream*

Guides on stream biology and watershed protection activities

- Four books: *Water Quality and Stream Biology*
  Streambank Habitat
  Watersheds
  Making Streams Better
- Sponsor: University of Wisconsin Extension, Dane County
- Cost: $5 per book.
- Info: 1-608-266-4106
  mindy.habecker@ces.uwex.edu

END

ELEMENTARY SCHOOL AGE ACTIVITIES

Kinni Karetakers Activity Sheet

Learning activities: Complete one activity from three of the seven following learning categories. The categories follow the curriculum of Project WET. Suggested Project WET activities are given in italics.

- ❑ 1. Students learn that **water is essential for all life** to exist (pick one activity):
  - Learn about the content of water in living things (*Aqua Bodies*)
  - Learn songs about water in our bodies (*Aqua Notes*)
  - Learn the role of water and membranes in living cells (*Let's Even Things Out*)
  - Learn how water is an essential factors that support life (*The Life Box*)
  - Learn about life supported by temporary wetlands (*Life in the Fast Lane*)
  - Learn how disease organisms can be spread in water (*No Bellyachers, Poison Pump*)
  - Learn how plants and animals adapt to different water conditions (*Water Address*)
  - Other - develop your own!

- ❑ 2. Students learn that **water connects all Earth systems** (pick one activity):
  - Learn about watersheds (*Branching Out!, Rainy-Day Hike*)
  - Learn the water storing function of wetlands (*Capture, Store. and Release*)
  - Learn the role of water in each of the four seasons (*A House of Seasons*)
  - Learn how water in its three phase's moves around the world (*Imagine!*)
  - Learn about the water cycle (*The Incredible Journey, Water Models*)
  - Learn how vegetation affects the movement of water (*Just Passing Through*)
  - Learn how precipitation affects human living habits (*Piece it Together*)
  - Learn about precipitation (*Poetic Precipitation, The Thunderstorm*)
  - Learn about streamside habitats (*Stream Sense*)
  - Learn about wetlands (*Wetland Soils in Living Color*)
  - Other - develop your own!

- ❑ 3. Students learn that **water is an important natural resource** (pick one activity):
  - Learn about urban runoff patterns and pollution (*A-maze-zing Water*)
  - Learn how water is a resource shared by many (*Common Water, Water Works*)
  - Learn what percent of the world's water is drinkable (*A Drop in the Bucket*)
  - Learn how moving water can do useful work (*Energetic Water*)
  - Learn how readily available water is to us for our use (*The Long Haul*)
  - Learn how individual activities affect water quality (*Sum of the Parts*)
  - Learn how much water are used in individual homes (*Water Meter*)
  - Other - develop your own!

- ☐ 4. Students learn that **water is a managed resource** (pick one activity):
  Learn economic impacts of flooding (*AfterMath*)
  Learn to plan a community around stream flow and flooding (*Back to the Future*)
  Learn about environmental restoration projects (*Humpty Dumpty*)
  Learn how aquatic insects indicate stream water quality (*Macroinvertebrate Mayhem*)
  Learn that small wastes of water adds up (*Money Down the Drain*)
  Learn about meeting water standards down to 1 ppm (*Reaching Your Limits*)
  Learn about waste water treatment (*Sparkling Water*)
  Learn about water management career (*Wet Work Shuffle*)
  Other - develop your own!

- ☐ 5. Students learn that **water resources are part of society** (pick one activity):
  Learn how water use in the 1800's and now differ (*Easy Street*)
  Learn about water use rights (*Pass the Jug*)
  Learn what is involved in guaranteeing clean water to all (*Water Bill of Rights*)
  Learn how changes in water management changed our lives (*Water Concentration*)
  Learn how waterways shaped the way our country developed (*Water Crossings*)
  Learn how water is used and valued in their community (*What's Happening*)
  Other - develop your own!

- ☐ 6. Students learn that **water resources are part of culture** (pick one activity):
  Learn how many sayings and proverbs come from water (*Raining Cats and Dogs*)
  Learn how to make an instrument that sounds like rain (*The Rainstick*)
  Learn why people find the sound and movement of water pleasing (*wAteR in moTion*)
  Learn about and re-create pre-historic water art (*Water Messages in Stone*)
  Learn to express feelings about water in writing (*Water Write*)
  Other - develop your own!

Doing activities: Complete one of the following activities. The Water Action Volunteers and Give Water a Hand programs can be used as guides. Suggested activities from the Wisconsin Water Action Volunteers Guide are given in italics.

- ☐ 1. **Stream or lake shore clean-up:** Make our streams and lakes more attractive and safer for wildlife and recreation through a clean-up event. (*Stream Cleanup*)

- ☐ 2. **Stream or lake investigations:** Visit a stream or lake and assess its health through water quality testing and habitat assessment. Complexity of assessment can vary as to age group. (*Critter Search*)

- ☐ 3. **Wetland investigation:** Visit a wetland and discover the diversity of life it supports and how it serves as a water storing "sponge".

- ❑ 4. **Storm drain stenciling:** Educate the public not to dump waste down storm drains that lead to streams and lakes by stenciling the message *Dump No Waste - Drains To Stream* next to storm drain inlets. (*Storm Drain Stenciling*)

- ❑ 5. **Water celebration:** Organize a "River Day" or "Lake Fair" that can bring fun and learning together and help the community come to a greater appreciation and understanding of water resources. (*Water Celebrations* in Project WET)

- ❑ 6. **Watershed monitors:** Monitor activities within a watershed, reporting to the proper authorities when water quality threatening activities are taking place, such as uncontrolled construction site erosion, livestock manure runoff, etc.

- ❑ 7. **Other** - develop your own!

