Nonpoint Source Control Plan for the Duck, Apple and Ashwaubenon Creeks 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, the Brown County Land Conservation Department, the Outagamie Land Conservation Department, and the Oneida Nation Planning Department.

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This plan is dedicated to the memory of

Becky Wallace,

a friend.

Nonpoint Source Control Plan for the Duck, Apple and Ashwaubenon Creeks Priority Watershed Project

The Wisconsin Nonpoint Source Water Pollution Abatement Program

JUNE, 1997

This Plan Was Cooperatively Prepared By:

Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade and Consumer Protection
and
Outagamie County Land Conservation Department
Brown County Land Conservation Department
Oneida Nation Planning Department

Publication WT-493-97

For copies of this document please contact:

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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.

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June 3, 1997

Mr. Ken Webster, Chair
Oneida Nation Environmental Resources Board
P.O. Box 365
Oneida, WI 54155

Ken

Dear Mr. Webster:

I am pleased to approve the Duck/Apple/Ashwaubenon Creeks Priority Watershed Plan. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection. This plan went before the Land and Water Conservation Board on June 3, 1997 and was approved at that time. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program. I am also approving the plan as an amendment to the Lower Fox River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Oneida Nation staff that participated in preparing the plan. We look forward to assisting the Oneida Nation and other units of government in the watershed in implementing the plan.

Sincerely,

George

Good luck on your project

George E. Meyer
Secretary

cc: Dr. Ron Baba - Oneida Nation
Jeff Sanders - Oneida Nation
Len Olson - DATCP
John Young - NER
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June 3, 1997

Mr. Robert N. Paltzer Jr., Chair
Outagamie County Land Conservation Committee
3365 W. Brewster St.
Appleton, WI 54914-1602

Bob

Dear Mr. Paltzer:

I am pleased to approve the Duck/Apple/Ashwaubenon Creeks Priority Watershed Plan. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection. This plan went before the Land and Water Conservation Board on June 3, 1997 and was approved at that time. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program. I am also approving the plan as an amendment to the Lower Fox River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Outagamie County staff that participated in preparing the plan. We look forward to assisting Outagamie County and other units of government in the watershed in implementing the plan.

Sincerely,

George

Good luck on your project.

George E. Meyer
Secretary

cc: Roy Burton - Outagamie County LCD
Len Olson - DATCP
John Young - NER
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June 3, 1997

Mr. Merlin Vandenplas, Chair
Brown County Land Conservation Committee
1150 Bellevue St.
Green Bay, WI 54302

Merlin

Dear Mr. Paltzer:

I am pleased to approve the Duck/Apple/Ashwaubenon Creeks Priority Watershed Plan. This plan meets the intent and conditions of s. 281.65, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan has been reviewed by the Department of Agriculture, Trade and Consumer Protection. This plan went before the Land and Water Conservation Board on June 3, 1997 and was approved at that time. My approval of the watershed plan completes the plan approval process as set forth in Wisconsin Statutes and allows the granting of funds through the Nonpoint Source Water Pollution Abatement Program. I am also approving the plan as an amendment to the Lower Fox River Basin Areawide Water Quality Management Plan.

I would like to express the Department's appreciation to the Brown County staff that participated in preparing the plan. We look forward to assisting Brown County and other units of government in the watershed in implementing the plan.

Sincerely,

George

Good luck on your project

George E. Meyer
Secretary

cc: Bill Hafs - Brown County LCD
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Oneida Tribe of Indians of Wisconsin

Post Office Box 365

Phone: (414) 869-2214

Oneida, WI 54155

Oneidas bringing several hundred bags of corn to Washington's starving army at Valley Forge, after the colonists had consistently refused to aid them.

UGWA DEMOLUM YATEHE Because of the help of this Oneida Chief in cementing a friendship between the six nations and the colony of Pennsylvania, a new nation, the United States was made possible.

RECEIVED
2 1997
WATERSHED MANAGEMENT

RESOLUTION NO 05-28-97C

Approval of the Duck-Apple-Ashwaubenon Creeks Priority Watershed Project

WHEREAS, the Oneida Tribe of Indians of Wisconsin is a federally recognizedIndian Government and a treaty tribe recognized by the laws of theUnited States, and

WHEREAS, the Oneida General Tribal Council is the governing body of the Oneida Tribe of Indians of Wisconsin, and

WHEREAS, the Oneida Business Committee has been delegated the authority of Article IV, Section 1 of The Oneida Tribal Constitution by the Oneida Tribal Council, and

WHEREAS, the Duck Creek and Apple Ashwaubenon Creeks projects were designated as "priority watersheds" in 1994 under the Wisconsin Nonpoint Source Water Pollution Abatement Program, and

WHEREAS, the Oneida Nation Water Resources Ordinance of May 8, 1996 designated the Duck-Apple-Ashwaubenon Creeks watershed as a priority watershed, and

WHEREAS, the Oneida Nation Planning Department, in cooperation with the Brown and Outagamie County Land Conservation Departments, the Wisconsin Department of Natural Resources, and the Wisconsin Department of Agriculture, Trade, and Consumer Protection, conducted and completed a detailed inventory of the land use and pollution sources within these watersheds in 1995 and 1996, and

WHEREAS, a draft of the plan has been available for review and comments were accepted at a community meeting held May 20, 1997, and

WHEREAS, the implementation of this plan will provide both technical assistance and cost-shared monies to the Oneida Tribe for the installation of conservation practices designed to reduce the source of nonpoint pollution and protect and improve the quality of the waters of the Oneida Reservation.

NOW THEREFORE BE IT RESOLVED: That the Oneida Business Committee does hereby approve the "Duck Creek and Apple-Ashwaubenon Creeks Priority Watershed Plan" and recommends that the implementation of the plan begin as soon as possible.

CERTIFICATION

I, the undersigned, as Secretary of the Oneida Business Committee, hereby certify that the Oneida Business Committee is composed of 9 members of whom 5 constitute a quorum. 9 members were present at a meeting duly called, noticed and held on the 28th day of May, 1997 : that the foregoing resolution was duly adopted at such a meeting by a vote of 8 members for; 0 members against, and 0 members not voting; and that said resolution has not been rescinded or amended in any way.

JULIE BARTON, TRIBAL SECRETARY
ONEIDA TRIBE OF INDIANS OF WISCONSIN

MAY 16 1997

RESOLUTION NO. 12--1997-1998

TO THE HONORABLE, THE OUTAGAMIE COUNTY BOARD OF SUPERVISORS

LADIES & GENTLEMEN:

MAJORITY

The Duck, Apple and Ashwaubenon Creeks Priority Watershed Project, authorized and funded through the Wisconsin Nonpoint Source Water Pollution Abatement Program, §144.25 Wis. Stats., and NR 120 Wis. Admin. Code, was previously accepted by the Outagamie County Board. The Outagamie County Land Conservation Department, Brown County Land Conservation Department, the Oneida Nation, and the Watershed Project Citizens Advisory Committee, along with the Wis. Department of Natural Resources and the Wis Department of Agriculture, Trade and Consumer Protection, worked cooperatively to prepare a pollution control plan for the DAA Watershed Project. This resolution approves of the plan and authorizes the submission of a grant application for the installation of the Best Management Practices for the DAA Watershed Project.

NOW, THEREFORE, the undersigned members of the Agriculture, Extension Education, Zoning & Land Conservation Committee recommend adoption of the following resolution.

BE IT RESOLVED, that the Outagamie County Board of Supervisors does approve of the Non-Point Source Pollution Control Plan as presented for the Duck, Apple, Ashwaubenon Creeks Priority Watershed Project (DAA), and

BE IT FURTHER RESOLVED, that the Outagamie County Board of Supervisors does also authorize the submission of a grant application for the DAA Watershed Project funding from Wisconsin Department of Natural Resources, and

BE IT STILL FURTHER RESOLVED, that the Outagamie County Board of Supervisors shall be required to accept said grant in resolution form should the DAA Priority Watershed receive the grant, and

BE IT FINALLY RESOLVED, that the Outagamie County Clerk be directed to forward a copy of this resolution to the Outagamie County Land Conservationist for inclusion with the grant application.

Dated this 13 day of May, 1997.

Respectfully submitted,
AGRICULTURE, EXTENSION EDUCATION, ZONING & LAND CONSERVATION COMMITTEE

Robert N. Paltzer, Jr.

Dale Nichols

James R. Pleuss

Marvin Obry

Lawrence Brockman

Duly and officially adopted by the County Board on: May 13, 1997

Signed: Marvin J. Fox
Board Chairperson

James D. Hensel
County Clerk

Approved: 5/15/97

Vetoed: _____

Signed: _____
County Executive

May 21, 1997

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COPY FOR YOUR INFORMATION
From
BROWN COUNTY CLERK
DARLENE K. MARCELLE

TO: THE HONORABLE CHAIRMAN AND MEMBERS
OF THE BROWN COUNTY BOARD OF SUPERVISORS

Ladies & Gentlemen:

Resolution Relating to the Approval of the Duck, Apple Ashwaubenon Priority Watershed Plan

WHEREAS, the Duck Creek and Apple Ashwaubenon Creeks projects were designated as "priority watersheds" in 1994 under the Wisconsin Nonpoint Source Water Pollution Abatement Program, and

WHEREAS, the Brown County Land Conservation Department, Outagamie County Land Conservation Department and the Oneida Nation Planning Department, in cooperation with the Wisconsin Department of Natural Resources and Wisconsin Department o Agriculture, Trade & Consumer Protection, conducted and completed a detailed inventory of the land use and pollution sources within these watersheds in 1995 and 1996, and

WHEREAS, a priority watershed plan has been prepared which assesses the existing water quality and watershed conditions, identifies the management practices, and actions necessary to improve and protect the water quality of these watersheds, outlines the tasks required and the agencies responsible for each and establishes time frames and cost estimates for the project; and

WHEREAS, a draft of the plan has been available for review and comments were accepted at public hearings held April 29, 1997 and April 30, 1997; and

WHEREAS, the implementation of this plan will provide both technical assistance and cost-share monies to eligible landowners and local governments within these priority watersheds for the installation of conservation practices designed to reduce the sources of nonpoint pollution and protect/improve the quality of Brown County's resources.

NOW, THEREFORE, BE IT RESOLVED, that the Brown County Board of Supervisors do hereby approve the "Duck Creek and Apple Ashwaubenon Creeks Priority Waterhshed Plan" and that the implementation of the plan begin as soon as possible.

Respectfully submitted,

Land Conservation Committee
Planning, Development &
Transportation Committee

Approved by:

County Executive
Date Signed 6/3/97
Final Draft Approved by Corporation Counsel

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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 Conservation 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	A sediment transfer model based on the Universal Soil Loss Equation
WPDES	Wisconsin Pollutant Discharge Elimination System [point source permit system]
WUWN	Wisconsin Unique Well Number assigned to well sample sites

Summary

Introduction

The purpose of the Nonpoint Source Control Plan developed for this project is to assess nonpoint pollutants in the Duck, Apple and Ashwaubenon Creeks Watershed and guide the implementation of control measures. Nonpoint source control measures and education are needed to meet very specific water resource objectives designed to protect and enhance the surface and groundwater in the watershed.

Nonpoint source (runoff) pollution cannot be easily traced to a single point of origin such as a point source effluent discharge from a wastewater treatment plant or industrial plant. Nonpoint source pollution occurs when rainwater or snow melt flows across the land and picks up soil particles, organic wastes and fertilizers that become pollutants when carried to surface and/or groundwater. These soil particles and organic wastes contain phosphorus and nitrogen, the same compounds found in commercial fertilizers. Soil particles also become sediment in the small streams, the Fox River and their receiving water, the bay of Green Bay. Nonpoint source pollution in the Duck, Apple and Ashwaubenon Creeks Watershed has lead to a general decrease in the quality of these streams and their tributaries. A decrease over time in the number of wetlands, through ditching and conversion to cropland, has lead to degraded water quality and unstable baseflows. Secondary sources of nonpoint pollutants in the Duck, Apple and Ashwaubenon Creeks watershed originate from streambank erosion and gully erosion resulting in sediment deposition in the creeks.

The Nonpoint Source Pollution Control Plan for the Duck, Apple and Ashwaubenon Creeks Priority Watershed was prepared by the Outagamie County Land Conservation Department, the Brown County Land Conservation Department and the Oneida Nation Planning Department with assistance from the Department of Natural Resources (DNR) and the Department of Agriculture, Trade & Consumer Protection (DATCP). The State Land and Water Conservation Board selected the Duck, Apple and Ashwaubenon Creeks Watershed as a priority watershed project through the state's Nonpoint Source Water Pollution Abatement Program in 1994. Planning began in January, 1995. The Duck, Apple and Ashwaubenon Creeks Watershed project joins approximately 86 similar watershed projects statewide in which runoff control measures are being planned and implemented. The Nonpoint Source Water Pollution Abatement Program was created in 1978 by the state Legislature to provide financial and technical assistance to landowners and local governments to reduce nonpoint source pollution.

This project is administered locally by the Outagamie County Land Conservation Department, the Brown County Land Conservation Department and the Oneida Nation Planning Department, with assistance from the University of Wisconsin-Extension and the Natural Resources Conservation Service (U.S. Department of Agriculture). The DNR and DATCP

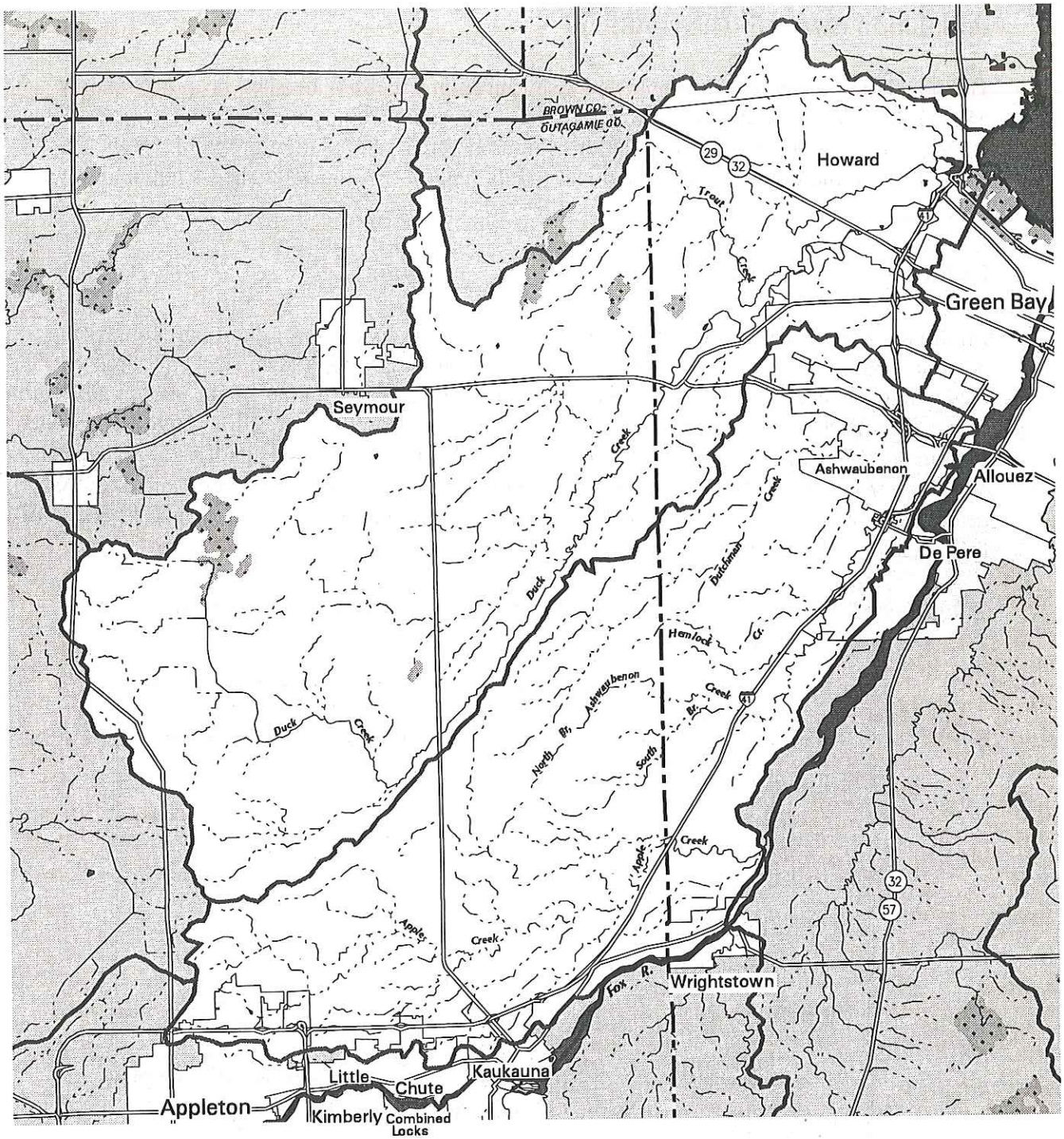
will administer the project at the state level. This plan will be primarily used by the County LCDs, the Oneida Nation Planning Department, DNR, DATCP, other units of government, legislators, external program evaluators and interested public.

General Characteristics

The Duck, Apple and Ashwaubenon Creeks Priority Watershed drains 265 square miles (169,910 acres) of predominantly agricultural land in Outagamie and Brown counties and the Oneida Nation Reservation in east central Wisconsin. It is located within the Lower Fox River Drainage Basin. The **Duck Creek** Watershed, approximately 152 square miles in surface area, lies within Brown County (33 percent) and Outagamie County (66 percent). Duck Creek originates in Burma Swamp, a large (approximately 2000 acres) wetland located in central Outagamie County. A total of 71 miles of named and unnamed streams are located in the watershed and all enter Green Bay at or near the mouth of Duck Creek. Land use in upstream portions of the watershed is predominately agricultural while downstream areas are dominated by residential and urban uses in and near metropolitan Green Bay. The **Apple and Ashwaubenon Creeks** Watershed is 113 square miles in size; approximately 60 percent lies within Outagamie County and 40 percent is located in Brown County. There are 171 miles of named and unnamed streams in the watershed, all of which empty into the Fox River. Land use in the watershed is primarily agriculture and residential, though industrial areas do exist in the urban areas of Green Bay and the north side of Appleton. Many intermittent tributaries discharge to Duck, Apple and Ashwaubenon Creeks and serve as the transport system for pollution to the system. The creeks are generally flashy and tend to flood with snowmelt and rain runoff; the headwaters are often dry in summer. Aquatic life habitat and macroinvertebrate communities in these headwaters are generally fair to poor in condition. Sediment and phosphorus loading from upland agricultural fields are the major sources of nonpoint pollution in the watershed.

Overall, 62 percent (165 square miles) of the Duck, Apple and Ashwaubenon Creeks watershed lies in Outagamie County, and 38 percent (100 square miles) lies within Brown County. Approximately 95 percent of the Oneida Nation Reservation lies within the watershed boundaries. The watershed is divided into eight smaller drainage areas, or subwatersheds (Map S-1).

Duck, Apple, Ashwaubenon Priority Project



Study Area

Wisconsin Department of Natural Resources
Watershed Management
May 1997

0 2 4 6 Miles

0 2 4 6 8 10 Kilometers

Scale 1:213,351

LEGEND

- Watershed Boundary
- Project Boundary
- Subproject Boundary
- Major Highway
- Perennial Stream
- Intermittent Stream
- County Boundary
- Wetland
- Open Water
- Municipal Area

Population Size and Distribution

The population of the Duck, Apple and Ashwaubenon Creeks Watershed is approximately 64,676. Most of the watershed's population in Outagamie County lives in rural areas, whereas in Brown County most of the population is in urban areas. Population growth rates in the watershed are increasing rapidly; regional trends suggest that the watershed's population will continue to expand.

Land Uses

Rural land uses predominate in the watershed; agriculture is the most common, comprising 58 percent. Dairy farming is the primary enterprise, with the average farm size 175 acres. Outagamie County ranks 9th statewide in milk production, 12th in hay, 11th in corn and 4th in corn silage production. Brown County ranks 13th in milk production, 8th in hay production, 12th in corn, 18th in corn silage production. Woodlands are scattered small 5-to-40 acre lots, and cover 7 percent of the land area, with the exception of the Burma Swamp and Trout Creek headwaters, which are as large as 700 acres. Developed land uses occupy about 22 percent of the watershed (Table S-1).

Table S-1. Summary of Land Uses in the Duck, Apple and Ashwaubenon Creeks Watershed

Land Uses	Acres	Percent
Agricultural	99,327	58
pasture	(993)	(<1)
cropland	(98,334)	(57)
Grassland/Woodland	21,251	12
Rural Developed	15,039	9
Wetland[1]	12,852	8
Urban Developed	21,441	13
Total	169,910	100

Note: Agricultural estimates are based on Winhusle inventory data. Other land use estimates are based on township land use maps. The estimates are of actual wetland acres, not cropped wet fields.
Source: Outagamie County, Brown County, DNR

Sources of Nonpoint Pollution

Rural Inventory

Staff from the Outagamie and Brown County LCDs and the Oneida Nation Planning Department collected data on agricultural lands, barnyards, streambanks and wells in the watershed. This data was used to estimate pollutants coming from or going to these particular areas. The following is a summary of the inventory results.

Upland Sediment

* More than 91,000 acres out of the 169,910 total acres in the watershed land area were inventoried.