Sharing activities: Complete one of the following activities.

- ❑ 1. Students **create posters** for public display on water use or protection issues. Posters can be entered in a state-wide environmental poster contest sponsored by County Land Conservation Departments.

- ❑ 2. Students **prepare and deliver a speech** on a water resource conservation topic. Speeches can be entered in a state-wide speech contest sponsored by County Land Conservation Departments.

- ❑ 3. Students **collect oral histories** about water resources from older community members. Oral histories can be put into writing and shared.

- ❑ 4. Students **write letters to local press** on water use or protection issues.

- ❑ 5. Student **present information**, ideas, opinions, or concerns on water resource issues to their local unit of government (town, village, city, or county) in writing or at a regularly scheduled board meeting.

- ❑ 6. Students **share knowledge** they have gained with students from lower grades.

- ❑ 7. Students **learn (or even write!) songs** that highlight water. Short plays on water can also be performed for other groups.

- ❑ 8. **Other** - develop your own!

MIDDLE SCHOOL AGE ACTIVITIES

Kinni Karetakers Activity Sheet

Learning activities: Complete one activity from three of the following seven learning categories. The categories follow the curriculum of Project WET. Suggested Project WET activities are given in italics.

- ☐ 1. Students learn that **water is essential for all life** to exist (pick one activity):
  - Learn the role of water and membranes in living cells (*Let's Even Things Out*)
  - Learn about life supported by temporary wetlands (*Life in the Fast Lane*)
  - Learn how disease organisms can be spread in water (*Poison Pump, Super Sleuths*)
  - Learn about plant transpiration and its role in the water cycle (*Thirsty Plants*)
  - Learn how plants and animals adapt to different water conditions (*Water Address*)
  - Other - develop your own!

- ☐ 2. Students learn that **water connects all Earth systems** (pick one activity):
  - Learn about watersheds (*Rainy-Day Hike*)
  - Learn about ground water (*Get the Ground Water Picture*)
  - Learn how water in its three phases moves around the world (*Imagine!*)
  - Learn about the water cycle (*The Incredible Journey, Water Models*)
  - Learn how vegetation affects the movement of water (*Just Passing Through*)
  - Learn how precipitation affects human living habits (*Piece it Together*)
  - Learn about precipitation (*Poetic Precipitation, The Thunderstorm*)
  - Learn about streamside habitats (*Stream Sense*)
  - Learn about wetlands (*Wetland Soils in Living Color*)
  - Other - develop your own!

- ☐ 3. Students learn that **water is an important natural resource** (pick one activity):
  - Learn how water is a resource shared by many (*Common Water, Water Works*)
  - Learn what percent of the world's water is drinkable (*A Drop in the Bucket*)
  - Learn how moving water can do useful work (*Energetic Water*)
  - Learn how water travel lead to important discoveries (*Great Water Journeys*)
  - Learn how readily available water is to us for our use (*The Long Haul*)
  - Learn about impact of water related natural disasters (*Nature Rules!*)
  - Learn how individual activities affect water quality (*Sum of the Parts*)
  - Learn how much water are used in individual homes (*Water Meter*)
  - Learn about acid rain (*Where Are the Frogs?*)
  - Other - develop your own!

- ☐ 4. Students learn that **water is a managed resource** (pick one activity):
  - Learn economic impacts of flooding (*AfterMath*)

Learn economic impacts of flooding (*AfterMath*)
Learn to plan a community around stream flow and flooding (*Back to the Future*)
Learn about water conservation approaches (*Every Drop Counts*)
Learn about environmental restoration projects (*Humpty Dumpty*)
Learn about ground water contamination (*A Grave Mistake, The Pucker Effect*)
Learn how aquatic insects indicate stream water quality (*Macroinvertebrate Mayhem*)
Learn that small wastes of water adds up (*Money Down the Drain*)
Learn about meeting water standards down to 1 ppm (*Reaching Your Limits*)
Learn about waste water treatment (*Sparkling Water, Super Bowl Surge*)
Learn about water management career (*Wet Work Shuffle*)
Other - develop your own!

- ☐ 5. Students learn that **water resources are part of society** (pick one activity):
  Learn about managing water as a shared limited resource (*Choices and Preferences, Dilemma Derby, Perspectives*)
  Learn how water use in the 1800's and now differ (*Easy Street*)
  Learn about water use rights (*Pass the Jug*)
  Learn about water's role in the news (*Water: Read All About It!*)
  Learn what is involved in guaranteeing clean water to all (*Water Bill of Rights*)
  Learn how changes in water management changed our lives (*Water Concentration*)
  Learn how waterways shaped the way our country developed (*Water Crossings*)
  Learn how water is used and valued in their community (*What's Happening*)
  Learn about balancing local and global, short term and long term concerns in water management (*Whose Problem Is It?*)
  Other - develop your own!

- ☐ 6. Students learn that **water resources are part of culture** (pick one activity):
  Learn how many sayings and proverbs come from water (*Raining Cats and Dogs*)
  Learn how to make an instrument that sounds like rain (*The Rainstick*)
  Learn about and create pre-historic water art (*Water Messages in Stone*)
  Learn to express feelings about water in writing (*Water Write*)
  Learn how the role of water in our present lives differs from the past (*Wish Book*)
  Other - develop your own!

Doing activities: Complete one of the following activities. The Water Action Volunteers and Give Water a Hand programs can be used as guides. Suggested activities from the Wisconsin Water Action Volunteers Guide are given in italics.

- ☐ 1. **Stream or lake shore clean-up:** Make our streams and lakes more attractive and safer for wildlife and recreation through a clean-up event. (*Stream Cleanup*)

- ☐ 2. **Stream or lake investigations:** Visit a stream or lake and assess its health through water quality testing and habitat assessment. (*Critter Search*)

- ❑ 3. **Wetland investigation:** Visit a wetland and discover the diversity of life it supports and how it serves as a water storing "sponge".