* An estimated 91,475 tons of sediment is delivered from cropland to watershed streams on an annual basis; this amounts to 98 percent of the total sediment load.

Barnyard Runoff

* 276 barnyards and animal lots were inventoried.

* An estimated 9,034 pounds of phosphorus are delivered to the streams and wetlands in the watershed annually from 276 yards.

Nutrient Management

* Farms were inventoried for critical acres needed for proper manure spreading.

* An estimated 122 farms do not have the needed acreage available for proper spreading of manure nutrients, which indicates that manure may be over-applied on these farm fields.

* Estimates based on data from WINHUSLE (a computer model that estimates sediment delivery) indicate that approximately 36,563 pounds of phosphorus are being delivered to streams due to improperly applied or winterspread manure, amounting to 18 percent of the total phosphorus load.

Streambank Erosion

* 200 miles of eroding or trampled streambank were inventoried.

* An estimated 7,040 tons of sediment is eroded from streambanks annually, representing 1.5 percent of the watershed's total sediment load.

* Livestock have access to less than 1 percent of the total stream length in the watershed.

Gully Erosion

* Gullies adjacent to streams were recorded during the streambank inventory; gullies next to streambanks deliver an esimated 1,000 tons of sediment to streams annually in the project watershed. Any additional gullies identified during implementation will be evaluated to determine if they are significant sources and eligible for cost sharing.

Groundwater

* Of the 146 private wells in the watershed that were tested for nitrates, none of them tested over the Health Advisory Level of 10 mg/l nor over the Preventive Action Limit (PAL) of 2 mg/l.These sample results indicate good groundwater quality in the Duck, Apple and Ashwaubenon Creeks watershed. It is presumed that the heavy clay soils in most of the watershed have prevented the infiltration of nitrates into the groundwater.

Urban Inventory

* A stormwater/erosion control questionnaire was sent to the following municipalities in January 1996: Appleton, Ashwaubenon, DePere, Green Bay, Howard, Kaukauna and Little Chute. The municipalities were asked to describe their management practices for runoff, including: street sweeping, stormwater controls, snow removal and salting, construction site erosion control, and local stormwater ordinances.

* A complete inventory of the Brown County urban area was conducted using maps that were digitized to various land use types (low-density residential, institutional, commercial, industrial, open space, and freeway). The municipalities involved include: Ashwaubenon, DePere, Green Bay, Howard, and Hobart. Subwatershed boundaries were drawn based on outfalls from sewer pipes. Pollutant load coefficients, derived from the Source Loading and Management Model (SLAMM), were used to determine contributions of suspended solids and phosphorus for the specified land uses within those municipalities. Projected growth was estimated for the 2020 build-out areas based on maps provided the municipalities and DNR.

* An inventory of the Outagamie County urban area was conducted using land use maps and projected growth maps provided by East Central Wisconsin Regional Planning Commission. Only a small portion of Appleton is located in the watershed and the Outagamie County urban area is smaller than the Brown County urban area. Pollutant load coefficients derived from the Green Bay area SLAMM model runs were used in the Appleton area to estimate pollutant loads.

* Model results show that for existing and transitional areas a total of 5,646,497 pounds (roughly 2800 tons) of sediment are delivered to streams from municipalities in the watershed (annually). Also delivered to surface waters from municipalities are: 19,382 pounds of total phosphorus, 643 pounds of total copper,

5,893 pounds of total zinc and 2,599 pounds of total PAHs. Much of this is deposited in the Lower Fox River, near the mouth at Green Bay.

Project Goals

Protect and enhance the water quality of the streams of all the subwatersheds in order to improve the water quality of watersheds and ultimately the Fox River and Green Bay.

The following is a summary of targeted reductions for the entire watershed.

Sediment Objectives: Reduce overall sediment delivered by 50 percent.

To meet the overall delivery goal, the following is needed:

* 50 percent reduction in sediment reaching streams from agricultural uplands in all subwatersheds.
* 25 percent reduction in sediment reaching streams from gully erosion in all subwatersheds.
* 10 percent reduction in sediment reaching streams from streambank erosion in all subwatersheds.

Phosphorus Objective: Reduce overall phosphorus load by 50 percent.

To meet this goal, the following is needed:

* 50 percent reduction in phosphorus from barnyards in all subwatersheds.
* 50 reduction in phosphorus from landspread manure.
* 50 percent reduction in phosphorus from upland sediment sources.

In addition, this plan calls for a *significant* effort to restore degraded or prior converted wetlands.

Urban Objectives:

* Reduce the mass loading of urban pollutants so that the loading in 2020 is 25 percent less than the 1995 load in selected subwatersheds and a "no change" from the 1995 load in others (see water resources table in watershed plan).

* Educate the public to recognize and subsequently reduce contaminants entering surface waters (see information and education chapter of watershed plan).

* Integrate Non-Structural Best Management Practices into the site-by-site planning process for new development (see watershed plan appendix).

* Maintain the hydologic characteristics of surface waters so that base flows are not significantly reduced below 1995 levels and so that stream discharge flows under the average annual flood are not significantly increased over 1995 levels. To accomplish this, the goal for new development is to maintain runoff characteristics under the 2-year, 24-hour rainfall conditions at levels that are consistent with pre-development conditions under good land management.

* Construction site erosion control (CSEC). This plan seeks to fully implement adequate ordinances for CSE control. It also seeks to have the local units of government intensify efforts to review erosion control plans and provide site inspection for compliance on all construction sites.

Community Information and Education Objectives

To develop community action that fosters change promoting sustained long-term improvement and protection of resources in the Duck, Apple and Ashwaubenon Creeks Project Watershed.

* Increase public awareness and understanding of the watershed program, runoff pollution, and water resources in the project area.

* Increase public involvement in implementation of watershed plan recommendations.

* Provide rural landowners information about watershed cost-sharing and other agricultural programs to reduce sediment loading from agricultural land.

* Reduce pollutant loads from new and existing urban areas by raising awareness and by helping local governments, residents and the construction industry develop the values, knowledge and skills needed for better compliance with construction erosion control regulations.

* Reduce the loss of nutrients and bacteria from animal waste by providing livestock owners with information about BMP's and watershed cost-sharing.

* Reduce sediment loadings from eroding streambanks by providing information about stabilization techniques and watershed cost-sharing.

Critical Sites

Nonpoint source pollutant load reduction in the Duck, Apple and Ashwaubenon Creeks Priority Watershed Project will be achieved mainly through voluntary participation. However, state statutes require that the nonpoint source control plan contain the necessary language to ensure the reasonable likelihood of achieving water quality goals and objectives. Landowners with sites that meet the established critical site criteria are required by law to address those specific sites by reducing the nonpoint source pollutant load to an acceptable level. Pollutant

reduction can occur solely though the action of the landowner with guidance from county staff or through watershed cost-sharing participation. Each identified site will be field verified before receiving notification as a critical site, with the findings sent to the DNR. Landowners interested in receiving cost-share assistance for installing best management practices will need to sign a cost-share agreement with either the Outagamie or Brown County Land Conservation Department or the Oneida Nation Planning Department if the land is owned by a tribal member or held in trust for the Oneida Nation.

Notification of landowners with critical sites will begin when Outagamie and Brown County LCDs and the Oneida Nation Planning Department staff have the ability to identify individual fields for specific management categories on the FOCS/WINHUSLE, GIS database or through the BARNY computer model for barnyard sites. The highest ranked sites will be notified first until all landowners or land operators with critical sites are notified. The notification 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 of either Wisconsin Administrative Code Chapter NR 243 for animal waste, or s. 144.025(2)(u), (v), or (w), for sediment delivery, and groundwater protection that landowners may face if no action is taken. Some of these include receiving a notice of discharge, requiring of a WPDES permit, or issuing a notice of intent.

* The right to appeal the designation of a critical site at an informal hearing before the land conservation committee for the county where the site is located. The landowner must give a written request to the county Land Conservation Committee (LCC) within 60 days of receipt of the notification letter. The LCC shall limit its appeal affirmation consideration to whether the critical site designation is consistent with critical site criteria established in the nonpoint source control plan.

Impact and Scope of Critical Sites

* Of the 276 barnyards inventoried, 3 were designated as critical site yards. Control of these 3 yards will achieve a minimum reduction of 25 percent of the barnyard phosphorus objective.

* Of the estimated 98,327 acres (an estimated 60 landowners) of cropland in the watershed, 1,776 acres have been designated as critical for sediment control. Control of this critical cropland will result in minimum reduction of 25 percent of the pollution reduction objective for sediment.

* Of the estimated 1,111 streambank sites inventoried in the watershed, 6 sites have been designated critical for sediment control. A standard has been designated in this watershed that any streambank or gully site contributing more than 100 tons

per year and determined by watershed staff to be cost effective for control will be designated as a critical site.

Management Actions

The Outagamie County LCD, Brown County LCD and the Oneida Nation Planning Department staff will contact all landowners who are eligible to receive cost sharing during the project's 10-year implementation. Management classifications are determined based on the level of pollution control needed to achieve water quality objectives in the watershed. Specific sites or areas within the watershed project are designated as either "critical," "eligible," or "ineligible." Designation as a critical sites indicates that controlling these specific sources is necessary to assure a 25 percent of the reduction goals for the project are met. To further insure that water quality objectives are met, nonpoint sources which are eligible but not critical and contribute less of the pollutant load are included in cost sharing eligibility.

The Outagamie County LCD, Brown County LCD and the Oneida Nation Planning Department will assist landowners in applying BMPs. Practices range from alterations in farm management, such as changes in manure spreading, crop rotations and conservation tillage, to engineered structures, such as clean water diversions, vegetated buffers, barnyards and manure storage facilities. These practices are tailored to specific landowner situations.

Landowner Eligibility

Table S-2 Barnyard Runoff Pollution Reduction Objective:

Reduction Objective: 50 percent or 4,517 pounds of phosphorus				
Management Category	**Phosphorus (lbs./year)**	**Number of Barnyards**	**P Controlled (lbs./year)**	**Percent of Actual Reduction**
Critical	> 255	3	1,264	28%
Eligible	20 to 254	114	3,439	72%
Not Eligible	< 20	159	-	-

Barnyard Runoff Eligibility

Landowners with barnyard sites that contribute 20 lbs. of phosphorus or more are eligible for cost-share assistance. As with all cost-shared best management practices, cost containment procedures will be used. In the case of eligible barnyards, landowners may need only to divert clean upland water and roof runoff away from the animal lot to bring the polluted runoff below the 20 lb target. Landowners with barnyards that still exceed an annual phosphorus load

of 20 lbs after installation of these low-cost controls, are eligible for additional controls that would bring them below 15 lbs.

Components of Waste Management System

Certain components of 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 that the waste may be spread on. 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 practices, optimally the development of both nutrient management and pest management (NRCS Std. 595) plans, including soil testing and crop scouting.

Manure Storage as Component of the Nutrient Management

Nutrient management will be a significant component of manure management systems, barnyards, and manure storage facilities. Cost-sharing eligibility for manure storage practices will be based on the development of a preliminary Nutrient Management Plan that is consistent with the NRCS 590 standard.

An operation is eligible for manure storage cost-sharing if the preliminary nutrient management plan demonstrates that manure cannot be practically managed during periods of snow-covered, frozen and saturated conditions without the installation of storage practices. The preliminary nutrient management plan must also demonstrate that proper utilization of the manure can be achieved following adoption of the intended storage practice. Existing structures which are environmentally unsound due to leaking to surface and/or groundwater will also be eligible for abandonment and or repair. Critical site designation will not be a component of the management strategy for manure storage in the Duck, Apple and Ashwaubenon Creeks Watershed.

Cropland Erosion

Table S-3 Rural Sediments

ELIGIBILITY CRITERIA		
Delivery Management Target Category	Sediment Delivery (tons/ac/yr)	Design Target (tons/ac/yr)
Critical	> =5.50	<5.50 (if done at landowners expense)
		= <0.40 (if done with cost-sharing) See the 3 options listed below
Eligible	> =0.10 & <5.50	0.40 or 50% reduced from sites that are 0.8 or less
Ineligible	under 0.10	N/A

Cropland and Other Upland Sediment Sources

Sediment eroding from cropped fields is the largest source of phosphorus in the watershed, accounting for over 78 percent of the total phosphorus load. Eeach ton of sediment delivered contributes approximately 1.78 lbs of phosphorus; therefore, to reach both the sediment reduction and phosphorus reduction objectives, it is necessary to control a large amount of sediment. The design target for eroding fields will be to control sediment delivery to surface water at a rate of .40 tons per acre or less, or a minimum of a 50 percent reduction in sediment delivery, whichever is greater. Landowners controlling upland sediment sources will be eligible for nutrient management plan development cost-share assistance.

Eligibility for upland cost-sharing is set at .1 tons per acre per year (.1 t/ac/yr) as an incentive for more voluntary landowner participation). This practice also expands the use of the whole farm approach to reach the farm sediment reduction goal when dealing with highly eroded fields. In previous watersheds projects, sign-ups for conservation tillage was low because landowners who were eligible for only a small percentage of their land did not want two separate tillage systems on their row cropland. The higher the percent of land a farmer has eligible, the more likely they are to convert to conservation tillage. Past experience in this area has shown that the target should be set no lower than ".4" (tons per acre) so that highly eroded fields can meet the target without being taken out of production and without discouraging farmers from signing up.

Control of sediment to the described target level will result in a decrease of 45,738 tons of sediment and a decrease of 81,413 pounds of associated phosphorus from agricultural fields.

A landowner can use one of three options to meet the upland sediment control requirements as defined in the above box:

1. Landowners can correct problem fields *through their own initiative* by installing the necessary practices to reduce the annual sediment load below the critical level of 5.50 tons delivered. **Project staff will be available to provide the necessary technical assistance.** Landowners choosing this option will not be eligible for upland cost-share assistance but are obligated to operate and maintain any installed practice for the length of the project.

2. Landowners can correct problem fields *with cost-share assistance* when installing the necessary practices but must reduce the annual sediment load to at least the target level of 0.04 tons/ac/yr or a 50 percent reduction in sediment delivery for fields that deliver 0.80 tons/ac/yr or less.

3. The *Whole Farm Approach* may also be used to meet critical upland sediment control requirements. Under this approach, the amount of sediment controlled through meeting critical sites criteria (listed in the box above) is calculated for a landowner. This "farm target number" must then be met through any combination of sediment control measures applied to any of the eligible lands on the farm. This method can also be used for any landowner that has some fields that deliver 0.8 or greater tons/ac/yr of sediment.

Any one of these alternatives may be used throughout the watershed depending on which system best suits the landowner's needs. The number of acres eligible for funding of control practices, the tons of sediment controlled, and the percent reduction for each management category is shown in Table S-4.

Table S-4. Upland Sediments

Subwatershed	Inventory Results				Goal- 50 % reduction in rural sediment delivered						
					Category Critical >5.5 sediment delivered			Category Eligible <5.5 and > 0.1 sed. del			Acres Not Eligible <0.1 Sed.Del.
	Total Area - (Acres)	Tons per year - Sediment delivered (Rural)	% contributed by watershed	objective reduction %	# Rural Acres	Target - Rural Tons Reduced	% Reduced of objective	#RURAL Acres	Target - RURAL Tons Reduced	% Reduced of objective	
Lancaster Creek	19,087	1,060	1	50	-	-	-	3,802	530	100	0
Trout	12,456	2,054	2	50	-	-	-	7,402	1,027	100	0
Fish Creek	34,105	19,646	21	50	254	1,676	17	17,821	8,147	83	49
Burma Swamp	31,723	39,569	43	50	1,283	8,132	41	19,385	11,651	59	41
Dutchman	19,181	4,256	5	50	-	-	-	12,473	2,128	100	32
Hemlock	18,791	5,528	6	50	13	99	4	16,977	2,665	96	0
Freedom	21,271	10,705	12	50	76	427	8	12,158	4,926	92	0
Appleton	13,296	8,657	10	50	150	1,100	25	7,412	3,229	75	0
TOTAL	169,910	91,475	100	N/A	1,776	11,434	25	97,430	34,303	75	122

NOTE: The subwatersheds in bold lettering are in Duck Creek and the remaining subwatersheds are in the Apple, Ashwaubenon Watershed.

Streambank and Gully Erosion

Eroding streambanks contribute an estimated 1.5 percent of the total annual sediment load reaching surface waters in the project area. Although the overall sediment contribution from streambank erosion is small, specific stream reaches have been severely degraded by bank erosion. Riparian areas, or areas adjacent to streams, have in general also been degraded by erosion and sedimentation. Protection of these areas are vital to the entire stream corridor system and are to be valued because of their potential for providing or enhancing aquatic habitat, upland wildlife habitat and water quality.

Critical Sites
Those sites which deliver 100 tons of sediment annually to surface waters and are determined by watershed staff to be feasible and cost-effective for control must be controlled. Six of the inventoried sites meet this criteria; six landowners are affected by this designation.

Eligibility (Cost-effectiveness)
Those sites eroding at a rate greater than 5 tons per year may be considered for cost-sharing. There are 240 sites with 7,045 feet of eligible streambank that meet this criteria; 87 landowners are affected. Eligibility will be based on an on-site evaluation by project staff. Generally, streambank sites that are inaccessible or shown to be less-than cost-effective will not be eligible for cost-sharing.

Table S-5 Streambank Erosion

Management Category	Sediment Delivery Tons/Yr	Reduction Objective	# of Landowners Affected
Critical	= >100 Tons/Yr	5 Tons/Yr	6
Eligible	= > 5 Tons/Yr	5 Tons/Yr	87
Not Eligible	< 5 Tons/Yr	NA	NA

Project Implementation

Project implementation is scheduled to begin in 1997 and continue for a period of 10 years. Implementation will consist of continuous educational programming for watershed residents, individual farm conservation planning, signing of cost-share agreements, practice installation, and installed practice monitoring and follow up.

Information and Education Priorities

To address project water quality problems, the information and education strategy must support implementation of the solutions recommended in the plan. Specifically, the strategy must help build:

1. Public appreciation of water resources, awareness of the watershed program, and support for water quality improvements.

2. Participation in the use of watershed BMPs:

   - Agricultural cropland practices
   - Nutrient and pesticide management planning from problem barnyards
   - Remediation of eroding streambanks in both the urban and rural areas
   - Retrofitting storm water controls from critical land uses in existing urban areas

3. Compliance with construction erosion control regulations.

4. Support for development and implementation of storm water ordinances and plans.

Due to limited funding, information and education programs cannot address all of these needs at once. Therefore, budgets and schedules for information and education programs will be based in large part on this priority list.

Conservation Planning and Contracting

Conservation planning and cost-share agreements for installing BMPs will be available to landowners the first 9 of the 10-year implementation phase. Voluntary participation will be emphasized throughout the project; sites determined as critical will be a priority. Other sites will be targeted for pollution control using ongoing inventory information. All practices on agreements must be installed before the project is scheduled to end. Landowners must maintain structural practices for at least 10 years from the installation of the final practice listed on the cost-share agreement. Exempt from the operation and maintenance period are: Conservation Tillage Incentive System, Nutrient Management, Pesticide Management and Cropland Protection Cover.

Cost-share agreements are recorded with the Register of Deeds, and in the event of property being sold, the new landowner will be required to install and maintain all of the remaining BMPs. Practices can be installed as soon as a landowner signs a cost-share agreement with the Outagamie or Brown County Land Conservation Department or the Oneida Nation Planning Department.

Project Implementation Costs

The DNR will award grants to Outagamie and Brown County LCDs, the Oneida Nation Planning Department, and to all eligible municipalities or other eligible grantee for the cost sharing of BMPs, staff support and educational activities. Tables S-6 and S-7 include estimates of the financial assistance needed to implement nonpoint source controls in the Duck, Apple and Ashwaubenon Creeks Watershed. Project costs assume a 75 percent participation rate by eligible landowners and a 100 percent participation rate by critical site landowners.

Table S-6 **Rural Duck, Apple and Ashwaubenon Creeks Watershed Project Costs are based on a 75 percent Landowner Participation Rate**

Item	State share of Costs
Cost-Share Funds: Practices	7,836,867
Cost-Share Funds: Easements	7,000
Local Assistance Staff Support*	4,849,760
Information/Education Direct	240,000
Other Direct (travel, supplies, etc.)	391,000
Engineering Assistance	12,000
* Salary + Indirect = $1,893,988/year Total	13,336,627

Source: DNR; DATCP, the Outagamie County Land Conservation Department, Brown County Land Conservation Department, and the Oneida Nation Planning Department

Table S-7 Estimated Total Costs for Urban Implementation †

	PROJECT ELEMENT	TOTAL COST	STATE SHARE	LOCAL SHARE
DEVELOPING URBAN AREAS				
1.	Construction Site BMPs	$3.5 Million	$0	$3.5 Million
2.	CSEC Ordinance Administration	included in urban staffing	--	--
PLANNED URBAN AREAS				
3.	Stormwater Management Plans	$0.14 Million	$0.14 Million	$0
4.	Stormwater Management BMPs	$7.1 Million	$0	$7.1 Million
EXISTING URBAN AREAS				
5.	Feasibility Studies	$0.12 Million	$0.12 Million	$0
6.	Structural BMPs[1]	$9.0 Million	$6.3 Million	$2.7 Million
7.	OR Street Sweeping[2],[3] (capital cost only)	$3.1 Million	$1.56 Million	$1.56 Million
INFORMATION & EDUCATION				
8.	Urban Staffing	$2.1 Million	$0.5 Million	$1.64 Million
WATERSHED TOTAL COST		**$25 Million**	**$8.6 Million**	**$16.5 Million**

† It is very expensive to implement urban BMPs. To do all the work needed to meet project goals, costs would likely exceed $50 million. Staff assumed such costs would not be borne by the NPS program, and therefore assume that 50% of the water quality goal would be met, costing $25 million, of which $8.6 would be paid by the state.