- ❑ 4. **Storm drain stenciling:** Educate the public not to dump waste down storm drains that lead to streams and lakes by stenciling the message *Dump No Waste - Drains To Stream* next to storm drain inlets. (*Storm Drain Stenciling*)

- ❑ 5. **Water celebration:** Organize a "River Day" or "Lake Fair" that can bring fun and learning together and help the community come to a greater appreciation and understanding of water resources. (*Water Celebrations* in Project WET)

- ❑ 6. **Watershed monitors:** Monitor activities within a watershed, reporting to the proper authorities when water quality threatening activities are taking place, such as uncontrolled construction site erosion, livestock manure runoff, etc.

- ❑ 7. **Other** - develop your own!

Sharing activities: Complete one of the following activities:

- ❑ 1. Students **create posters** for public display on water use or protection issues. Posters can be entered in a state-wide environmental poster contest sponsored by County Land Conservation Departments.

- ❑ 2. Students **prepare and deliver a speech** on a water resource conservation topic. Speeches can be entered in a state-wide speech contest sponsored by County Land Conservation Departments.

- ❑ 3. Students **collect oral histories** about water resources from older community members. Oral histories can be put into writing and shared.

- ❑ 4. Students **write letters to local press** on water use or protection issues.

- ❑ 5. Student **present information**, ideas, opinions, or concerns on water resource issues to their local unit of government (town, village, city, or county) in writing or at a regularly scheduled board meeting.

- ❑ 6. Students **share knowledge** they have gained with students from lower grades.

- ❑ 7. Students **learn (or even write!) songs** that highlight water. Short plays on water can also be performed for other groups.

- ❑ 8. **Other** - develop your own!

HIGH SCHOOL AGE ACTIVITIES

Kinni Karetakers Activity Sheet

Learning activities: Complete one activity from three of the following seven learning categories. The categories follow the curriculum of Project WET. Suggested Project WET activities are given in italics.

- ☐ 1. Students learn that **water is essential for all life** to exist (pick one activity):
  - Learn the role of water and membranes in living cells (*Let's Even Things Out*)
  - Learn about life supported by temporary wetlands (*Life in the Fast Lane*)
  - Learn how disease organisms can be spread in water (*Poison Pump, Super Sleuths*)
  - Learn how plants and animals adapt to different water conditions (*Water Address*)
  - Other - develop your own!

- ☐ 2. Students learn that **water connects all Earth systems** (pick one activity):
  - Learn about ground water (*Get the Ground Water Picture*)
  - Learn about the water cycle (*The Incredible Journey, Water Models*)
  - Learn how precipitation affects human living habits (*Piece it Together*)
  - Learn about precipitation (*Poetic Precipitation, The Thunderstorm*)
  - Learn about streamside habitats (*Stream Sense*)
  - Learn about wetlands (*Wetland Soils in Living Color*)
  - Other - develop your own!

- ☐ 3. Students learn that **water is an important natural resource** (pick one activity):
  - Learn about land use within a watershed (*Color Me a Watershed*)
  - Learn what percent of the world's water is drinkable (*A Drop in the Bucket*)
  - Learn how moving water can do useful work (*Energetic Water*)
  - Learn how water travel lead to important discoveries (*Great Water Journeys*)
  - Learn how readily available water is to us for our use (*The Long Haul*)
  - Learn about impact of water related natural disasters (*Nature Rules!*)
  - Learn how individual activities affect water quality (*Sum of the Parts*)
  - Learn how much water are used in individual homes (*Water Meter*)
  - Other - develop your own!

- ☐ 4. Students learn that **water is a managed resource** (pick one activity):
  - Learn to plan a community around stream flow and flooding (*Back to the Future*)
  - Learn the relationship between environmental protection and business profitability (*The CEO*)
  - Learn how the impact of water resources is reflected in literature (*Dust Bowls and Failed Levees*)
  - Learn about ground water contamination (*A Grave Mistake, The Pucker Effect*)

Learn about ground water contamination (*A Grave Mistake, The Pucker Effect*)
Learn how aquatic insects indicate stream water quality (*Macroinvertebrate Mayhem*)
Learn about the cost of providing clean water to a community (*The Price is Right*)
Learn about waste water treatment (*Sparkling Water, Super Bowl Surge*)
Learn about water management career (*Wet Work Shuffle*)
Other - develop your own!

- ❑ 5. Students learn that **water resources are part of society** (pick one activity):
  Learn about managing water as a shared limited resource (*Choices and Preferences, Dilemma Derby, Perspectives, Hot Water*)
  Learn how water use in the 1800's and now differ (*Easy Street*)
  Learn about water use rights (*Pass the Jug*)
  Learn about water's role in the news (*Water: Read All About It!*)
  Learn what is involved in guaranteeing clean water to all (*Water Bill of Rights*)
  Learn about water law (*Water Court*)
  Learn how waterways shaped the way our country developed (*Water Crossings*)
  Learn how water is used and valued in their community (*What's Happening*)
  Learn about balancing local and global, short term and long term concerns in water management (*Whose Problem Is It?*)
  Other - develop your own!

- ❑ 6. Students learn that **water resources are part of culture** (pick one activity):
  Learn how many sayings and proverbs come from water (*Raining Cats and Dogs*)
  Learn how to make an instrument that sounds like rain (*The Rainstick*)
  Learn to express feelings about water in writing (*Water Write*)
  Learn how the role of water in our present lives differs from the past (*Wish Book*)
  Other - develop your own!