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[1] Assumes 25% of eligible sites will be designed and installed. The estimate was based on detention ponds, but other structural urban practices are eligible for cost-sharing.

[2] This is an interim BMP not listed in NR120, of the Wisconsin Administrative Code. Street sweeping, using high-efficiency sweepers is currently being piloted in the Osceola Creek Watershed Project. The results of that evaluation will determine the acceptable cost share rates for this and other watershed projects.

[3] Assumes 50% cost-share rate

Project Evaluation and Monitoring

The evaluation strategy for the project involves collecting, analyzing and reporting information to track progress in three areas:

1. *Administrative:* This category includes the progress in providing technical and financial assistance to eligible landowners, and carrying out education activities identified in the plan. The Outagamie County LCD, Brown County LCD and the Oneida Nation Planning Department will track progress in this area and report to the DNR and DATCP annually.

2. *Pollutant Reduction Levels:* The Outagamie County LCD, Brown County LCD and the Oneida Nation Planning Department will calculate the reductions in the nonpoint source pollutant loadings resulting from changes in land use practices and report to the DNR and DATCP during the annual review meeting.

3. *Water Resources:* The DNR may monitor changes in water quality, habitat, and water resource characteristics periodically during the project and at the end of the project period.

CHAPTER ONE
Purpose, Legal Status and General Description

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. The 265-square-mile Duck, Apple and Ashwaubenon Creeks Watershed, located in Outagamie County, Brown County and the Oneida Nation, was designated a "priority watershed" in 1995. The primary objective of this project is to reduce nonpoint source pollution loads and to enhance and protect the water quality of streams in the Duck, Apple and Ashwaubenon Creeks Watershed and in Green Bay. This watershed is one of the major contributors of sediment and phosphorus to Green Bay. The Duck, Apple and Ashwaubenon Creeks Watershed is part of the Lower Fox River Basin.

Nonpoint sources of pollution in the watershed include: erosion from agricultural lands, eroding streambanks, roadsides and developing areas; runoff from livestock wastes and established urban areas; and agricultural practices. Pollutants from nonpoint sources are carried to the surface water or groundwater through rainfall runoff or seepage, and snowmelt.

The following is an overview of the Nonpoint Source (NPS) Priority Watershed program:

- 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 high degree of water quality impairment from nonpoint sources of pollution become eligible for consideration as a priority watershed project. Currently, there are 80 eligible watersheds. Twelve (12) projects are completed and 68 are underway. As directed by the state legislature, all of these high ranking watersheds must be planned by 2015. Designation as a priority watershed project enables special financial support to local governments and private landowners in the watershed to reduce nonpoint source pollution.

- A priority watershed project is guided by a plan such as this one, prepared cooperatively by the DNR, DATCP and local units of government, with input from a local citizen's advisory committee. Project 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.

- Upon approval by state and local authorities, local units of government implement the plan. Water quality improvement is achieved through mandatory and voluntary implementation of nonpoint source controls 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 is 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 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 to encourage participation.

- The DNR and DATCP review the progress of the counties and other implementing units of government, and provide assistance throughout the 10-year project. The DNR monitors improvements in water quality resulting from control of nonpoint sources in the watershed.

Legal Status of the Nonpoint Source Control Plan

The Duck, Apple and Ashwaubenon Creeks Priority Watershed Plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 144.25 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared through the cooperative efforts of the DNR, DATCP, Outagamie County Land Conservation Department, Brown County Land Conservation Department and the Oneida Nation Planning Department for the benefit of the resources in Outagamie County, Brown County, the Oneida Nation and the following municipalities: the cities of Appleton, Green Bay and DePere; the towns of Black Creek, Center, Hobart, Grand Chute, Freedom, Lawrence, Oneida, Osborn, Pittsfield, Seymour, Suamico, Wrightstown and Vandenbroek; the villages of Ashwaubenon, Howard, Freedom, Kaukauna, Little Chute and Wrightstown.

This watershed plan allows the Outagamie and Brown County Land Conservation Departments and the Oneida Nation Planning Department to enter into cost-share and local assistance grants with the DNR and 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 147 and 144 of the Wisconsin Statutes to regulate significant nonpoint pollution sources in the project area.

This priority watershed plan was approved by DNR following approvals by the Land and Water Conservation Board, the Outagamie County Board, the Brown County Board and the Oneida Nation Business Committee.

Amendments to the Plan

This plan is subject to the amendment process under NR120.08(4) for substantive changes. The Department of Natural Resources will make the 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 Watershed Management under Chapter 147 of the Wisconsin Statutes. This program is separate from the Nonpoint Source Pollution Abatement Program and applies to certain classes of dischargers statewide as identified in NR 216. In cases where the programs do overlap, implementation grants may only apply to activities identified in the watershed plan. Practices to control construction site erosion and storm water runoff from new development are not eligible for cost sharing. In industrial areas, cost sharing is available as specified in NR 120.10 (1)(g) — only in the non-industrial parts of facilities where a problem has also been identified in the priority watershed plan.

Priority Watershed Project
Planning and Implementation Phases

Planning Phase

The planning phase of the Duck, Apple and Ashwaubenon Creeks Watershed project began in 1995. The following information gathering and evaluation activities were completed during this stage:

- Inventory of the conditions and uses of groundwater, streams, and lakes.
- Inventory of the types of land uses and severity of nonpoint sources affecting groundwater, streams and lakes.
- Evaluation of the types and severity of other factors which may be affecting water quality. Examples include evaluation of discharges from municipal wastewater treatment plants and natural or endemic stream conditions, which has been conducted through the ongoing integrated resource management effort in the Fox-Wolf Basin.
- Determination of nonpoint source controls and other measures necessary to improve and/or protect water quality.
- Preparation and approval of a program for local implementation of the project so that plan recommendations would be carried out.
- Survey of urban residents' pollution awareness, conduct professionally facilitated focus groups and gain feedback from the Rural and Urban Citizens Advisory Committees.

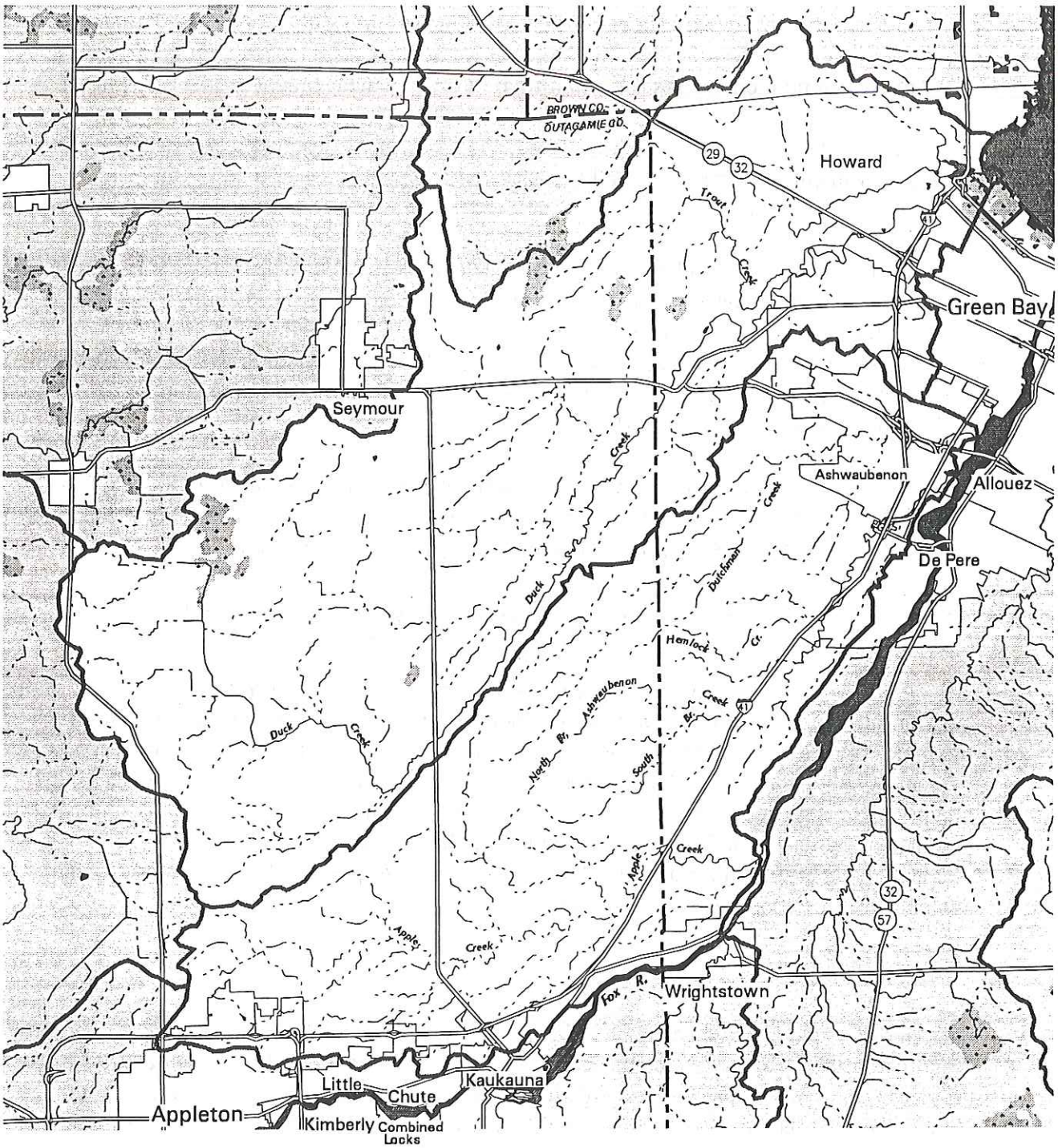
Implementation Phase

The implementation phase of the Duck, Apple and Ashwaubenon Creeks Priority Watershed Project began following review of the draft priority watershed plan, a public hearing, and approval by the DNR, LWCB, and the Board of Supervisors for Outagamie County, Brown County and the Oneida Nation Business Committee. Public review during plan development occurred primarily through the efforts of the Duck, Apple and Ashwaubenon Creeks Watershed Citizen Advisory Committees.

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.

Duck, Apple, Ashwaubenon Priority Project



Study Area

Wisconsin Department of Natural Resources
Watershed Management
May 1997

0 2 4 6 Miles

0 2 4 6 8 10 Kilometers

Scale 1:213,351

LEGEND

- Watershed Boundary
- Project Boundary
- Subproject Boundary
- Major Highway
- Perennial Stream
- Intermittent Stream
- County Boundary
- Wetland
- Open Water
- Municipal Area

- In the rural portions of the watershed, the Outagamie County LCD, Brown County LCD and the Oneida Nation Planning Department contact their respective 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 required actions for implementing the plan recommendations.

- In rural areas, the landowner signs a cost-share agreement with Outagamie or Brown County Land Conservation Department or the Oneida Nation Planning Department 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 must be perpetual or for a period of at least 20 years

  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 their private landowners.

Location and Community Information

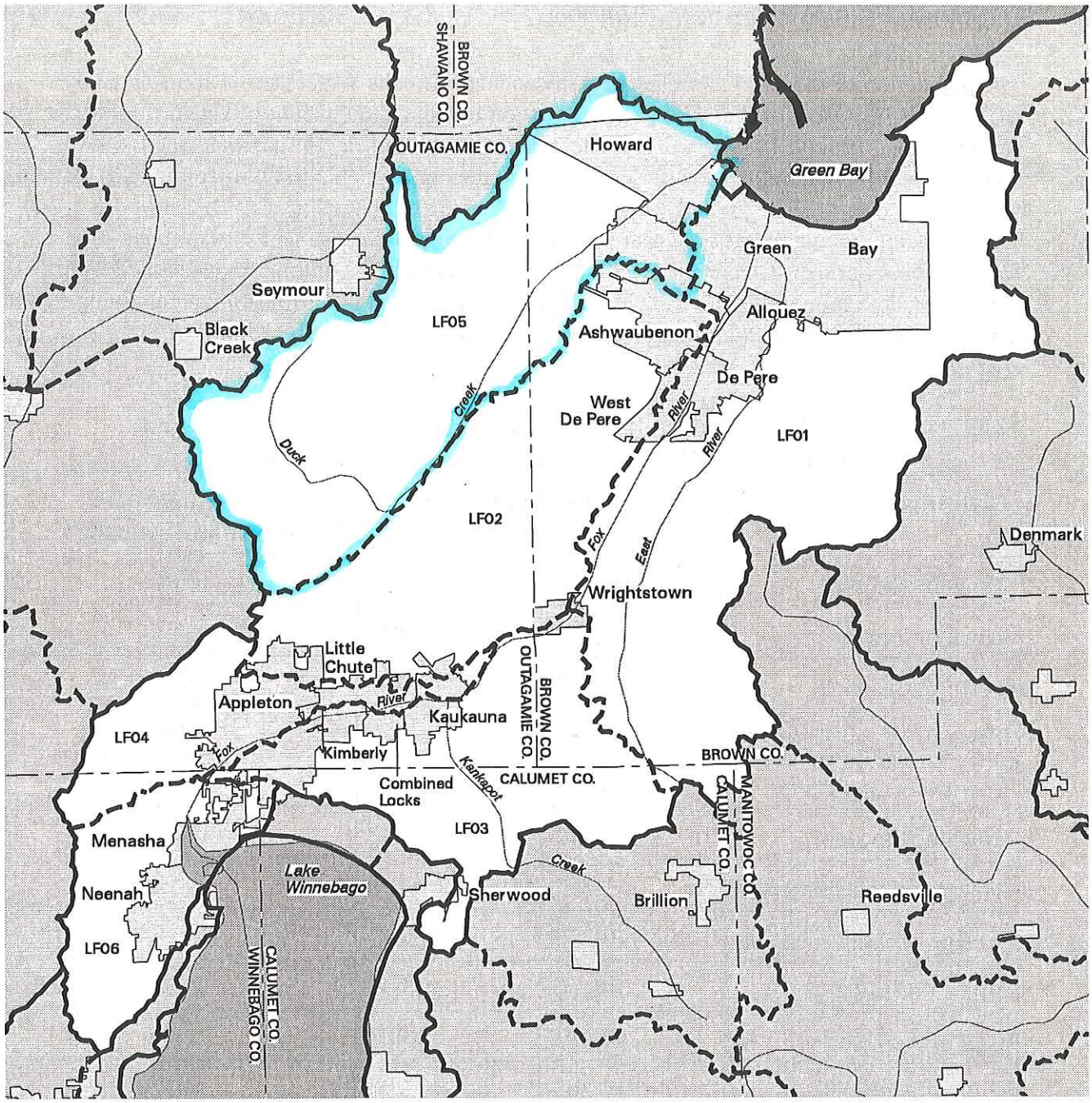
The Duck, Apple and Ashwaubenon Creeks Watersheds encompass a 265 square mile drainage basin located in Northeastern Outagamie County and west central Brown County and includes the majority of the 65,400 acre Oneida Nation reservation. See Map 1-1. Approximately 62 percent (170 square miles) of the watershed area lies within the boundaries of Outagamie County and 38 percent (95 square miles) lie within Brown County. Land use in the upstream portions of the watershed is predominately agricultural while downstream areas are typically residential, urban and industrial land uses. The Duck, Apple and Ashwaubenon Creeks Watershed lies within the Fox-Wolf Basin.

Civil Divisions

The Duck, Apple and Ashwaubenon Creeks Watershed lies within Outagamie County, Brown County and the Oneida Nation. Incorporated areas in the watershed include the cities of Appleton, Green Bay and DePere the villages of Ashwaubenon, Howard, Little Chute, Kaukauna, Oneida and Wrightstown and the towns of Freedom, Grand Chute, Hobart, Lawrence, Pittsfield, Oneida, Suamico, Vandenbroek, and Wrightstown.

Public land within the watershed includes the Outagamie County Landfill, Plamann Park, the Wisconsin State Reformatory, Brown County Golf Course, Brown County Park, Pamprin Park, Austin Straubel International Airport, Brown County Landfill and the Sanger B. Powers Correctional Facility. See Map 1-1 for civil divisions.

Lower Fox River Basin



Study Area

Mapscale 1:373361

Subwatershed Codes and Names

LF01 = East River
LF02 = Apple & Ashwaubenon Creeks
LF03 = Plum & Kankapot Creeks
LF04 = Fox River/Appleton
LF05 = Duck Creek
LF06 = Little Lake Butte des Morts

LEGEND

- Management Unit Boundary
- Watershed Boundary
- River
- County Boundary
- Open Water
- Municipal Area

Wisconsin Department
of Natural Resources
BEITA - GEO Services Section
May, 1997

Population Size and Distribution

The population of the Duck, Apple and Ashwaubenon Creeks Watershed is approximately 64,676 persons. Most of the watershed population in Outagamie County lives in rural areas and in Brown County, in urban areas. The population growth rate in the watershed is increasing rapidly. Regional trends suggest the watershed's population will continue to expand.

The following population estimates are from the Wisconsin Department of Administration Demographic Services Center (Table 1-1). Population estimates within the watershed were derived by determining the percentage of land area from each civil division and applying this percentage to the population. *This calculation assumes that density is uniform throughout the civil division.*

Table 1-1 Population Estimates for Civil Divisions of the Duck, Apple and Ashwaubenon Creeks Watershed

Civil Division	1995 Estimate	Watershed Estimate	Percent of Municipal Population in Watershed
Town of Hobart	4,771	4,771	100%
Town of Lawrence	1,429	1,429	100%
Town of Suamico	6,280	300	5%
Town of Wrightstown	1,873	600	32%
Town of Grand Chute	16,338	1,300	8%
Town of Freedom	4,712	4,712	100%
Town of Vandenbroek	1,392	1,392	100%
Village of Ashwaubenon	17,295	17,295	100%
Village of Little Chute	10,160	2,900	29%
City of Appleton	57,582	3,900	7%
City of Kaukauna	12,505	1,200	10%
City of DePere	18,397	2,759	15%
City of Green Bay	100,786	22,118	22%
TOTAL		64,676	

Based on this table, it appears that the towns of Hobart, Lawrence, Wrightstown, Vandenbroek; the villages of Ashwaubenon, Little Chute; and the cities of Kaukauna, DePere, and Green Bay could be actively involved in this watershed project.

Land Uses

Rural land uses predominate in the Duck Apple and Ashwaubenon Creeks Watershed. Agriculture is the most widespread land use, comprising 58 percent of the land area. Dairy farming is the primary enterprise, with the average farm size 175 acres. Brown County ranks 13th in milk production statewide; 8th in hay production; 12th in corn; and 18th in corn silage production. Outagamie County ranks 9th statewide in milk production; 12th in hay; 11th in corn; and 4th in corn silage production.

Woodlands comprise 19 percent of the watershed and are generally are scattered small 5-to-40 acre lots, with the exception of woodlands in the Burma Swamp and Trout Creek headwaters, which together have 700 acres of woodlands. Developed land uses comprise about 8 percent of the watershed (Table 1-2).

Municipalities and Existing Land Uses

Of the roughly 33 square miles of urban area in this watershed, 80 percent is in Brown County and 20 percent is in Outagamie County. Urban land uses are illustrated further in Tables 1-3 through 1-6.

Table 1-3 shows that there are approximately 17,400 acres (27 square miles) of urban land uses distributed among the 5 civil divisions and Wisconsin DOT right-of-ways in the Brown County portion of the watershed. Some of these acres are located within the Oneida Reservation boundary. In 1995, substantial portions of the total urban area were located within the village of Howard, the village of Hobart, the City of Green Bay, and the town of Hobart.

Table 1-4 shows that in 1996 there were approximately 3740 acres (6 square miles) of urban land uses distributed among the 8 civil divisions in the Outagamie County portion of the watershed. In 1996, substantial portions of the total urban area were located within the city of Appleton and the towns of Grand Chute and Vandenbroek.

Table 1-5 shows how urban areas are distributed among the subwatersheds in the Brown County portion of the watershed and which municipalities are key contributors to urban land uses that drain to surface waters. Each municipality contributes a significant acreage of urban land to at least one subwatershed. For example, the city of Green Bay forms a significant portion of the urban drainage to both the Beaver Dam Creek and Direct Drainage subwatersheds. The village of Ashwaubenon critically influences the Dutchman's Creek subwatershed, while the village of Howard influences the quality of the Lancaster Brook and Slough Creek subwatersheds. The town of Hobart forms a significant portion of the Fish Creek and Trout Creek subwatersheds. These land use configurations are the key determinant for the amount of urban stormwater pollutants that are discharged to area streams, the Lower Fox River and Green Bay.

Table 1-6 shows the distribution of urban areas among subwatersheds of the Outagamie County portion of the watershed. Almost all 8 municipalities contribute significant urban acreage to at

least one subwatershed. For example, Vandenbroek contributes substantial acreage to both the Freedom and Appleton subwatersheds.

Table 1-2 Summary of Land Uses in the Duck, Apple and Ashwaubenon Creeks Watershed

Land Uses	Acres	Percent
Agricultural	99,327	52
pasture	(993)	(1)
cropland	(98,334)	(57)
Grassland/Woodland	21,251	12
Rural Developed	15,039	9
Wetland[1]	12,852	8
Developed/Urban	21,441	13
Total	169,910	100

[1] These are estimates of wetland acres based on WINHUSLE inventory data. The estimates are of actual wetland acres, not cropped wet fields. See wetland section in this chapter for a more comprehensive estimate of wetland acreage.

Source: Outagamie County, Brown County, WDNR

Table 1-3 **1995 Urban Land Uses by Civil Division in the Brown County Portion of the Duck, Apple and Ashwaubenon Creeks Watershed** (in acres)

Civil Division	Residential	Commercial	Industrial	Institutional	Open Space/ Parks	Freeway	Civil Total Acres
V. Ashwaubenon	1,450	619	793	223	851	0	3,936
C. DePere	146	54	121	52	579	0	952
C. Green Bay	2,209	231	316	129	1,326	0	4,211
T. Hobart	2,963	389	0	0	300	0	3,652
V. Howard	2,118	305	701	86	951	0	4,161
WDOT	0	0	0	0	0	505	505
Area Totals	8,886	1,598	1,931	490	4,007	505	17,417

Table 1-4 **1996 Urban Land Uses by Civil Division in the Outagamie County Portion of the Duck, Apple and Ashwaubenon Creeks Watershed** (in acres)

Civil Division	Residential	Commercial	Industrial	Institutional	Open Space/ Parks	Freeway	Civil Total Acres
C. Appleton	249	257	96	104	38	NA	744
C. Kaukauna	72	142	150	32	0	NA	396
V. Little Chute	190	64	130	33	18	NA	435
T. Kaukauna	159	24	26	3	0	NA	212
T. Center	76	0	0	0	0	NA	76
T. Freedom	288	0	56	6	0	NA	350
T. Grand Chute	357	24	106	4	256	NA	747
T. Vandenbroek	514	73	187	2	4	NA	780
Area Totals:	1905	584	751	184	316	0	3740

Table 1-5 Areal Extent of Urban Land Uses by Subwatershed and Civil Division, Brown County Portion - Duck, Apple and Ashwaubenon Creeks Watershed, 1995

Subwatershed	Municipality	Land Use in Acres									
		Residential Density			*Res. Total*	Comm	Ind	WDOT Hwy	Inst	Urban Open Space	Civil Division Total Acres
		Low	Med	High							
Beaver Dam Ck.	V. Ashwaubenon		66		*66*	66					132
	C. Green Bay		1198	79	*1277*	231	291		129	270	2198
	V. Howard		156	48	*204*	195	318		9	218	944
	Subtotal		**1420**	**127**	*1547*	**492**	**609**	**103**	**138**	**488**	3377
Direct Drainage	C. Green Bay		587		*587*		25			536	1148
	T. Hobart		68		*68*						68
	V. Howard	46	299		*345*	15	11			287	658
	Subtotal	**46**	**954**		*1000*	**15**	**36**			**823**	1874
Dutchman's Creek	V. Ashwaubenon	26	1214	113	*1353*	442	499		193	720	3207
	C. Green Bay		176		*176*					354	530
	T. Hobart	165	150		*315*	389					704
	Subtotal	**191**	**1540**	**113**	*1844*	**831**	**499**	**110**	**193**	**1074**	4551
Fish Creek	C. Green Bay		169		*169*					166	335
	T. Hobart	751	160		*911*					170	1081
	Subtotal	**751**	**329**		*1080*					**336**	1416

Subwatershed	Municipality	Land Use in Acres									
		Residential Density			*Res. Total*	Comm	Ind	WDOT Hwy	Inst	Urban Open Space	Civil Division Total Acres
		Low	Med	High							
Hemlock Creek	V. Ashwaubenon		21	10	*31*	111	294		30	131	597
	C. DePere		130	16	*146*	54	121		52	579	952
	Subtotal		**151**	**26**	*177*	**165**	**415**	**232**	**82**	**710**	**1781**
Lancaster Brook	T. Hobart	341	331		*672*					130	802
	V. Howard	41	1245	14	*1300*	95	53		77	233	1758
	Subtotal	**382**	**1576**	**14**	*1972*	**95**	**53**		**77**	**363**	**2560**
Slough Creek	V. Howard	100	169		*269*		319			213	801
	Subtotal	**100**	**169**		*269*		**319**	60		**213**	**861**
Trout Creek	T. Hobart	953	44		*997*						997
	Subtotal	**953**	**44**		*997*						997
Watershed Totals (acres)		**2423**	**6183**	**280**	*8886*	**1598**	**1931**	**505**	**490**	**4007**	**17417**

Table 1-6 Areal Extent of Urban Land Uses by Subwatershed and Civil Division, Outagamie Portion - Duck, Apple and Ashwaubenon Watershed, 1996

Subwatershed	Municipality	(in acres)							
		Residential Density							
		Single Family	Multi Family	Res. Total	Comm	Ind.	Inst	Parks/ Open Space	Civil Division Total Acres
Freedom Subwatershed	C. Kaukauna	72	0	*72*	142	150	32	0	396
	V. Little Chute	80	8	*88*	58	108	13	18	285
	T. Freedom	60	0	*60*	0	0	0	0	60
	T. Kaukauna	159	0	*159*	24	26	3	0	212
	T. Vandenbroek	268	0	*268*	48	5	2	2	325
	Subtotal	**639**	**8**	*647*	**272**	**289**	**50**	**20**	**1278**
Appleton Subwatershed	C. Appleton	232	17	*249*	257	96	104	38	477
	V. Little Chute	72	30	*102*	6	22	20	0	150
	T. Center	76	0	*76*	0	0	0	0	76
	T. Freedom	148	23	*171*	0	56	6	0	233
	T.Grand Chute	356	1	*357*	24	106	4	256	747
	T. Vandenbroek	246	0	*246*	25	182	0	2	455
	Subtotal	**1130**	**71**	*1201*	**312**	**462**	**134**	**296**	**2405**
Burma Swamp Subwatershed	T. Center	263	0	*263*	0	0	0	0	263
	T. Freedom	57	0	*57*	0	0	0	0	57
	Subtotal	**320**	**0**	*320*	**0**	**0**	**0**	**0**	**320**

Projected Growth of Urban Areas

Tables 1-7 through 1-10 present estimates of planned urban growth in the watershed. Table 1-7 shows projected increases by subwatershed in Brown County, representing full build-out to the proposed limits in the draft land use plan prepared by Brown County. Clearly, development in this area will be considerable (45 percent increase in the watershed), with its significance varying by subwatershed. Planned growth is not an issue, for example, in the Beaver Dam Creek Subwatershed, and is only a marginal issue in the Direct Drainage Subwatershed; it can be considered significant in all other subwatershed drainage areas where it varies from 35 to 100 percent. Importantly, portions of the smaller tributary streams such as Lancaster Brook, Slough Creek, Trout Creek and small tributaries to Duck Creek within the Fish and Drainage subwatersheds may be particularly affected. It will be helpful to overlay the planned land use information on the stream network information layer to identify any small tributaries that are likely to be affected by changes in imperviousness and pollutant loading. Table 1-8 shows projected increases by subwatershed in Outagamie County; Tables 1-9 and 1-10, planned growth in the Brown County and Outagamie portions, respectively. Most of the municipalities listed will be potential sources of increased urban pollutant loadings on either a subwatershed or watershed basis if steps are not taken to regulate or otherwise manage this pollution source.

Table 1-7 Increases in Urban Development within the Brown County Portion of the Duck, Apple and Ashwaubenon Creeks Watershed, 1995 to 2010.

	Urban Area (acres)		Planned Increase	
Subwatershed	1995	2010	acres	% Change
Beaver Dam Creek	3,377	3,457	80	2%
Direct Drainage	1,874	2,064	190	10%
Dutchman's Creek	4,551	7,291	2,740	60%
Fish Creek	1,416	1,906	490	35%
Hemlock Creek	1,781	2,381	600	34%
Lancaster Brook	2,560	5,120	2,560	100%
Slough Creek	861	1,661	800	93%
Trout Creek	997	1,347	350	35%
Watershed Totals	17,417	25,227	7,810	45%

Source: Brown County Planning Department, Southeast Wisconsin Regional Planning Commission (SEWRPC), 1996, Outagamie Land Conservation Department These numbers reflect only those portions of the civil divisions located within the watershed.

Table 1-8 **Increases in Urban Land Use Within the Outagamie County Portion of the Duck, Apple and Ashwaubenon Creeks Watershed, 1996 to 2020.**

Subwatershed	Urban Area (acres)		Planned Increase	
	1996	2020	acres	% Change
C. Appleton	744	2531	1787	240%
C. Kaukauna	396	497	101	26%
V. Little Chute	435	635	200	46%
T. Kaukauna	212	684	472	223%
T. Center	339	724	385	113%
T. Freedom	290	760	470	162%
T. Grand Chute	747	852	105	14%
T. Vandenbroek	720	3239	2519	349%
Totals	3883	9922	6039	155%

Source: Southeast Wisconsin Regional Planning Commission (SEWRPC), 1996, Outagamie Land Conservation Department These numbers reflect only those portions of the civil divisions located within the watershed.

Table 1-9 **Estimated Type and Location of Projected Increases in Urban Land Use within the Brown County Portion of the Duck, Apple and Ashwaubenon Creeks Watershed, 1995 to 2010.**

Subwatershed	Projected Growth (acres)	Projected Land Use Type	Projected Location	Portion of Subwatershed Growth	Portion of Watershed Growth
Beaver Dam Creek	80	Residential	V. Howard	100%	1%
Direct Drainage	190	Residential	C. Green Bay	74%	2%
		Commercial	V. Howard	26%	1%
Dutchman's Creek	2,740	Industrial	V. Ashwaubenon	14%	5%
		Miscellaneous	C. Green Bay	12%	4%
		Industrial Commercial	T. Hobart	42%	15%
		Residential Industrial Commercial	T. Lawrence	32%	11%
Fish Creek	490	Residential Industrial Commercial	T. Hobart	100%	6%
Hemlock Creek	600	Residential Industrial Commercial	T. Lawrence	100%	8%
Lancaster Brook	2,560	Residential	T. Hobart	16%	5%
		Residential Commercial	V. Howard	84%	28%
Slough Creek	800	Residential Commercial	V. Howard	100%	10%
Trout Creek	350	Residential	T. Hobart	100%	4%
Watershed Totals	7,810				100%

Source: Southeast Wisconsin Regional Planning Commission (SEWRPC), 1996, Outagamie Land Conservation Department

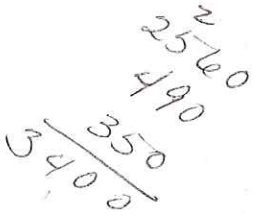
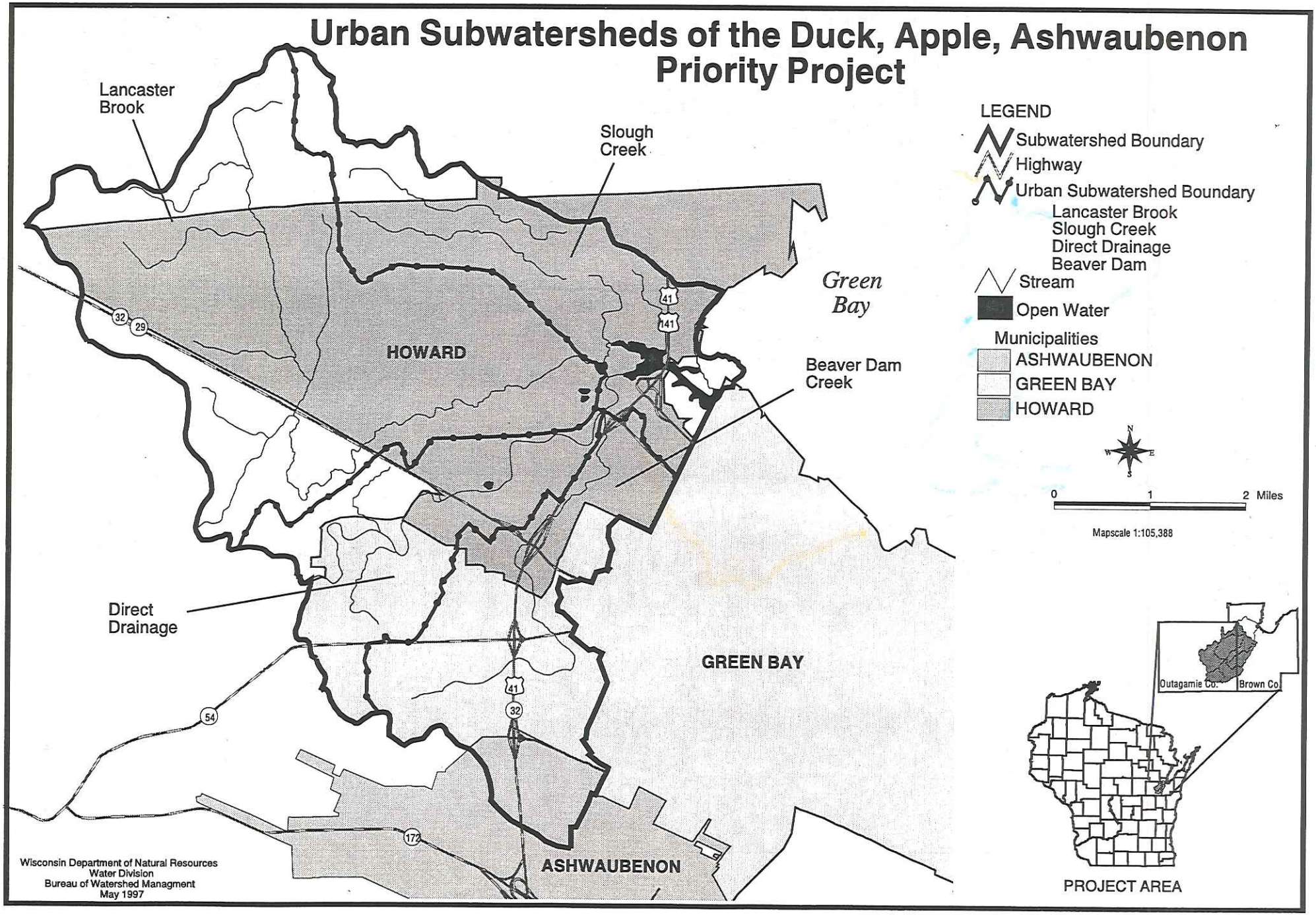


Table 1-10 Projected Land Use Acreage by Subwatershed and Civil Division, Outagamie Portion - Duck, Apple and Ashwaubenon Watershed, Year 2020

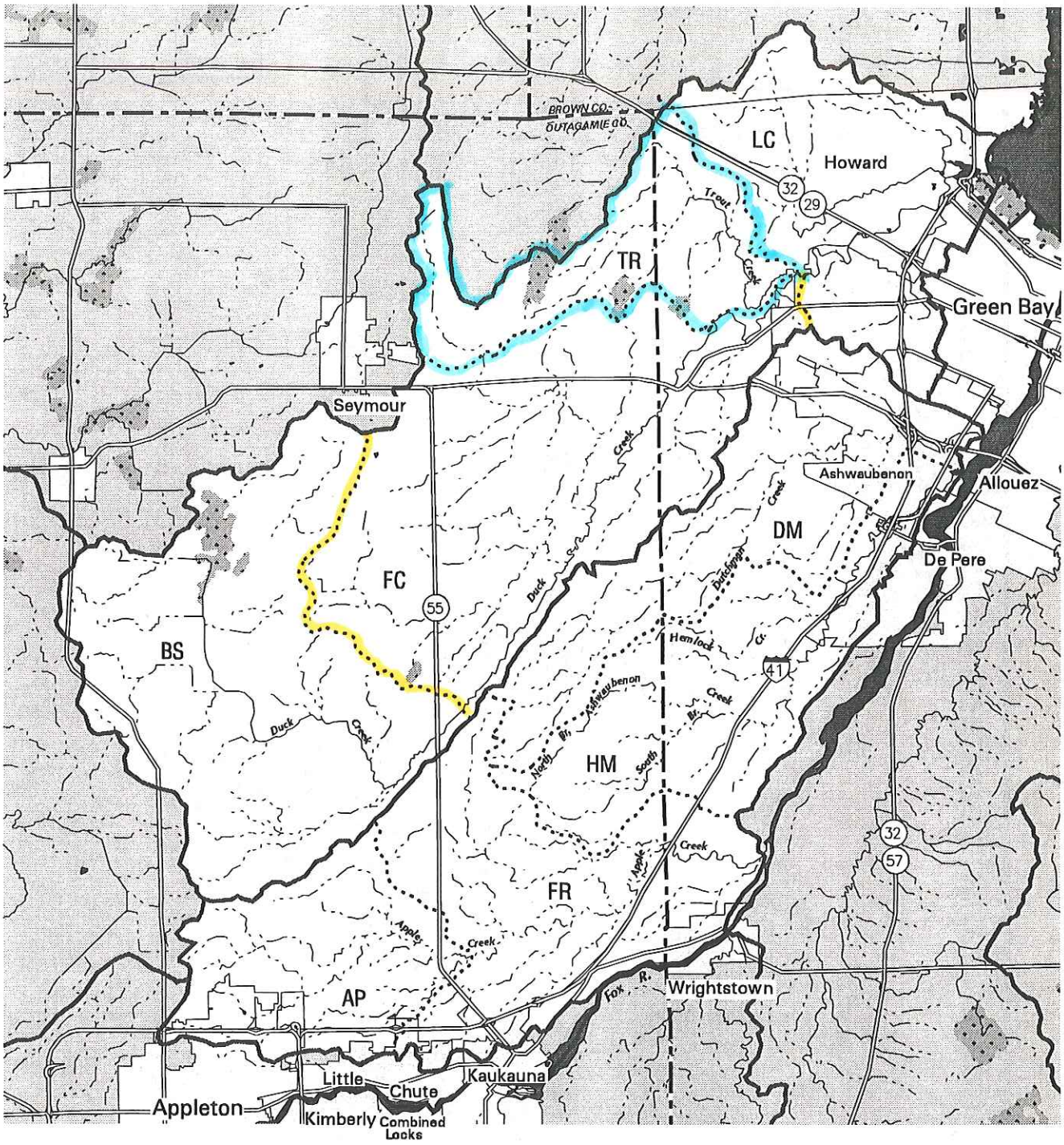
Subwatershed	Municipality	Projected Land Use Acreage, Year 2020							
		Residential Density							
		Single Family	Multi Family	*Res. Total*	Comm	Industry	Public/ Institu.	Parks/ Open Space	Civil Division Total Acres
Freedom Subwatershed	C. Kaukauna	92	0	*92*	142	231	32	0	497
	V. Little Chute	100	8	*108*	58	208	13	18	405
	T. Freedom	200	0	*200*	0	0	0	0	200
	T. Kaukauna	365	0	*365*	50	266	3	0	684
	T. Vandenbroek	1468	20	*1488*	188	79	2	72	1829
	Subtotal	**2225**	**28**	*2253*	**438**	**784**	**50**	**90**	3615
Appleton Subwatershed	C. Appleton	1488	94	*1333*	462	236	129	122	2431
	V. Little Chute	146	36	*80*	6	22	20	0	230
	T. Center	191	0	*115*	0	0	0	0	191
	T. Freedom	363	23	*215*	80	56	6	40	568
	T.Grand Chute	436	1	*80*	49	106	4	256	852
	T. Vandenbroek	926	50	*730*	25	332	25	52	1410
	Subtotal	**3550**	**204**	*3754*	**622**	**752**	**184**	**470**	5782
Burma Swamp Subwatershed	T. Center	503	0	*503*	30	0	0	0	533
	T. Freedom	137	0	*137*	15	0	0	40	192
	Subtotal	640	0	*640*	45	0	0	40	725

Urban Subwatersheds of the Duck, Apple, Ashwaubenon Priority Project



Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Managment
May 1997

Rural Subwatersheds of the Duck, Apple, Ashwaubenon Priority Project



LEGEND

- Watershed Boundary
- Project Boundary
- Subproject Boundary
- Major Highway
- Perennial Stream
- Intermittent Stream
- County Boundary
- Wetland
- Open Water
- Municipal Area

Study Area

Subwatershed Codes and Names

DM = Dutchmans Creek	AP = Appleton
FC = Fish Creek	FR = Freedom
TR = Trout Creek	HM = Hemlock
LC = Lancaster	BS = Burma Swamp

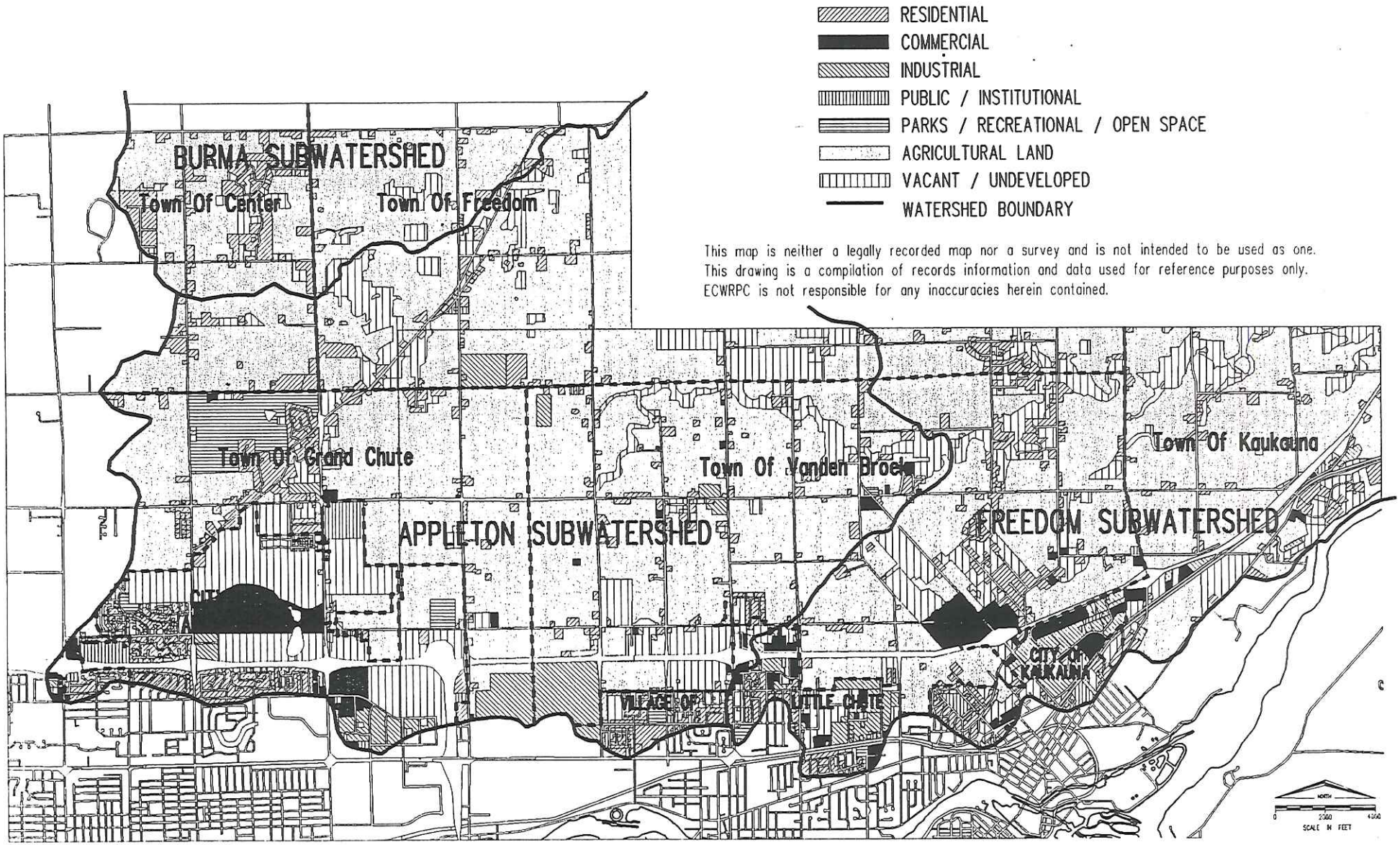
0 2 4 6 Miles

0 2 4 6 8 10 Kilometers

Scale 1:213,351

Wisconsin Department of Natural Resources
Watershed Management
June 1997

Urban Land Use of the Appleton Area



This map is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records information and data used for reference purposes only. ECWRPC is not responsible for any inaccuracies herein contained.