Doing activities: Complete one of the following activities. The Water Action Volunteers and Give Water a Hand programs can be used as guides. Suggested activities from the Wisconsin Water Action Volunteers Guide are given in italics.

- ❑ 1. **Stream or lake shore clean-up:** Make our streams and lakes more attractive and safer for wildlife and recreation through a clean-up event. (*Stream Cleanup*)

- ❑ 2. **Stream or lake investigations:** Visit a stream or lake and assess its health through water quality testing and habitat assessment. Complexity of assessment can vary as to age group. (*Critter Search*)

- ❑ 3. **Wetland investigation:** Visit a wetland and discover the diversity of life it supports and how it serves as a water storing "sponge".

- ❑ 4. **Storm drain stenciling:** Educate the public not to dump waste down storm drains that lead to streams and lakes by stenciling the message *Dump No Waste - Drains To Stream* next to storm drain inlets. (*Storm Drain Stenciling*)

- ❑ 5. **Water celebration:** Organize a "River Day" or "Lake Fair" that can bring fun and learning together and help the community come to a greater appreciation and understanding of water resources. (*Water Celebrations* in Project WET)

- ❑ 6. **Watershed monitors:** Monitor activities within a watershed, reporting to the proper authorities when water quality threatening activities are taking place, such as uncontrolled construction site erosion, livestock manure runoff, etc.

- ❑ 7. **Other** - develop your own!

Sharing activities: Complete one of the following activities:

- ❑ 1. Students **create posters** for public display on water use or protection issues. Posters can be entered in a state-wide environmental poster contest sponsored by County Land Conservation Departments.

- ❑ 2. Students **prepare and deliver a speech** on a water resource conservation topic. Speeches can be entered in a state-wide speech contest sponsored by County Land Conservation Departments.

- ❑ 3. Students **collect oral histories** about water resources from older community members. Oral histories can be put into writing and shared.

- ❑ 4. Students **write letters to local press** on water use or protection issues.

- ❑ 5. Student **present information**, ideas, opinions, or concerns on water resource issues to their local unit of government (town, village, city, or county) in writing or at a regularly scheduled board meeting.

- ❑ 6. Students **share knowledge** they have gained with students from lower grades.

- ❑ 7. Students **learn (or even write!) songs** that highlight water. Short plays on water can also be performed for other groups.

- ❑ 8. Students **develop a WWW site** for sharing water resource information.

- ❑ 9. **Other** - develop your own!

COLLEGE AGE ACTIVITIES

Kinni Karetakers Activity Sheet

Learning activities: Complete one activity for three of the following seven learning categories. Flexibility is given to students and instructors in selecting learning activities that best fit class requirements.

- ☐ 1. Students learn that **water is essential for all life** to exist.
- ☐ 2. Students learn that **water connects all Earth systems.**
- ☐ 3. Students learn that **water is an important natural resource.**
- ☐ 4. Students learn that **water is a managed resource.**
- ☐ 5. Students learn that **water resources are part of society.**
- ☐ 6. Students learn that **water resources are part of culture.**

Doing activities: Complete one of the following activities. The Water Action Volunteers and Give Water a Hand programs can be used as guides. Suggested activities from the Wisconsin Water Action Volunteers Guide are given in italics.

- ☐ 1. **Stream or lakeshore clean-up:** Make our streams and lakes more attractive and safer for wildlife and recreation through a clean-up event. (*Stream Cleanup*)
- ☐ 2. **Stream or lake investigations:** Visit a stream or lake and assess its health through water quality testing and habitat assessment.
- ☐ 3. **Wetland investigation:** Visit a wetland and discover the diversity of life it supports and how it serves as a water storing "sponge".
- ☐ 4. **Storm drain stenciling:** Educate the public not to dump waste down storm drains that lead to streams and lakes by stenciling the message *Dump No Waste - Drains To Stream* next to storm drain inlets. (*Storm Drain Stenciling*)
- ☐ 5. **Water celebration:** Organize a "River Day" or "Lake Fair" that can bring fun and learning together and help the community come to a greater appreciation and understanding of water resources. (*Water Celebrations* in Project WET)

- ☐ 6. **Watershed monitors:** Monitor activities within a watershed, reporting to the proper authorities when water quality threatening activities are taking place, such as uncontrolled construction site erosion, livestock manure runoff, etc.

- ☐ 7. **Other** - develop your own!

Sharing activities: Complete one of the following activities:

- ☐ 1. Students **create posters** for public display on water use or protection issues.

- ☐ 2. Students **prepare and deliver a speech** on a water resource conservation topic.

- ☐ 3. Students **collect oral histories** about water resources from older community members. Oral histories can be put into writing and shared.

- ☐ 4. Students **write letters to local press** on water use or protection issues.

- ☐ 5. Student **present information**, ideas, opinions, or concerns on water resource issues to their local unit of government (town, village, city, or county) in writing or at a regularly scheduled board meeting.

- ☐ 6. Students **share knowledge** they have gained with students from lower grades.

- ☐ 7. Students **learn (or even write!) songs** that highlight water. Short plays on water can also be performed for other groups.

- ☐ 8. Students **develop a WWW site** for sharing water resource information.

- ☐ 9. **Other** - develop your own!

Kinni Karetakers Activity Sheet

Learning activities: Complete an activity from one of the following seven learning categories. Flexibility is given as to how the learning is done - it could be from reading a book or article, attending a workshop, interviewing a specialist, or taking a class.