Prepared By: EAST CENTRAL WISCONSIN REGIONAL PLANNING COMMISSION – FEBRUARY 1997

CHAPTER TWO
Watershed Conditions and Nonpoint Sources of Pollution

This chapter discusses the physical characteristics, existing conditions, objectives and management categories for the water resources in the Duck, Apple and Ashwaubenon Creeks priority watershed. Information is presented for each subwatershed and by pollution source.

Physical Setting

Climate and Precipitation

The frequency, duration, and amount of precipitation falling to earth influences surface and groundwater quality and quantity, soil moisture content, runoff characteristics, and the physical condition of waterways. The Duck, Apple and Ashwaubenon Creeks Watershed lies in the continental zone within the Great Lakes Basin. The local climate is characterized by long and relatively cold, snowy winters and summers which are mostly warm with periods of hot humid conditions. Mean annual precipitation within the watershed averages 29 inches of rain and melted snow, most of which results from thunderstorms during the growing season (May-September). Runoff occurs primarily in February, March and April, when the land surface is frozen and soil moisture is highest.

Geology

The bedrock underlying an area is generally named for the unit which lies nearest the surface. The Duck, Apple and Ashwaubenon Creeks Watershed rests on the back slope of the Sinnipee limestone group. This formation, which tilts gently to the southeast, is considerably lower than the Niagara Foundation, which dominates the watershed east of the Fox River. The Sinnipee group was formed during the latter part of the Paleozoic Era, which began around 600 million years ago and lasted for 375 million years. During that time, warm shallow seas rose and fell, leaving behind deposits of sand, silt and clay, which were compacted and cemented to form rock layers. These layers were unevenly eroded and worn during periods when the seas receded. A number of younger bedrock layers that formerly existed within the watershed, including shales, cherts and Niagara Dolomite, were completely worn away over time.

The Sinnipee, or Galena, group consists of a dolomitic limestone layer, gray to blue in color and 10 to 310 feet in thickness, with some chert and shale. This formation has poor water-bearing qualities and was once thought to be impermeable. New information, however, may reshape thinking on the importance of this bedrock layer in relation to water supplies. Along many miles of its course, Duck Creek has cut through overlying material and has exposed this formation. The present belief is that the Sinnipee Dolomite may allow water to flow into older underlying layers which form the water table.

The Cambrian sandstones, in the formation of the Trempeleau, Tunnel City and Elk Mound groups, are the major aquifers underlying the watershed. These are fine-to-coarse grained well-cemented units found 500 to 700 feet below the surface. Additional Ordovician (younger) sandstones, occurring immediately under the Sinnipee Dolomite group, may be found approximately 125 feet beneath Duck Creek, in the area near the Oneida Golf and Riding Club and Brown County Park. Total thickness of all these sandstone aquifers within the watershed is about 600 feet .The oldest bedrock -- and that which is furthest from the surface -- is a complex of hard crystalline rocks, including granite. These are nearly 1.5 billion years old and were formed during the Precambrian Era. This layer is found 725 feet beneath the surface of Duck and Ashwaubenon creeks in the north-eastern portion of the watershed.

Topography

Glaciation has strongly influenced the watershed's topography and surface drainage patterns. During the Pleistocene Age one million years ago, large sheets of ice expanded down from Canada into the United States. There were four separate glacial advancements into the area of the watershed, known as the Nebraskan, Kansan, Illinoisan and Wisconsin stages, respectively. The most recent advance, the Wisconsin stage, had two major substages: the Cary (greatest influence) and the Valders (most recent). The Wisconsin stage began 70,000 years ago and ended 9,000 years ago (estimates vary).

As the 1-to-2 mile thick Cary ice sheet advanced, it carried large quantities of rock, gravel, soil and other debris, which together are known as glacial drift. When temperatures warmed and the ice began to melt, the glacial drift was deposited as landforms known as ground moraines. As melting continued, trapped water formed a large shallow lake in what is now the Fox Valley; this waterbody is known as Early Lake Oshkosh (our present Lake Winnebago is a remnant of this larger lake). Large quantities of sand were deposited in the northern portion of the watershed near the confluence of Duck and Trout creeks, producing the sandy soils and parent material present today.

After the Cary ice sheet retreated and glacial lake water subsided, our present drainage system began to develop. The warm Two Creek Interval, an intermission between glacial substages, lasted around 5,000 years until the ice readvanced 11,000 years ago during the Valders substage. This ice sheet was much thinner than the Cary ice sheet and only slightly modified the existing topography . The retreat of the Valders left deposits of till high in red clay content

scattered over older glacial deposits. The Valders, with its deposition of red clay, gave the watershed its gently rolling topography and provided productive agricultural soils. Various sand-silt-clay mixes account for the variety and productivity of these loam soils.

The elevation of the watershed varies from a high of 850 feet a mile southeast of Black Creek, to 585 feet near the mouth of Duck Creek. The southern portion of the watershed within Outagamie County is characterized by flat-to-gently rolling topography. Within Brown County and on the Oneida Reservation, the landscape is interrupted by ridges flanking Duck Creek and by the rugged ravines of the Trout Creek area. Local relief is characterized by surface drainage patterns in which streams have cut into glacial landforms.

Soils

Due to the watershed's location within both Outagamie and Brown Counties, and due to the existence of two distinct sets of soil associations and maps, the watershed's soils will be discussed by county. Information on Brown County soils was published in June, 1974 while Outagamie County soil information was published in 1978. Both counties are in the process of updating their soil surveys.

Outagamie County

Two groups, the Hortonville-Symco and Winneconne-Manawa Associations, cover nearly 80 percent of the watershed within Outagamie County. Hortonville-Symco soils are well drained and somewhat poorly drained and vary from nearly level to steep in gradient. Ranging from medium-to-coarse textured, this group is moderately permeable and is usually underlain by calcareous or clay loam glacial till. This association is found mainly west and north of Duck Creek. The Winneconne-Manawa Association shares similar characteristics with the above-mentioned Hortonville-Symco. However, it is generally slowly permeable and underlain by silty clay glacial till or lacustrine sediment. The headwaters of Apple Creek flow from and through soils of the Winneconne-Manawa Association.

The Menominee-Grays-Rousseau, Carbondale-Keowns-Cathro, and Onaway-Solona Associations make up the remaining 20 percent of the watershed within the county. The Menominee-Grays-Rousseau group includes well-drained to moderately well-drained soils nearly level to sloping. Varying from coarse to medium textured, they are permeable underlain by lacustrine silt loam and very fine sand, windblown fine sand, or sandy loam glacial till. Within the watershed, the Menominee-Grays-Rousseau Association is found in the valley through which Duck Creek flows. The far northern portion of the Duck Creek watershed in Outagamie County is dominated by the Onaway-Solona Association. Well- drained to somewhat poorly-drained, these soils are nearly level to moderately steep, medium textured, and moderately permeable. They are underlain mainly by calcareous loam or sandy loam glacial till. The final groupis the Carbondale-Keowns-Casco Association , located at the headwaters of Duck Creek within the Burma Swamp Subwatershed. Poorly to very-poorly

drained, these soils are nearly-level organic and medium-textured grains with moderate permeability. They are most frequently underlain by lacustrine silt and fine sand, organic material or loamy sediment.

Brown County

The watershed area located in Brown County is dominated by two soil associations, the Shawano-Boyer-Sisson and Oshkosk-Manawa. The Shawano-Boyer-Sisson group, located within the valleys and ravines of Duck and Trout creeks, is comprised of deep, excessively-drained and well-drained soils varying from nearly level to steep. Typically sandy or sandy loams, these soils are often located on outwash plains and ridges and glacial lake plains. The Oshkosh-Manawa Association consists of deep, well drained to somewhat poorly drained soils with clayey or sandy subsoils. Varying from nearly level to steep, they are found on glacial lake plains dissected by narrow "V"-shaped valleys. Within this watershed, the Oshkosk-Manawa group is found along the west bank of the Fox River.

Three smaller soil combinations are found within the Brown County portion of the watershed. The Waymor-Hochheim and the Kewaunee-Manawa Associations are deep, well-drained to poorly-drained, level to moderately steep soils found near the headwaters of Dutchman Creek. Finally, a small area of Carbondale-Cathro-Marsh soils, typified by very poorly-drained organic soils and marshes, is located just south of Trout Creek's headwaters.

Water Resource Conditions and Goals

This section describes the general conditions of surface and groundwater resources in the Duck, Apple and Ashwaubenon Creeks Watershed. It describes classifications used for the area's surface water and recreational resources in the watershed. Narrative descriptions of subwatersheds are included, as well as several tables that provide summaries of the watershed's resources. Table 2-1 in the next section also provides a summary of surface water resources in each subwatershed. Groundwater quality and quantity are also discussed.

Water Use Classifications

Surface water quality standards and criteria are expressions of conditions necessary to support biological and recreational uses. Water quality standards for recreational and biological uses for waters within the project area outside of the Oneida Indian Reservation are contained in Chapters NR 102, NR 104 and NR 105 of the Wisconsin Administrative Code. The Water Quality Standards of the Oneida Nation determine the designated uses for all surface waters and wetlands within the exterior boundaries of the Reservation.

In addition to these standards, other criteria were used to assess the suitability of surface waters for recreational and biological uses for the purposes of this project. Data characterizing stream size and accessibility were used to help determine the suitability and types of recreation a stream is capable of supporting. Information on current recreational use of surface waters (provided by users at public access points and discussions with local government and Tribal officials) were also used to assess the suitability of surface waters for recreation. Use classifications and supporting water quality standards used to evaluate water resource conditions are discussed below.

Biological Stream Use

Streams within the State of Wisconsin and on the Oneida Reservation are classified according to the biological uses desired for each waterway. In each subwatershed discussion, these classifications are listed for streams identified in the Lower Fox River Water Quality Management Plan . The codified stream classification determines allowable pollutant loads to the receiving waterbody . Wisconsin's water resources are classified by 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 include intermediate surface waters of limited capacity and naturally poor water quality or habitat, capable of supporting only a limited community of forage fish or other aquatic life.

LAL = Limited Aquatic Life Communities includes marginal surface waters severely limited because of low flow and naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of aquatic life.

The water resources of the Oneida Reservation are classified as either:

CWE = Cold Water Ecosystems: waters of the Reservation where water temperature, habitat and other characteristics are suitable or intended to be

suitable for the support and propagation of cold water fish and other aquatic life, or serving as a spawning or nursery area for cold water fish species.

WWE = **Warm Water Ecosystems:** waters of the Reservation where water temperature, habitat and other characteristics are suitable or intended to be suitable for support and propagation of warm water fish and other aquatic life, or serving as a spawning or nursery area for warm water fish species.

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

Class I Trout streams of high quality; populations are sustained by natural reproduction.

Class II Trout streams with some natural reproduction but may need stocking to maintain a desireable fishery.

Class III Trout streams with no natural reproduction that require annual stocking of legal-size fish to provide sport fishing.

Table 2-1 summarizes the biological uses of waters in the Duck, Apple and Ashwaubenon Creeks Watershed.

Recreational Stream Use/State of Wisconsin

Recreational stream use classifications are described by a level of human body contact determined to be safe and reasonable. The system applies to all surface waters including those categorized as intermediate or marginal under the above referenced biological use classification system.

Full Body Contact. These waters are used for human recreation where immersion of the head is expected and occurs often. Recreation activities classified as full body contact include swimming, waterskiing, sailboarding and other similar activities.

Partial Body Contact. These waters are used for human recreation where immersion of the head is not frequent and contact is most often incidental or accidental. Recreational activities classified as partial body contact include boating, canoeing, fishing and wading.

Non-Contact. These waters should not be used for human recreation. This category is used infrequently and only when extenuating circumstances, such as high concentrations of in-place pollutants, an uncontrollable pollution source or other conditions dictate that contact with the water would pose an unnecessary health risk.

Recreational Stream Use/Oneida Reservation

Primary-Contact. Waters that are suitable for activities involving prolonged human contact where the risk of ingesting small quantities of water is likely; examples include, but are not limited to, swimming, tubing, rafting and skin diving.

Secondary-Contact. Waters that are suitable for activities in which human contact with the water may, but need not, occur and in which the probability of ingesting raw water is unlikely. Examples include, but are not limited to, fishing, wading and boating.

Surface Water and Recreational Resources

For the purposes of this project, the Duck, Apple and Ashwaubenon Creeks Watershed is subdivided into 8 subwatersheds. Each subwatershed conveys surface water to one or more of the Duck, Apple or Ashwaubenon creeks. Major tributaries, associated streams and wetlands, the reservoir and subwatershed divides are shown in Map 1-1. See Table 2-1 for the general conditions of water resources in the Duck, Apple and Ashwaubenon Creeks Watershed.

Subwatersheds in the Duck, Apple and Ashwaubenon Creeks Watershed

Burma Swamp	(BS)	Appleton	(AP)
Fish Creek	(FC)	Freedom	(FR)
Trout Creek	(TR)	Hemlock Creek	(HM)
Lancaster Brook	(LC)	Dutchman Creek	(DM)

Streams

There are two major subwatersheds involved in this project: the Duck Creek Subwatershed and the Apple-Ashwaubenon Subwatershed. Streams and wetlands are the predominant surface water features in these subwatersheds. Perennial streams, which have a combined length of about 188 miles, maintain at least a small continuous flow throughout most of the year. Duck Creek, 42 miles in length, is the longest perennial stream in the watershed. Other primary streams include Apple Creek (24 miles), Dutchman Creek (17 Miles) and Ashwaubenon Creek (15 miles).

While the majority of the Duck, Apple and Ashwaubenon Creeks Watershed supports a warm water fishery, portions of Trout Creek and Lancaster Brook have been classified as Cold Water Ecosystems in the Oneida Nation Water Quality Standards. Four (4) miles of Apple Creek, the first 7 1/2 miles of Ashwaubenon Creek, the first 10 miles of Duck Creek, the first 4 miles of Dutchman's Creek and the first 2 miles of Lancaster Creek support a warm water sport fishery. The remainder of the watershed is classified as a warm water forage fishery.

Duck, Apple and Ashwaubenon creeks, and their tributary streams, are not reaching their potential uses due to pollution from nonpoint sources. Sedimentation and phosphorus loading from upland agricultural fields are the major sources of nonpoint pollution in the watershed. Upland areas account for well over 80 percent of the overall load. Eroding streambanks and improperly managed livestock operations are also contributors. In addition, land use changes in riparian and upland areas, in concert with the destruction of nearly 70 percent of the area's historical wetlands, have led to the 'flashy' characteristics exhibited by area streams. Consistently low summer water levels and periods of 'no flow' play a major role in limiting aquatic life throughout the watershed.

In Trout Creek the overall objective is to improve the stream's ability to maintain a healthy sport fishery. Trout Creek would benefit from reduced sedimentation and nutrient loading rates, particularly in the upper reaches of the subwatershed. Buffering of the creek and its feeder streams would help improve overall water quality and habitat for fish and other aquatic life.

The remaining streams in the watershed will be described in more detail in the subwatershed descriptions.

Green Bay and Lake Michigan

The Duck, Apple and Ashwaubenon Creeks Watershed enters Lake Michigan at Green Bay. The Bay has excessive sediment and nutrient loadings, which are addressed, in part, by both the Green Bay Remedial Action Plan (WDNR, 1988; WDNR, 1992) and the nonprofit organization Fox-Wolf Basin 2000's report "Toward a Cost-Effective Approach to Water Resources Management in the Fox-Wolf Basin: A First-Cut Analysis." Of the 20 watersheds in the Fox-Wolf Basin, Duck Creek ranks the second highest for sediment delivery to Green Bay and the Apple-Ashwaubenon Creek Watershed ranks third highest. The Green Bay Remedial Action Plan calls for a 50 percent reduction in combined sediment loads from all sources to the bay of Green Bay.

Lakes

Although there are no naturally occuring lakes within the project area, an abandoned quarry near the intersection of County Highway J and North Overland Road supports a diverse population of bass and other gamefish. The quarry has a surface area of 5 1/2 acres and is maintained through groundwater recharge resulting from prior excavation. During storm events, Duck Creek occasionally overflows its banks and connects with the quarry.

Wetlands

Wetlands are valuable natural resources. They provide wildlife habitat, fish spawning and rearing areas, recreation, storage of runoff and flood flows and pollutant removal . The largest

contiguous areas of wetlands in the watershed occur at the headwaters of Duck and Trout creeks, with dozens of smaller riparian wetlands adjacent to perennial and intermittent streams in the project area. These riparian, or floodplain wetlands, support furbearers and waterfowl populations and may provide seasonal habitat for sport fish.

A wetland and wildlife habitat inventory was undertaken to identify existing and modified or converted wetlands for the purpose of protection from degradation or potential restoration (Table 2-2).The inventory focused on wetlands which are presently, or have been in the past, degraded through drainage, grazing, cropping or other activities causing water storage loss and sediment build up. Data was collected on 439 wetlands (11,990 acres) from Natural Resource Conservation Service maps, air photos and DNR wetland inventory maps. Guidelines for wetland restoration, which will be a component of this project, are outlined at the end of this chapter. Wetlands comprise roughly 7 percent of land area in the project area.

Recreation

Recreational opportunities on and in the watershed's streams have been severely impaired due to excess sedimentation and nutrient loading. In addition, land use changes in upland areas have led to increased peak flows and diminished year-round flow within surface waters . Fishing and swimming opportunities that once existed are now all but gone.

However, there exists great potential for future use of these streams. The installation of best management practices, including restoration of headwater wetlands, would result in increased water quantity and quality and more opportunities for fishing and canoeing, as well as hiking, hunting and wildlife observation. Vegetated riparian buffers will stabilize streambanks and reforested streambank corridors will aid in lowering in-stream water temperatures, increasing habitat for cold water aquatic species .

Table 2-1: Surface Water Resource Conditions, Goals and Objectives for the Duck, Apple and Ashwaubenon Creeks Watershed

SUBWATERSHED	STREAM NAME	LENGTH (MILES)	EXISTING BIOLOGICAL USE & MILES	LIMITING FACTORS	OBSERVED &POTENTIAL SOURCES	SURFACE WATER RESOURCE GOALS	SURFACE WATER RESOURCE OBJECTIVES
Burma Swamp	Duck Creek	30 - 42	WWSF / 2 WWFF / 10	SED, NUT HAB, DO FLOW, TEMP	NPS-PSB, CON, BY, CL, URB, DCH	-Improve aquatic life habitat and water quality -Reduce sediment and nutrient loading -Increase stream baseflow	-Maintain, enhance and create buffers -Promote Ag BMP's -Promote alternatives to tiling and ditching -Limit livestock access to the stream -Improve infiltration
Fish Creek	Duck Creek	6 - 30	WWSF	SED, NUT, HAB, DO, FLOW, TEMP	NPS-PSB, CON, BY, CL, URB, DCH	-Improve aquatic life habitat and water quality -Increase stream base flow -Enhance wildlife habitat -Reduce sediment and nutrient loading	-Maintain, enhance and create buffers -Restrict livestock access to the stream -Control construction site erosion -Promote good Ag BMP's -Maintain, enhance and create wetlands -Decrease sedimentation of spawning areas -Promote alternatives to tiling and ditching -Encourage good land use planning
Trout Creek	Trout Creek	8	WWFF	SED, NUT, HAB, DO, FLOW	NPS-PSB, CON, BY, CL	-Improve aquatic life habitat and water quality -Increase stream baseflow -Enhance wildlife habitat -Reduce sediment and nutrient loading	-Maintain, enhance and create buffers -Control construction site erosion -Maintain, enhance and create wetlands -Encourage good land use planning -Decrease sedimentation of spawning areas -Preserve the habitat of the redside dace -Promote Ag BMP's
Lancaster Creek	Duck Creek	0 - 6	WWSF	SED, NUT, HAB, DO, FLOW	NPS-PSB, CON, BY, CL, URB	-Improve aquatic life habitat and water quality -Increase stream baseflow -Enhance wildlife habitat -Reduce sediment and nutrient loading	-Maintain, enhance and create buffers -Control construction site erosion -Maintain, create and enhance wetlands -Encourage good land use planning -Decrease sedimentation of spawning areas -Promote Ag BMP's -Decrease sedimentation of spawning areas
	Lancaster Creek	8	UNK.				
	Beaver Dam Creek	4	WWFF / 4				
	Unn. Creek (T24N,R20E,S10)	2	UNK.				
	Unn. Creek (T25N,R20E,S36)	6	UNK.				
	Unn. Creek (T25N,R20E,S34)	1	UNK.				
Appleton	Apple Creek	12 - 24	WWFF/12	SED, NUT, HAB, DO, FLOW, TEMP	NPS-PSB, CON, BY, CL, URB, DCH	-Improve aquatic life habitat and water quality -Increase stream baseflow -Enhance wildlife habitat -Reduce sediment and nutrient loading	-Maintain, enhance and create buffers -Restrict livestock access to the stream -Control construction site erosion -Promote Ag BMP's -Maintain, enhance and create wetlands -Decrease sedimentation of spawning areas -Promote alternatives to tiling and ditching
	Unn. Creek (T21N,R19E,S01)	1	UNK.				
	Unn. Creek (T21N,R19E,S02)	4	UNK.				

Table 2-1: Surface Water Resources Conditions, Goals and Objectives for the Duck, Apple and Ashwaubenon Creeks Watershed

SUBWATERSHED	STREAM NAME	LENGTH (MILES)	EXISTING BIOLOGICAL USE (MILES)	LIMITING FACTORS	OBSERVED OR POTENTIAL SOURCES	SURFACE WATER RESOURCE GOALS	SURFACE WATER RESOURCE OBJECTIVES
Freedom	Apple Creek	0 - 12	WWSF / 4 WWFF/ 8	SED,NUT, HAB, DO, FLOW, TEMP	NPS-PSB, CON, BY, CL, URB, FLOW	-Improve aquatic life habitat and water quality -Increase stream baseflow -Enhance wildlife habitat -Reduce sediment and nutrient loading	-Maintain, enhance and create buffers -Restrict livestock access to the stream -Control construction site erosion -Promote Ag BMP's -Maintain, enhance and create wetlands -Encourage good land use planning -Promote alternatives to tiling and ditching
	Unn. Creek (T22N,R19E,S25)	4	UNK.				
	Unn. Creek (T22N,R19E,S27)	1	UNK.				
	Unn. Creek (T22N,R19E,S28)	4	UNK.				
	Unn. Creek (T22N,R19E,S31)	4	UNK.				
	Unn. Creek (T22N,R19E,S32)	4	UNK.				
Hemlock	Ashwaubenon Creek	15	WWSF / 7.5 WWFF / 7.5	SED, NUT, HAB, DO, FLOW, TEMP	NPS-PSB, CON, BY, CL, URB, FLOW	-Improve aquatic life habitat and water quality -Increase stream baseflow -Enhance wildlife habitat -Reduce sediment and nutrient loading	-Maintain, enhance and create buffers -Restrict livestock access to the stream -Control construction site erosion -Encourage land use planning -Maintain, enhance and create wetlands -Decrease sedimentation of spawning areas -Promote Ag BMPs
	Hemlock Creek	7	UNK.				
	North Branch Ashwaubenon Cr.	7	UNK.				
	South Branch Ashwaubenon Cr.	6	UNK.				
	Unn. Creek (T23N,R20E,S21)	4	UNK.				
	Unn. Creek (T23N,R20E,S31)	2	UNK.				
	Unn. Creek (T22N,R20E,S06)	3	UNK.				
	Unn. Creek (T22N,R19E,S12)	1	UNK.				
	Unn. Creek (T22N,R19E,S12)	2	UNK.				
	Unn. Creek (T22N,R19E,S11)	2	UNK.				
Dutchman	Dutchman Creek	0 - 17	WWSF / 4 WWFF / 13	SED, NUT, HAB, NH3, FLOW, DO, TEMP	NPS-PSB, CON, BY, CL, URB, FLOW	-Improve aquatic life habitat and water quality -Increase base stream flow -Enhance wildlife habitat -Reduce sediment and nutrient loading	-Maintain, enhance and create buffers -Restrict livestock access to the stream -Control construction site erosion -Promote Ag BMP's -Maintain, enhance and create wetlands -Decrease sedimentation of spawning areas -Encourage good land use planning
	Unn. Creek (T23N,R20E,S09)	2	UNK.				
	Unn. Creek (T23N,R20E,S09)	3	UNK.				

LEGEND:

[1] **Biological Use, Existing** - this column indicates the existing biological use supported by the stream as defined in NR 102 (04)(3) under fish and aquatic life uses.
COLD - coldwater communities
WWSF - warmwater sport fish communities
WWFF - warmwater forage fish communities
LFF - limited forage fishery (intermediate surface waters)

2 **Limiting Factors**
HAB - Habitat (lack of cover, sedimentation scouring etc.)
SED - Sedimentation (filling in of pools)
TEMP - Temperature (extreme high for trout)
DO - Dissolved Oxygen (to low)
FLOW - Flooding or fluctuating water levels
ALG - Algae (abundant)
NUT - Nutrient enrichment
TURB - Turbidity
BAC - Bacteria (MMFCC/100 ml)

[3] **Observed or Potential Sources**
NPS - Unspecified nonpoint sources
CL - Cropland erosion
SL - Shoreline erosion
SB - Streambank erosion
PSB - Streambank pasturing
BY - Barnyard or exercise lot runoff
PSM - Point source, municipal treatment plant discharge
PSI - Point source, industrial discharge (rotten granite pit dewatering)
NMM - Non-metallic mining (rotten granite/gravel)
UR - Urban runoff
CON - Construction site erosion
DCH - Ditching

Table 2-2 Wetland Inventory Summary: Duck, Apple and Ashwaubenon Creeks Watershed

Subwatershed	Total Sites	Total Acres
Burma Swamp	93	2,493
Fish Creek	80	5,878
Trout Creek	32	732
Lancaster Brook	60	2,341
Appleton	43	136
Freedom	41	439
Hemlock Creek	28	357
Dutchman Creek	62	483
Totals	**439**	**12,852**

Source: DNR wetland maps

Groundwater Resources

Regional Aquifers

Groundwater within the project area originates from precipitation that percolates downward to the zone of saturation (the area where all pores, cracks, and fissures in the aquifer are filled with water). This percolating water eventually becomes part of the underground reservoir from which drinking water in the watershed is drawn. Groundwater moves through fractures, joints, and pore spaces in response to gravity. Its movement through the bedrock acquifer is dependent upon the permeability of the rock. Rock containing shale, clay and dolomite (as is common within the watershed), slows the downward movement of water. While the movement of water through sand and gravel is rapid, clay and silt slow the rate at which water moves downward through the upper sections of the aquifer.

Since 1936, the State of Wisconsin has required well drillers to document well construction and rock and soil layers encountered during well installation. Information from geologic logs, driller construction reports and Wisconsin Geological and Natural History Survey (WGNHS) reports for Outagamie and Brown Counties and the Oneida Nation's land is included below. The most important potable water supply within the watershed is an underground aquifer composed of Cambrian and Ordovician age sandstone. This system is the principle source available to watershed residents for domestic use. The upper-most portion of the sandstone aquifer ranges from an elevation of less than 500 feet above sea level in the eastern portion of the watershed to 600 feet at its most western extent.

Principle aquifers within the watershed are found in the St Peters formation and the Trempealeau, Tunnel City and Elk Mound groups. Private wells in the watershed vary from 50 to 550 feet in depth and provide the bulk of the area's residents potable water needs. Wells located within the St. Peter's formation are considerably shallower than those found in the deeper Cambrian layers. Artesian wells and springs are present in areas where the groundwater is confined by a low permeability layer such as a clay lens. These lenses occur throughout the glacially deposited sediments. Subsurface groundwater saturation depths vary considerably in the project area.

Direction of Groundwater Flow

Local groundwater flow in the Duck, Apple and Ashwaubenon Creeks Watershed typically mirrors the topography of the land surface and flows "downhill" or down gradient toward the nearest surface water. Regional groundwater in the watershed generally flows in a northeasterly direction towards the Fox River and Green Bay.

Groundwater Quality

Groundwater quality in the watershed is generally considered good, although localized problems do occur, and arsenic has been detected in wells. Private well samples were collected and analyzed for nitrate (NO_3) + nitrite (NO_2). Sample analytical results are summarized in Table 2-3. Samples analyzed for nitrate (NO_3) + nitrite (NO_2) showed concentrations ranging from "no detect" to 0.40 parts per million (ppm) or milligrams per liter (mg/L). The groundwater enforcement standard (ES) for nitrate is 10 mg/L. Nitrate (NO_3) + nitrite (NO_2) concentrations above 2 mg/L exceed the state's preventive action limit (PAL).

No sample exceeded 2 mg/l. Results so far do not indicate a pattern of groundwater contamination that can be linked to specific sources of nitrate. These results can not be extrapolated to represent groundwater quality throughout the entire watershed.

No samples were collected for coliform bacteria or hazardous substances such as volatile organic compounds. Coliform bacteria can be a drinking water problem where septic systems, land spreading of manure or barnyards are located upgradient (generally uphill) of a well. Bacteria can enter the drinking water supply along the well casing of improperly constructed wells. Some wells with high levels of bacteria can be rehabilitated.

Volatile organic compounds (VOCs) generally enter a well from nearby leaking underground gasoline or other fuel storage tanks and from spills. Once these compounds are in the groundwater they are difficult to clean up. In general, wells contaminated with VOCs have to be abandoned and a new well drilled.

Enforcement Standard (ES) Health Advisory Level: The concentration of a substance at which a facility regulated by DILHR, DATCP, DOT or DNR must take action to reduce the concentration of the substance in groundwater.

Preventative 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, and provide a basis for design codes and management criteria.

Arsenic

Research into the presence of arsenic in groundwater in Outagamie County and Winnebago County began in 1991 after this naturally occuring metal was found in groundwater below a potential landfill site in Winnebago County. Since that time, researchers have investigated 2125 private water supply wells for arsenic over a broad geographic range in parts of Brown,

Outagamie, and Winnebago counties. Overall, the range of concentrations found in wells within these three counties was between 1.0 ug/l and 12000 ug/l. Results showed that 32 percent of sampled wells contained greater than 5 micrograms per liter (ug/l), which is the state preventative action limit (PAL). Eighty-six (86) of the 2125 wells exceeded the state health advisory limit of 50 micrograms per liter (50 ug/l) (Burkel and Stoll, May 1996).

The presence of arsenic in this region is principally due to naturally occuring processes within two of the region's geologic formations -- the St. Peter Sandstone and the overlying Platteville/Galena Dolomite. Researchers believe that contact between the two formations is the predominant source of elevated arsenic concentrations. Unfortunately, these two formations are the region's principle sources of potable waters upply.

Based on data gathered from the study cited above, an arsenic advisory has been designated for both Outagamie and Winnebago counties. Guidelines for new well drilling and construction have reduced the risk of groundwater contamination by arsenic for those wells. Fifteen wells containing arsenic concentrations exceeding the health advisory were successfully reconstructed or new wells were constructed based on the new guidelines. These constructions eliminated or substantially reduced arsenic levels in the well water samples.

Table 2-3 Nitrate Detected in Sampled Wells in the Duck, Apple and Ashwaubenon Creeks Watershed

NITRATE		
	Number of Nitrate Samples	
Subwatershed	less than 2.0 mg/l	%
Trout Creek	12	100
Fish Creek	29	100
Burma Swamp	24	100
Dutchman Creek	20	100
Hemlock Creek	17	100
Freedom	18	100
Appleton	14	100
Lancaster Creek	12	100
Totals	146	100

Water Supplies

Water supplies for domestic, agricultural, and industrial uses in the Duck, Apple and Ashwaubenon Creeks Watershed are obtained from both private groundwater sources and municipal systems. There are three principal aquifers lying beneath the watershed from which groundwater is obtained. Water obtained from these aquifers is either pumped from individual private wells or is through municipal pumping facilities.

Potential Groundwater Quality Problems

Potential sources of groundwater quality problems in the Duck, Apple and Ashwaubenon Creeks Watershed include "Superfund" sites, solid and hazardous waste disposal sites, leaking underground storage tanks sites and spill sites. Many of these sites are listed in the DNR Publication SW-144, The Wisconsin Remedial Response Site Evaluation Report (December 1991) and the publication PUBL-SW-108-93, Registry of Waste Disposal Sites (June 1993). The database from which these documents were generated is continually updated. The Appendices B, C and D list known spill, leaking septage tank, and leaking underground storage tank sites located in the watershed. There is one Superfund site in the project area and one located just outside of the area; the former is in Brown County; the latter, in Outagamie County. Potential pollution associated with nonpoint sources is described in various sections throughout the remainder of this chapter.

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 of Pollution

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 four permitted industrial discharges to the waters of the Duck, Apple and Ashwaubenon Creeks Watershed (see table below). In addition to these four distinct discharges to the watershed, there are a number of discharges in the East River Watershed, which lies adjacent to the planning watershed on the southeast side of the Fox River and which may or may not have an impact on the planning watershed. These point sources generally discharge to groundwater and/or the Fox River.

Sewage Treatment Systems and Sewer Service Area Planning

The availability of sanitary sewer is growing in the project area. Populations are served in both the Green Bay Area (by the Green Bay Metropolitan Sewerage District) and in the Fox Cities in Outagamie County by Heart of the Valley and Appleton Sewer Service Areas (SSAs). Requests to expand all three of these SSAs, which in part lie in the project area were submitted in 1997. Wastewater generated outside SSAs is disposed of through private on-site systems.

The SSA planning process is implemented under NR121 and involves identifying and protecting areas sensitive to water quality degradation; these areas are determined to be unsuitable for sanitary sewer. Brown County is in the process of revising its definition of environmentally sensitive areas under the SSA Program. One of the most important aspects of sensitive areas protection under the SSA planning program is maintenance of a natural hydroregime, which if disturbed, can cause major problems for local and downstream areas.

In 1997, the Towns of Hobart and Lawrence and the Village of Ashwaubenon in Brown County submitted a plan to add approximately 1600 acres of land into a joint SSA. Evaluating this request will require an environmental assessment. Similarly, the East Central Regional Planning Commission has submitted a Year 2020 SSA plan for the Heart of the Valley area that requests the addition of approximately 5411 acres of land that includes headwaters and tributaries of Apple Creek. The ECRPC has also requested 3121 acres of land to be added to the Appleton SSA. These requests will also undergo environmental assessments by the DNR.

Municipal Waste Water Treatment Plants

The point source discharges of wastewater from municipal and industrial sources in the planning area include: 4 industrial discharges and 2 municipal discharges are permitted under the WPDES wastewater program.

Point Sources in the Duck, Apple & Ashwaubenon Creeks Watershed

FACILITY NAME	PERMIT # EXP. DATE	RECEIVING WATER	CLASS	ACTIVITIES
FABCO EQUIPMENT	0046612 000930	Ashwaubenon Cr. Via storm sewer	WWSF	IND
SUPER VALUE STORES INC	0043923 8921231	Dutchman's Creek via stormsewer	WWSF	IND
FREEDOM SANITARY DIST #1	0020842 980930	Duck Creek		MUN
NEW HARVEST FOODS INC	0045080 960930	Groundwater Lower Fox & Upper Green Bay & Little Suamico R. Via unnamed tributary	N/A	IND
PROVIMI INC	0044628 010630	Duck Creek via unnamed tributary		IND
SANGER B POWERS CORRECTIONAL CENTER	0061221 001231	Groundwater Lower Fox River drainage basin	N/A	MUN

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, poor design or maintenance, such as when tanks go unemptied. Pollutants from septic system discharges include: nitrates, bacteria, viruses and hazardous materials from household products. Generally, in the Duck, Apple and Ashwaubenon Creeks Watershed, *the majority of soils (clays and silty-clays) are not suitable for conventional septic tank soil absorption systems*. Landspreading of septic system waste during the winter months can also create surface water quality problems.

Counties have been using the Wisconsin Fund since 1981. The Wisconsin Fund is a Private Sewage System Replacement Grant Program offering financial assistance designed to help eligible homeowners and small business operators offset the costs of replacing a failing septic system. *The program is administered by the Brown County and Outagamie County Zoning Departments.* The grant program applies to principle residences and small businesses built prior to July 1, 1978, and is subject to income and size restrictions. Seasonal homes are not eligible for participation in this program. Interested individuals should contact their county zoning department for more information.

Solid Waste Disposal Sites

There are 38 abandoned waste disposal sites in the watershed; this number includes transfer stations, which are grouped with landfills in the *Registry of Waste Disposal Sites* (June 1993), from which this data was obtained. There are 7 active waste disposal sites in the watershed. Two of these sites are active landfills in Brown County (WDNR, PUBL-SW-108-93).

Petroleum Storage: Leaking Underground Storage Tank (LUST) Sites

The Wisconsin Remedial Response Site Evaluation Report (DNR SW-144-91) lists sites identified through the LUST program. The LUST list is dynamic and frequently updated. Please contact DNR for a current list of sites. At the time this plan was sritten, 1996, there were roughly 300 known LUST sites in the watershed. Of these, 228 were in Outagamie County (112 in Appleton) and 164 in Brown County (134 in Green Bay). Appendix B lists these sites and substances found.

Other Contaminated Sites

The Wisconsin Remedial Response Site Evaluation Report also has the *Inventory of Sites or Facilities Which May Cause or Threaten to Cause Environmental Pollution* and the *Spills Program List*, which includes sites or facilities identified under the Hazardous Substance Spill Law. See Appendix C for list of spill sites.

Water Quality Goals and Project Objectives

The project team, including staff from the DNR, Brown and Outagamie counties, the Oneida Nation and DATCP, developed water quality goals and project objectives. Objectives for each subwatershed and are included in the next section. Details can be found in the Duck, Apple and Ashwaubenon Creeks Watershed Project Appraisal Report (Johnson, 1996) available through DNR's Northeast Region Office.

The following are goals for the water resources:

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

Enhancement: Enhancement refers to a change 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 that prevent achievement of its full biological potential.

Restoration: Restoration refers to upgrading the existing biological use to support a higher category of biological use. An example is a stream that historically supported healthy populations of warmwater game fish, but no longer does. The goal in this situation is to improve conditions so that viable populations of forage and warmwater game fish species are reestablished.

Water quality conditions needed to support goals for streams and lakes are the basis for determining the type and level of nonpoint source control to be implemented under the project. This chapter discusses the physical characteristics, existing conditions, nonpoint sources, objectives and management categories for water resources in the Duck, Apple and Ashwaubenon Creeks Watershed. Information is presented for each subwatershed and pollution source.

Subwatershed Discussions

This section describes the physical conditions of each subwatershed in the project area and water quality conditions. Discussions for each subwatershed include: a general description, water quality conditions, rural nonpoint source pollutants and objectives and urban nonpoint sources and objectives. Table 2-1 summarizes water resource conditions. Maps 2-1 through 2-8 show more detail of the subwatersheds.

Water Resources Goals and Objectives

Overall Water Resources Goal Enhance the water quality of the streams of the subwatersheds to improve the water quality of all the subwatersheds, the Fox River and ultimately the receiving water, the bay of Green Bay.

Secondary Goals: Letters following each goal correspond to actions in the following section See the matrix below for a visual representation of these goals and actions.