- ☐ 1. Learn that **water is essential for all life** to exist.
- ☐ 2. Learn that **water connects all Earth systems.**
- ☐ 3. Learn that **water is an important natural resource.**
- ☐ 4. Learn that **water is a managed resource.**
- ☐ 5. Learn that **water resources are part of society.**
- ☐ 6. Learn that **water resources are part of culture.**

Doing activities: Complete one of the following activities either individually or part of a group event. The Water Action Volunteers and Give Water a Hand programs can be used as guides. Suggested activities from the Wisconsin Water Action Volunteers Guide are given in italics.

- ☐ 1. **Stream or lakeshore clean-up:** Make our streams and lakes more attractive and safer for wildlife and recreation through a clean-up event. (*Stream Cleanup*)
- ☐ 2. **Stream or lake investigations:** Visit a stream or lake and assess its health through water quality testing and habitat assessment. (*Critter Search*)
- ☐ 3. **Wetland investigation:** Visit a wetland and discover the diversity of life it supports and how it serves as a water storing "sponge".
- ☐ 4. **Storm drain stenciling:** Educate the public not to dump waste down storm drains that lead to streams and lakes by stenciling the message *Dump No Waste - Drains To Stream* next to storm drain inlets. (*Storm Drain Stenciling*)
- ☐ 5. **Water celebration:** Organize a "River Day" or "Lake Fair" that can bring fun and learning together and help the community come to a greater appreciation and understanding of water resources. (*Water Celebrations* in Project WET)

- ☐ 6. **Watershed monitors:** Monitor activities within a watershed, reporting to the proper authorities when water quality threatening activities are taking place, such as uncontrolled construction site erosion, livestock manure runoff, etc.

- ☐ 7. **Project helper:** Assist another group or individual in their water resource protection or improvement project by helping out as a supervisor, assistant, or supplier of goods or services.

- ☐ 8. **Other** - develop your own!

Sharing activity: Share in some way information about how water resources can be protected or improved. It could be a presentation to a club you belong to, a section in your annual holiday letter to family and friends, or a letter to the newspaper. What it is does not matter just as long as at least one other person learns a bit more about water resources.

- ☐ Describe your selected sharing activity here:

_____

_____

_____

COMMUNITY GROUP OR BUSINESS ACTIVITIES

Kinni Karetakers Activity Sheet

Learning activities: Complete an activity from one of the following seven learning categories. Flexibility is given as to how the learning is done - the easiest would be having a speaker or school group make a presentation to your group or staff. A sharing activity for one group could be a learning activity for yours!

- ☐ 1. Learn that **water is essential for all life** to exist.
- ☐ 2. Learn that **water connects all Earth systems.**
- ☐ 3. Learn that **water is an important natural resource.**
- ☐ 4. Learn that **water is a managed resource.**
- ☐ 5. Learn that **water resources are part of society.**
- ☐ 6. Learn that **water resources are part of culture.**

Doing activities: Complete one of the following activities. The Water Action Volunteers and Give Water a Hand programs can be used as guides. Suggested activities from the Wisconsin Water Action Volunteers Guide are given in italics.

- ☐ 1. **Stream or lakeshore clean-up:** Make our streams and lakes more attractive and safer for wildlife and recreation through a clean-up event. (*Stream Cleanup*)
- ☐ 2. **Stream or lake investigations:** Visit a stream or lake and assess its health through water quality testing and habitat assessment. (*Critter Search*)
- ☐ 3. **Wetland investigation:** Visit a wetland and discover the diversity of life it supports and how it serves as a water storing "sponge".
- ☐ 4. **Storm drain stenciling:** Educate the public not to dump waste down storm drains that lead to streams and lakes by stenciling the message *Dump No Waste - Drains To Stream* next to storm drain inlets. (*Storm Drain Stenciling*)
- ☐ 5. **Water celebration:** Organize a "River Day" or "Lake Fair" that can bring fun and learning together and help the community come to a greater appreciation and

understanding of water resources. (*Water Celebrations* in Project WET)

- ☐ 6. **Watershed monitors:** Monitor activities within a watershed, reporting to the proper authorities when water quality threatening activities are taking place, such as uncontrolled construction site erosion, livestock manure runoff, etc.

- ☐ 7. **Project helper:** Assist another group or individual in their water resource protection or improvement project by helping out as a supervisor, assistant, or supplier of goods or services.

- ☐ 8. **Other** - develop your own!

Sharing activity: Share in some way information about how water resources can be protected or improved. It could be a section in your group's or business' newsletter or WWW site, an article in the newspaper, or a poster display.

- ☐ Describe your selected sharing activity here:

_____

_____

_____

Priority Watershed Projects in Wisconsin: 1998

REV. 7/98

Year Selected-Map Number	Large-scale Priority Watershed Project	County(ies)
79-1	Galena River ♦	Grant, Lafayette
79-2	Elk Creek ♦	Trempealeau
79-3	Hay River ♦	Barron, Dunn
79-4	Lower Manitowoc River ♦	Manitowoc, Brown
79-5	Root River ♦	Racine, Milwaukee, Waukesha
80-1	Onion River ♦	Sheboygan, Ozaukee
80-2	Sixmile-Pheasant Branch Creek ♦†	Dane
80-3	Big Green Lake ♦	Green Lake, Fond du Lac
80-4	Upper Willow River ♦	Polk, St. Crox
81-1	Upper West Branch Pecatonica River ♦	Iowa, Lafayette
81-2	Lower Black River ♦	La Crosse, Trempealeau
82-1	Kewaunee River ♦	Kewaunee, Brown
82-2	Turtle Creek ♦	Walworth, Rock
83-1	Oconomowoc River ♦	Waukesha, Washington, Jefferson
83-2	Little River ♦	Oconto, Marinette
83-3	Crossman Creek/Little Baraboo River ♦	Sauk, Juneau, Richland
83-4	Lower Eau Claire River ♦	Eau Claire
84-1	Beaver Creek ♦	Trempealeau, Jackson
84-2	Upper Big Eau Pleine River ♦	Marathon, Taylor, Clark
84-3	Sevenmile-Silver Creeks ♦	Manitowoc, Sheboygan
84-4	Upper Door Peninsula ♦	Door
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge, Ozaukee
84-6	North Branch Milwaukee River	Sheboygan, Washington, Ozaukee, Fond du Lac
84-7	Milwaukee River South	Ozaukee, Milwaukee
84-8	Cedar Creek	Washington, Ozaukee
84-9	Menomonee River	Milwaukee, Waukesha, Ozaukee, Washington
85-1	Black Earth Creek	Dane
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet
85-3	Waumandee Creek	Buffalo
86-1	East River	Brown, Calumet
86-2	Yahara River - Lake Monona	Dane
86-3	Lower Grant River	Grant
89-1	Yellow River	Barron
89-2	Lake Winnebago East	Calumet, Fond du Lac
89-3	Upper Fox River (Ill.)	Waukesha
89-4	Narrows Creek - Baraboo River	Sauk
89-5	Middle Trempealeau River	Trempealeau, Buffalo
89-6	Middle Kickapoo River	Vernon, Monroe, Richland
89-7	Lower East Branch Pecatonica River	Green, Lafayette
90-1	Arrowhead River & Daggets Creek	Winnebago, Outagamie, Waupaca
90-2	Kinnickinnic River (Milwaukee Basin)	Milwaukee
90-3	Beaverdam River	Dodge, Columbia, Green Lake
90-4	Lower Big Eau Pleine River	Marathon
90-5	Upper Yellow River	Wood, Marathon, Clark
90-6	Duncan Creek	Chippewa, Eau Claire
91-1	Upper Trempealeau River	Jackson, Trempealeau
91-2	Neenah Creek	Adams, Marquette, Columbia
92-1	Balsam Branch	Polk
92-2	Red River - Little Sturgeon Bay	Door, Brown, Kewaunee
93-1	South Fork Hay River	Dunn, Polk, Barron, St. Croix
93-2	Branch River	Manitowoc, Brown
93-3	Soft Maple/Hay Creek	Rusk
93-4	Tomorrow/Waupaca River	Portage, Waupaca, Waushara
94-1	Duck Creek	Outagamie, Brown
94-2	Apple/Ashwaubenon Creeks	Outagamie, Brown
94-3	Dell Creek	Sauk, Juneau
94-4	Pensaukee River	Shawano, Oconto
94-5	Spring Brook	Langlade, Marathon
94-6	Sugar/Honey Creeks	Walworth, Racine
95-1	Pigeon River	Manitowoc, Sheboygan
95-2	Middle Peshtigo/Thunder Rivers	Marinette, Oconto
95-3	Fond du Lac River	Fond du Lac, Winnebago
95-4	Lower Rib River	Marathon
95-5	Kinnickinnic River (St. Croix Basin)	St. Croix, Pierce
95-6	Lower Little Wolf	Waupaca
95-7	Pine & Willow Rivers	Waushara, Winnebago

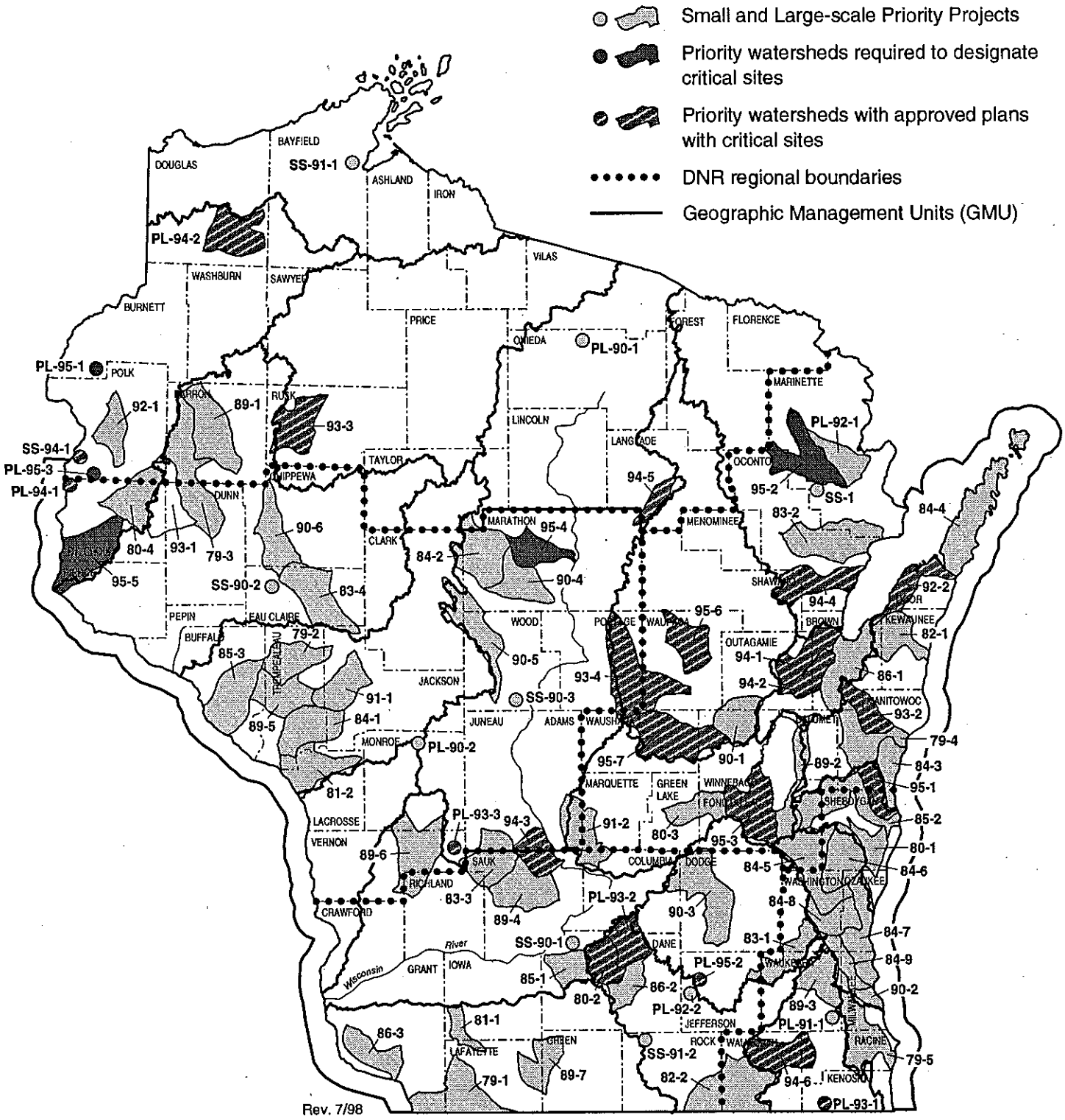
Year Selected-Map Number	Small-scale Priority Watershed Project	County(ies)
SS-1	Bass Lake ♦	Marinette
SS-90-1	Dunlap Creek	Dane
SS-90-2	Lowes Creek	Eau Claire
SS-90-3	Port Edwards - Groundwater Prototype ♦	Wood
SS-91-1	Whittlesey Creek	Bayfield
SS-91-2	Spring Creek	Rock
SS-94-1	Osceola Creek	Polk