1. Increase baseflow to reduce the occurrence and severity of low flow conditions: a,b,c,e,f
2. Improve aquatic life and fisheries habitat and water quality: a,b,c,d,e,f,g,h,i,j,l,m,n
3. Improve the water quality of the bay of Green Bay: a,b,c,d,e,f,g,h,i
4. Reduce sediment and nutrient loading: a,b,c,d,e,f,g,h,i
5. Improve wildlife habitat: a,b,c,d,j,k

Actions: *Below are actions needed to reach the goals listed above.*

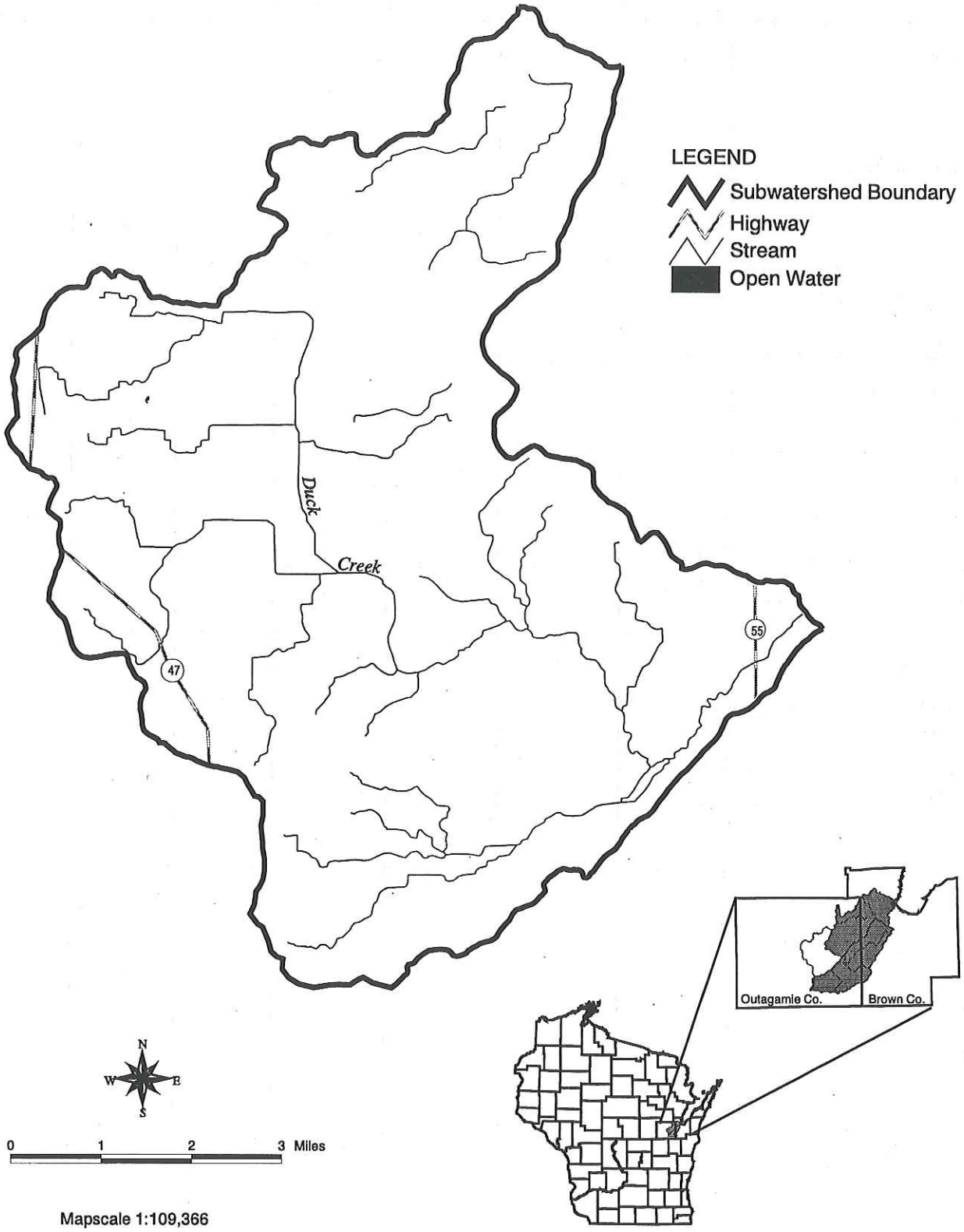
a maintain, enhance and create wetlands to slow the release of water for consistent flow
b encourage good land use planning
c promote agricultural best management practices
d create and maintain buffers to filter sediment and pollutants, provide shade, stabilize streambanks
e promote alternatives to tiling and ditching
f improve infiltration
g controll construction site erosion
h reduce nutrient and sediment loading by 50 percent as identified in the Green Bay RAP.
i limit livestock access to the streams
j preserve, enhance and create wetlands for northern pike spawning
k preserve, enhance and create wetlands, woodlands, grasslands and corridors.
l decrease sedimentation of spawning areas to improve seasonal runs of walleye and perch.
m preserve the habitat of the redside dace.
n conduct an assessment of the need for the sill (dam) structure on Dutchman Creek.

Table 2-4 Water Resources Goals and Actions by Subwatershed

Subwatersheds → / Goals ↓	Burma Swamp	Fish Creek	Trout Creek	Lancaster Creek	Appleton	Freedom	Hemlock	Dutchman
Increase baseflow	# 1	X	X	X	# 1	X	X	X
Improve aquatic habitat and water quality	X	# 1	# 1	# 1	X	# 1	# 1	# 1
Improve the water quality of Green Bay	X	X	X	X	X	X	X	X
Reduce sediment and nutrient loading	X	X	X	X	X	X	X	X
Improve wildlife habitat	X	X	X	X	X	X	X	X
Objectives ↓								
Wetlands to provide more baseflow and water retention	X	X	X	X	X	X	X	X
Encourage good land use planning	X	X	X	X	X	X	X	X
Promote agricultural BMPs	X	X	X	X	X	X	X	X
Promote Better buffers	X	X	X	X	X	X	X	X
Promote alternatives to tiling and ditching	X	X	X	X	X	X	X	X
Improve infiltration	X	X	X	X	X	X	X	X
Control construction site erosion	X	X	X	X	X	X	X	X
Reduce sediment and nutrient loads by 50%	X	X	X	X	X	X	X	X
Limit livestock access to streams	X	X	X		X	X	X	X
Wetlands for fish spawning	X	X	X	X	X	X	X	X
Preserve wildlife corridors	X	X	X	X	X	X	X	X
Reduce sedimentation of spawning areas		X		X		X	X	X
Determine status of sill (Dam) on Dutchman Creek								X
Preserve the habitat of the redside dace		X	X					

#1 Indicates the most important goal for the subwatershed

Burma Swamp Subwatershed



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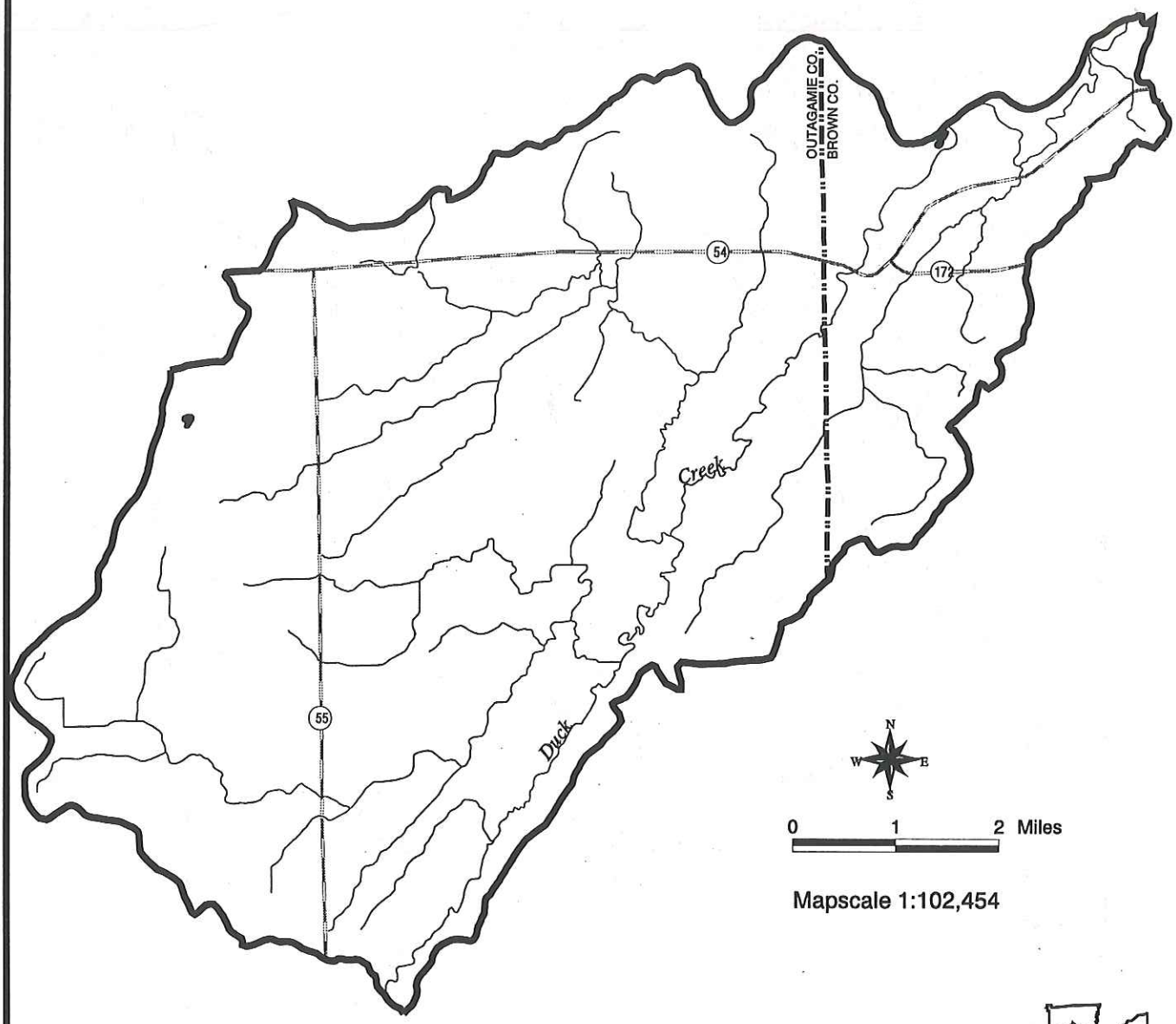
PROJECT AREA

Wisconsin Department of Natural Resources
Water Division
Bureau of Watershed Management
May 1997

Fish Creek Subwatershed



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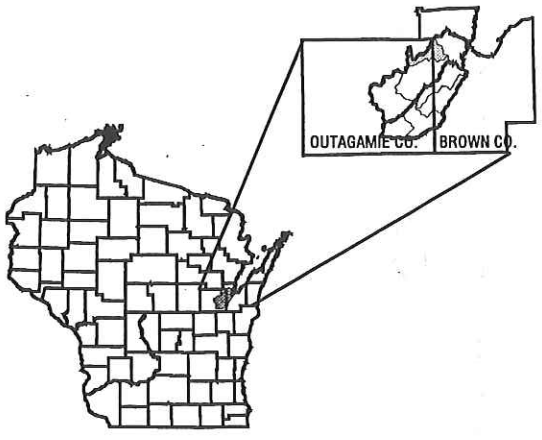


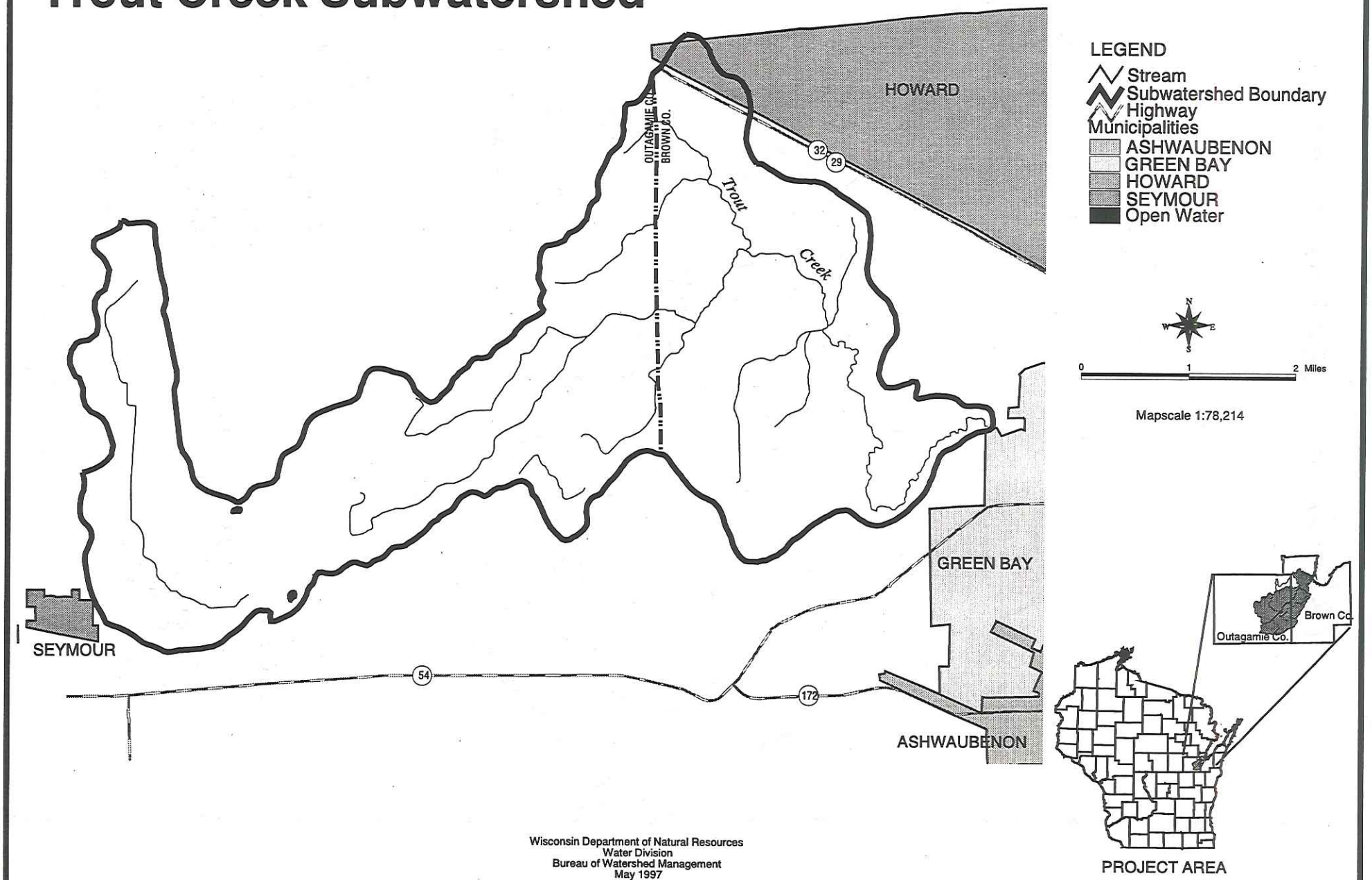
PROJECT AREA

LEGEND

- Subwatershed Boundary
- County Boundary
- Highway
- Stream
- Open Water

Wisconsin Department of Natural Resources
Water Division
Bureau of Water Resources Management
May 1997

Trout Creek Subwatershed



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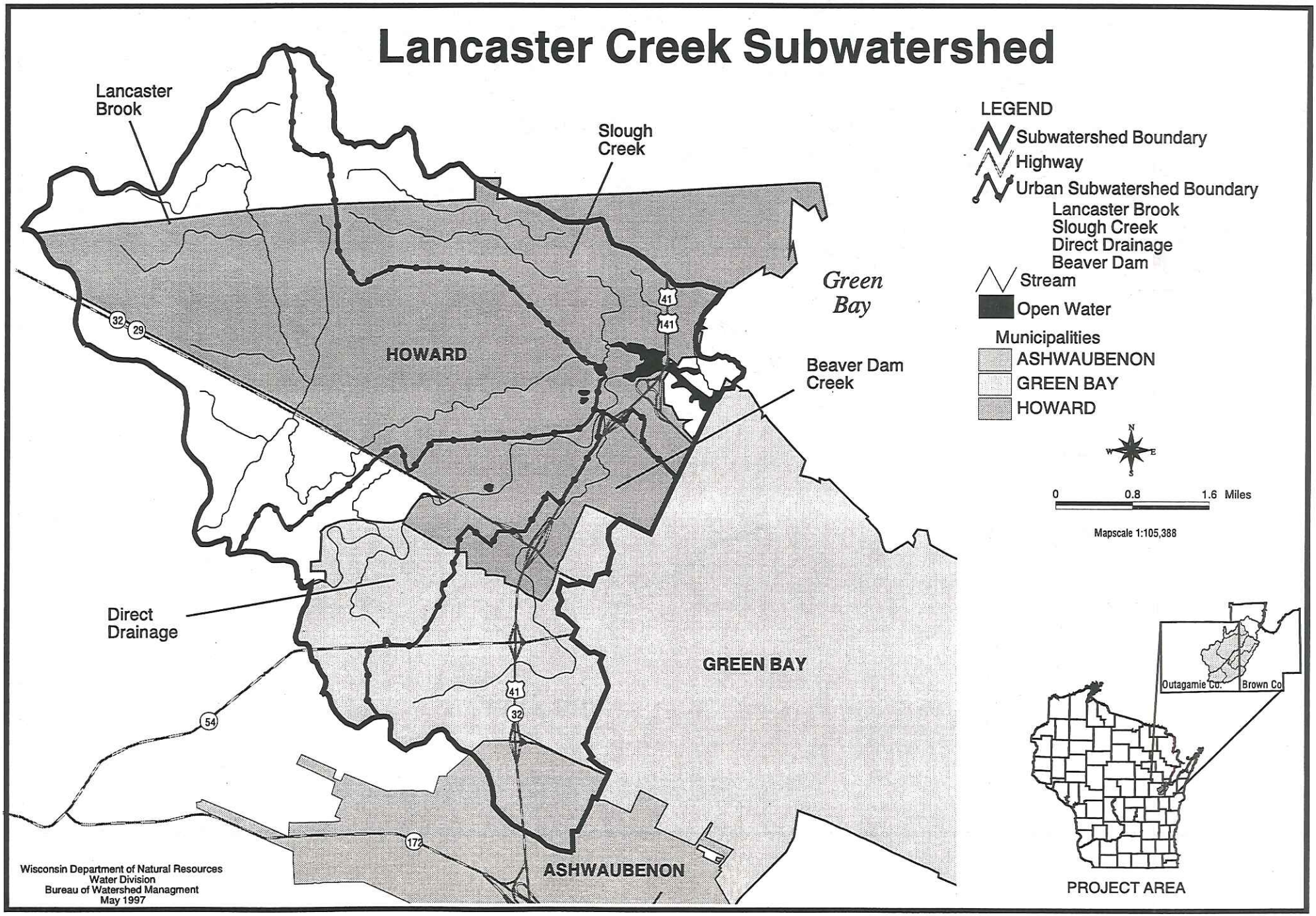
Water Division
Bureau of Watershed Management
May 1997

Lancaster Creek Subwatershed



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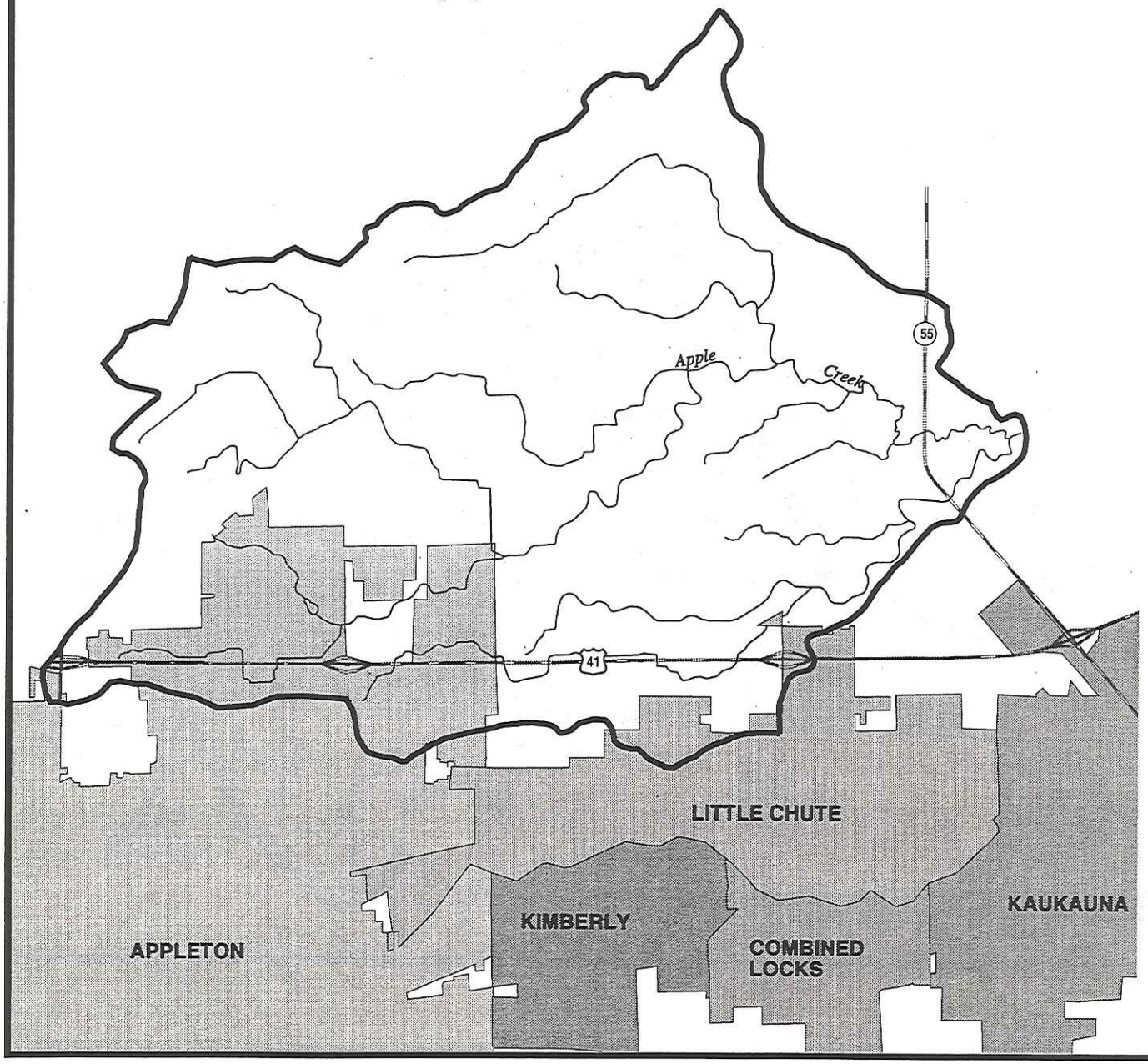
Water Division
Bureau of Watershed Managment
May 1997