Year Selected-Map Number	Priority Lake Project	County(ies)
PL-90-1	Minocqua Lake ♦	Oneida
PL-90-2	Lake Tomah	Monroe
PL-91-1	Little Muskego, Big Muskego, Wind Lakes	Waukesha, Racine, Milwaukee
PL-92-1	Lake Noquebay	Marinette
PL-92-2	Lake Ripley	Jefferson
PL-93-1	Camp/Center Lakes	Kenosha
PL-93-2	Lake Mendota	Dane, Columbia
PL-93-3	Hillsboro	Vernon
PL-94-1	St. Croix County Lakes Cluster	St. Croix
PL-94-2	Upper St. Croix/Eau Claire River	Douglas
PL-95-1	Big Wood Lake	Burnett, Polk
PL-95-2	Rock Lake	Jefferson
PL-95-3	Horse Creek	Polk, St. Croix

♦ Project completed

† Sixmile-Pheasant Branch is being redone as part of the Lake Mendota project (PL-93-2).

Priority Watershed Projects in Wisconsin



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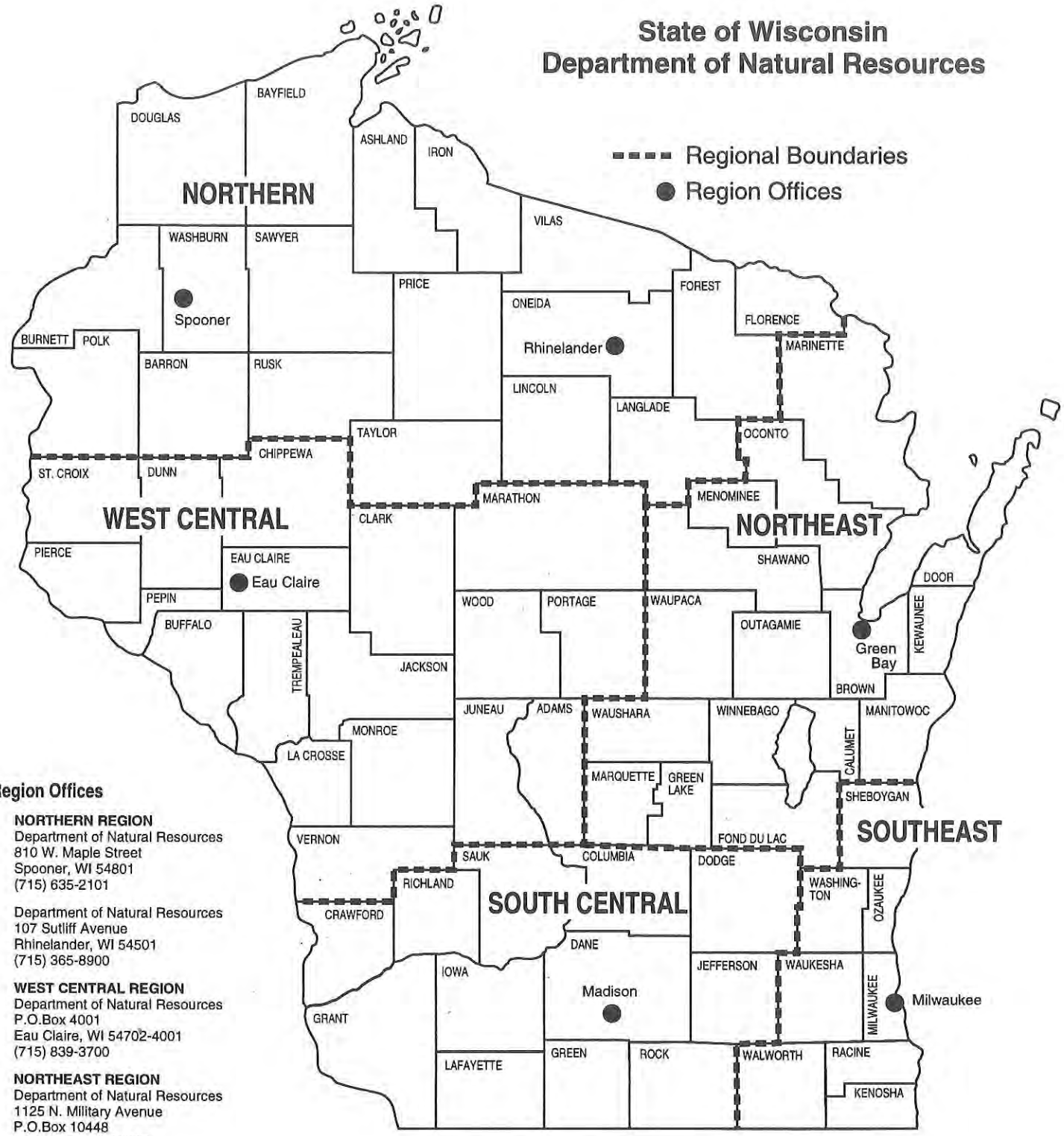

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810 W. Maple Street
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107 Sutliff Avenue
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Department of Natural Resources
1125 N. Military Avenue
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Department of Natural Resources
2300 N. Dr. Martin Luther King Jr. Dr.
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SOUTH CENTRAL REGION
Department of Natural Resources
3911 Fish Hatchery Road
Fitchburg, WI 53711
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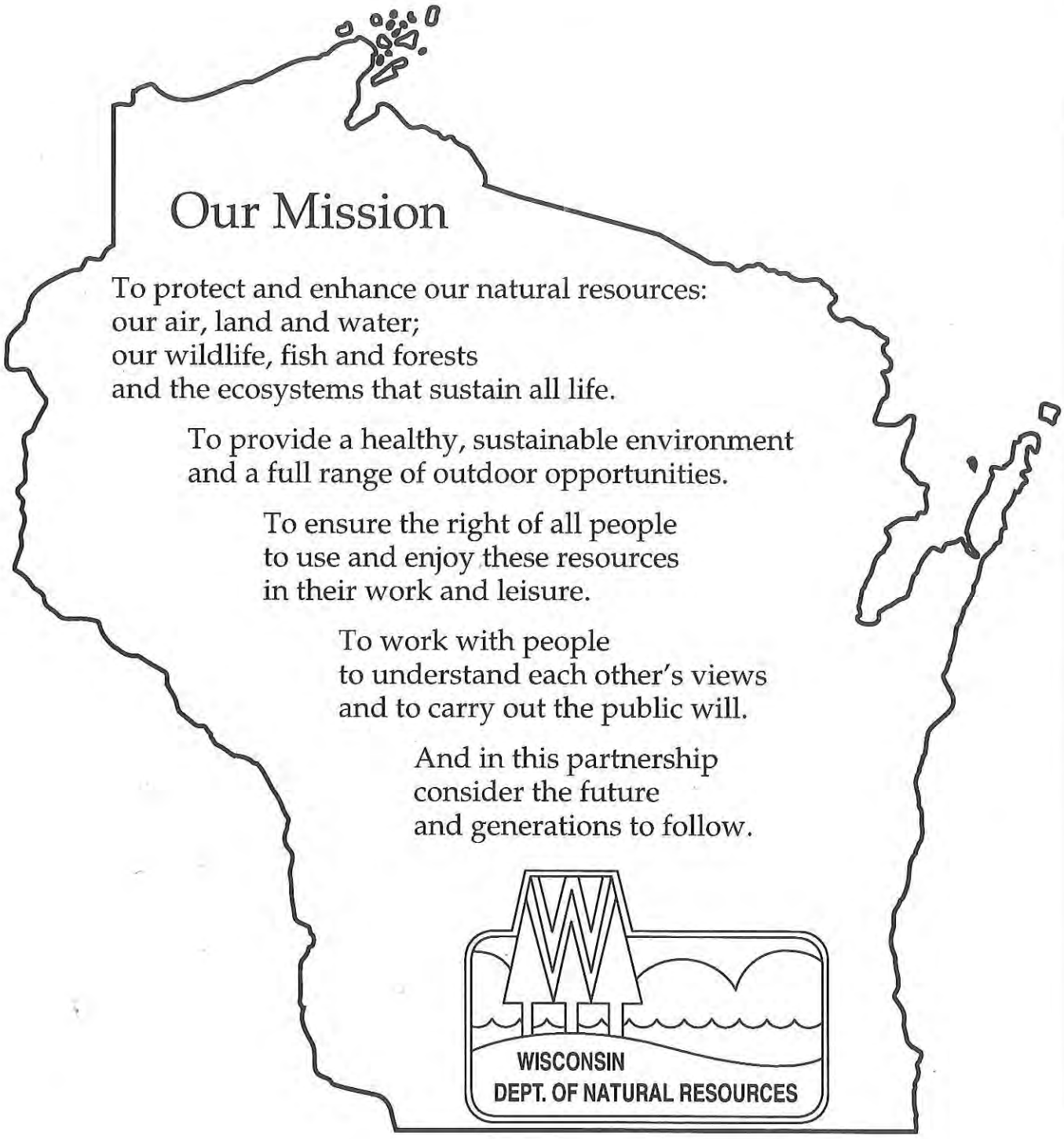

Our Mission

To protect and enhance our natural resources:
our air, land and water;
our wildlife, fish and forests
and the ecosystems that sustain all life.

To provide a healthy, sustainable environment
and a full range of outdoor opportunities.

To ensure the right of all people
to use and enjoy these resources
in their work and leisure.

To work with people
to understand each other's views
and to carry out the public will.

And in this partnership
consider the future
and generations to follow.

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