Appleton Subwatershed



LEGEND

- Subwatershed Boundary
- Highway
- Stream

Municipalities

- APPLETON
- COMBINED LOCKS
- KAUKAUNA
- KIMBERLY
- LITTLE CHUTE
- Open Water

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0 1 2 Miles

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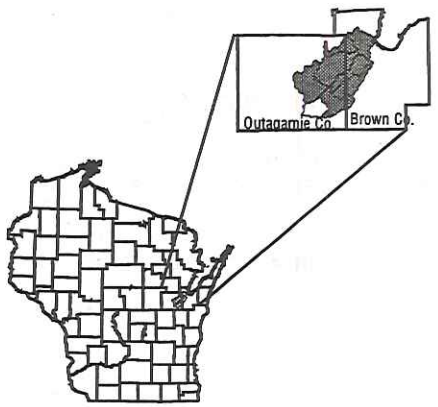

PROJECT AREA

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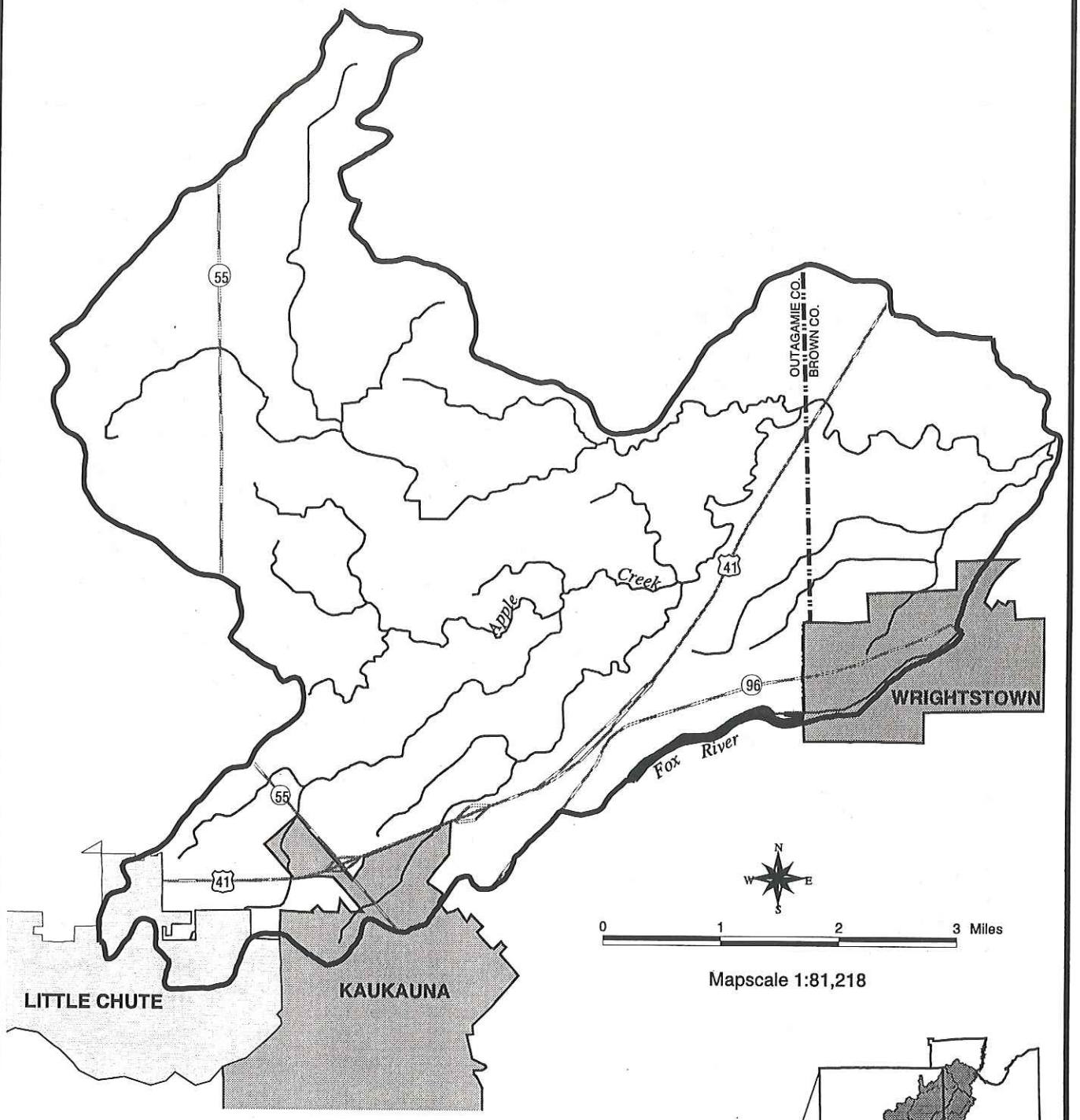
Bureau of Watershed Management
May 1997

Freedom Subwatershed



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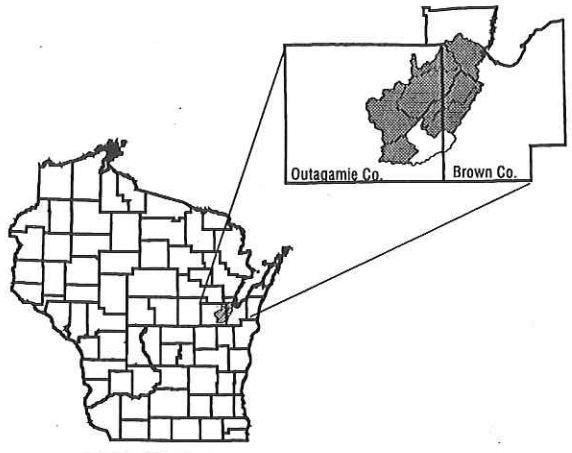
LEGEND

- Subwatershed Boundary
- County Boundary
- Highway
- Stream
- Open Water

Municipalities

- KAUKAUNA
- LITTLE CHUTE
- WRIGHTSTOWN



PROJECT AREA

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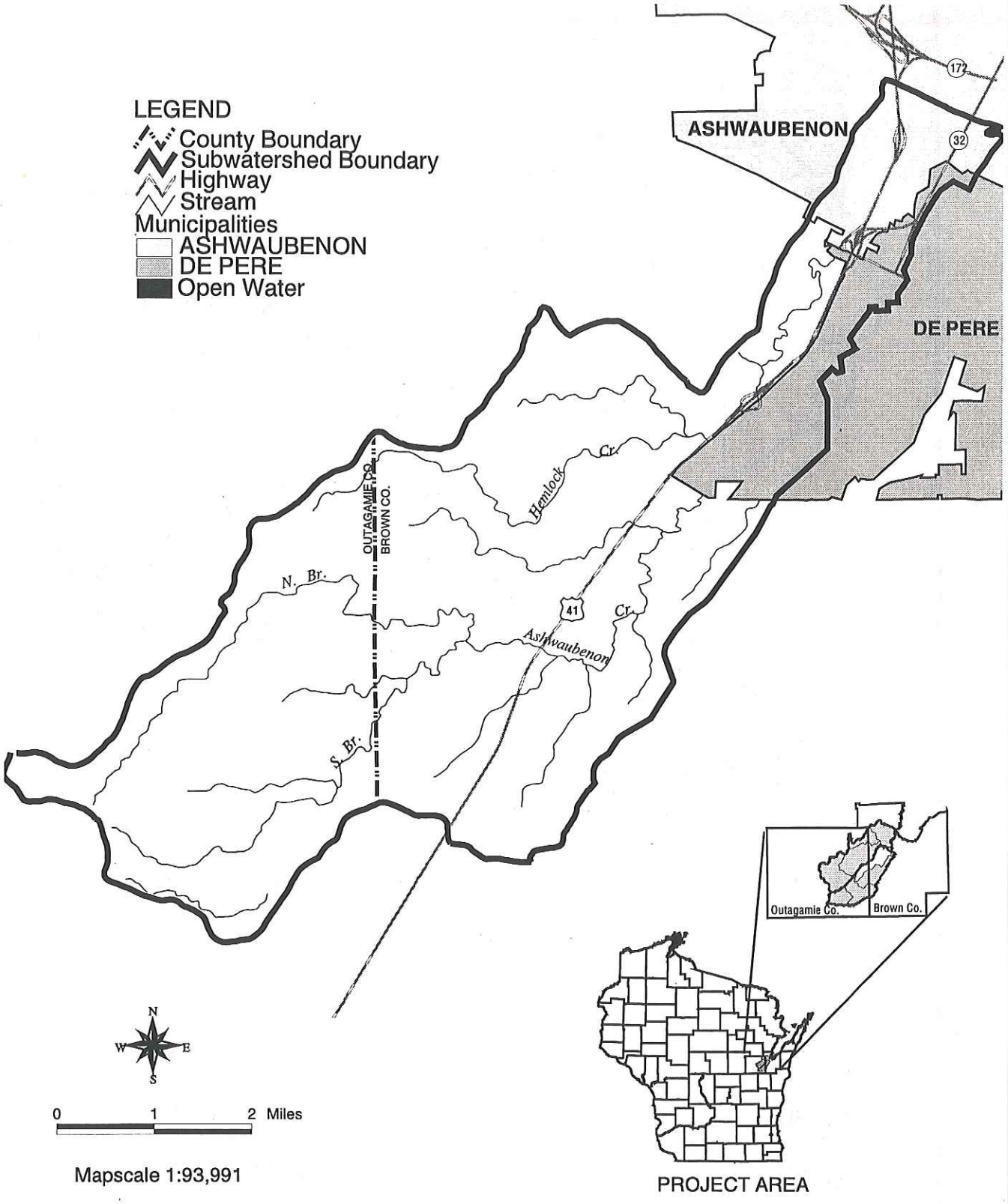
Hemlock Creek Subwatershed



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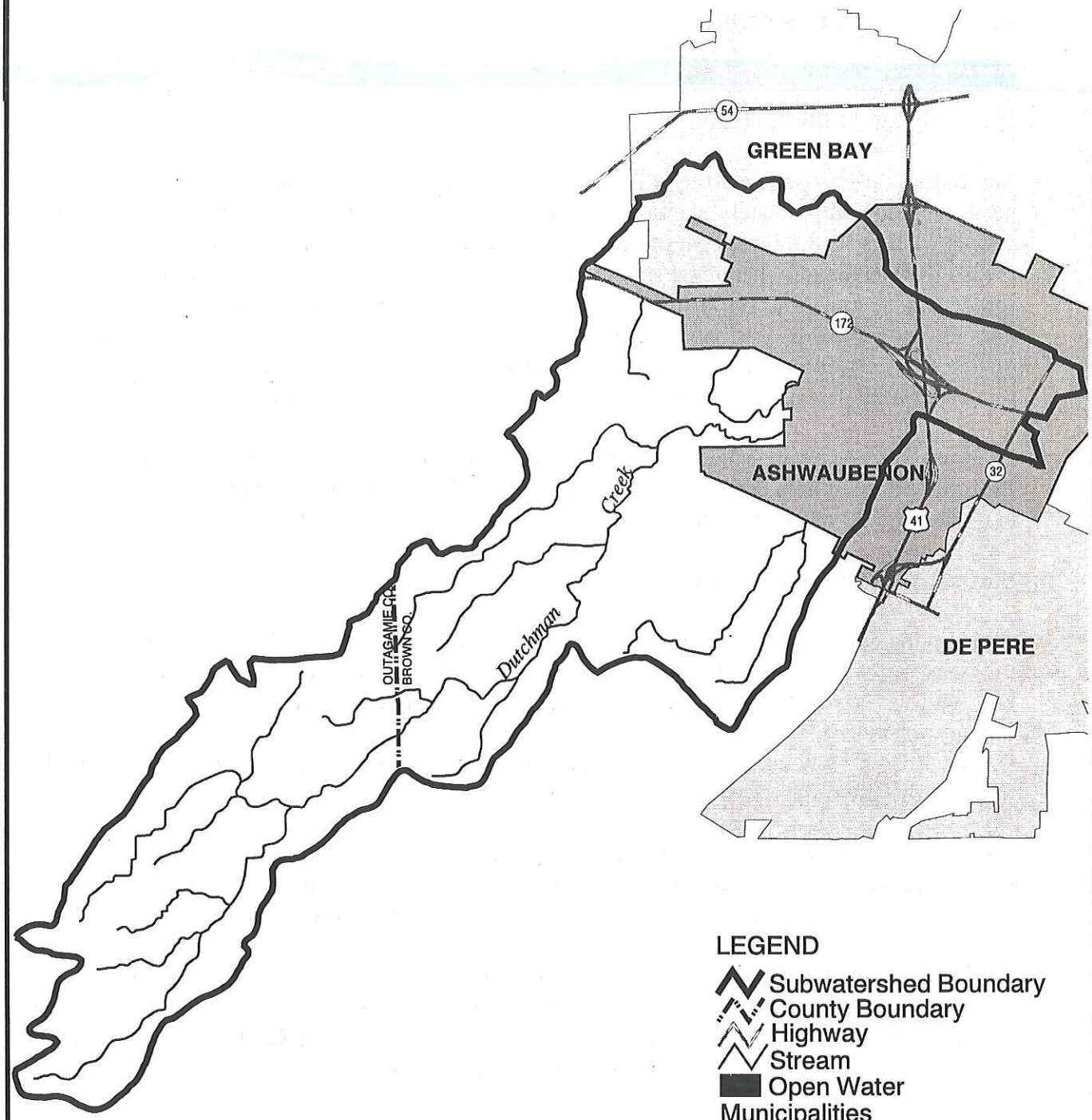
Bureau of Watershed Management
May 1997

Dutchman's Creek Subwatershed

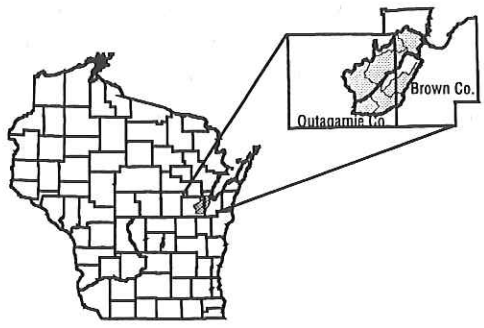


LEGEND

- Subwatershed Boundary
- County Boundary
- Highway
- Stream
- Open Water

Municipalities

- ASHWAUBENON
- GREEN BAY
- DE PERE



PROJECT AREA

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Department of Natural Resources
Water Division
Bureau of Watershed Management
May 1997

Burma Swamp Subwatershed

The Burma Swamp Subwatershed (Table 2-1; Map 2-1) consists of Duck Creek from its headwaters to approximately one-quarter mile south of Center Valley Road near the town of Freedom. This 12.8 mile stretch of Duck Creek drains 49.6 square miles of land. Duck Creek is identified as the only perennial stream in the subwatershed and is classified as a warm water forage fishery (WDNR, 1997). In summer, this section of Duck Creek and its tributaries are normally dry. Flow occurs only after rain events. According to long-time residents of the town of Freedom, this is a common occurrence most summers. One 30-year resident could remember only 3 years in which Duck Creek flowed throughout the summer.

Land use in the subwatershed is predominantly agriculture, although most of the village of Freedom lies within its boundaries; 78 percent of the land use in the subwatershed is agricultural, 13 percent is woodland and wetland and 9 percent is urban or developed.

Surface Water Resource Conditions

The existing conditions of the surface water in this subwatershed were hard to determine due to the lack of water during most of the monitoring season. From mid-June through mid-August no flow was observed in Duck Creek at Highway 55 (the farthest downstream road crossing in this subwatershed). Ponded areas did exist upstream of Highway 55 and they were characterized by low dissolved oxygen and turbid water. Bullheads and rusty crayfish were the only aquatic life observed.

Stream habitat ratings indicate "fair" water quality at County Highway S. Dissolved oxygen was monitored August 29 through September 13, 1995 at County Highway S, west of Freedom. In general, oxygen concentrations were good, only rarely dropping below 5 mg/l.

Fishery resources are limited to species that migrate upstream from perennial portions of Duck Creek and species that can tolerate low dissolved oxygen levels. According to DNR Fish Management (October, 1995) if water flowed into early June, it is probable that northern pike would be able to spawn and have good recruitment of the young .

Streambank buffers are rare ; livestock pasturing and farming practices occur right up to the stream in many cases. The stream's substrate is composed primarily of soft sediment though some in-stream habitat does exist, usually in areas of higher velocity where scouring occurs. The many drainage channels in this watershed causes stream flashiness and dramatic water fluctuations.

The lack of flow year-round is the limiting factor in this subwatershed; however, when water is present, better habitat and water quality is attainable if sediment and nutrient loading were reduced. Stream ditching and warm water temperatures prevent the resource from meeting its potential.

Rural Nonpoint Source Pollutants

- The Burma Swamp Subwatershed contains 77 animal lots which contribute 2052 pounds of phosphorus [organic] annually, representing an estimated 23 percent of the phosphorus load from barnyards to the Duck, Apple and Ashwaubenon Creeks Watershed.

- Upland sediment delivery in the Burma Swamp Subwatershed is 22,139 tons annually, or 23 percent of the load to the Duck, Apple and Ashwaubenon Creeks Watershed. Cropland is the major source of sediment in this subwatershed, contributing 98 percent of the total load.

- Four (4) percent of the sediment delivered from streambanks throughout the Duck, Apple and Ashwaubenon Creeks Watershed originates in the Burma Swamp Subwatershed.

Fish Creek Subwatershed

The Fish Creek Subwatershed (Table 2-1; Map 2-2) contains a portion of Duck Creek and many unnamed tributaries, numbering 30 miles of stream draining 53.3 square miles of land. Duck Creek is the only perennial stream in this subwatershed and is classified as a warm water sport fishery. All the tributaries are intermittent and none are classified.

Land use is 82 percent agriculture, 9 percent wetland and woodland, and 9 percent urban or developed. The village of Oneida falls within this subwatershed.

Surface Water Resource Conditions

The condition of surface water resources of the Fish Creek Subwatershed were difficult to ascertain due to dry conditions during summer with the exception of rain events. Duck Creek can be characterized as a string of stagnant pools separated by dry streambed. The creek flows sluggishly through this subwatershed, even during periods of high precipitation. Streambank buffering is sparse and bank erosion is common. Substrate is composed primarily of soft sediment, though significant areas of bedrock exist. The stream is turbid and carries a large load of suspended material.

Limited numbers of northern pike and smallmouth bass were found in this subwatershed. Their occurrence peaked nearest to the mouth of Duck Creek and rapidly decreased farther upstream. Forage minnow species were also present .

Habitat evaluations for the subwatershed ranked Duck Creek from "fair" to "good". HBI results from Center Valley Road rated this stream segment as "good" in October, 1994 and "excellent" in April, 1995. The data suggest that the large change in the HBI result from fall to spring was due to the presence of *Prosimulium mysticum*, a relatively intolerant Dipteran. EPT values for this reach were 81 percent in October and 1 percent in April. Dissolved oxygen was monitored from June 13 through June 26, 1995 at Center Valley Road and from June 12 through June 20, 1995 at CTH FF. Both runs showed classic diel (24-hour) dissolved oxygen swings, indicating high primary production, or photosynthesis, during the day and high respiration rates at night. The low dissolved oxygen levels combined with high water temperatures were likely stressful to aquatic life .

Triazine monitoring was conducted at the USGS gauge station located at CTH FF. Triazine samples ranged in value from 0.1 to 0.8 ppb. Triazine levels greater than 6 ppb have been found to reduce algae growth (LaLiberte, 1984).

Water chemistry sampling at CTH FF was conducted by students from UW-Green Bay to compare urban and rural concentrations and loadings of phosphorus and suspended solids to the stream. The samples were analyzed for suspended solids, ortho-phosphorus and total phosphorus and combined with flow data to determine loadings. Out of the first three runoff events of the year that were monitored, the concentrations and loads were highest during the first two events (University of Wisconsin - Green Bay, May 1995).

Duck Creek would benefit from reduced sedimentation in pools and riffles and stabilized streambank and flow conditions. Low stream flow and high water temperatures in summer do not provide good aquatic life habitat and water quality. The high level of nutrient loading needs to be reduced to limit algae growth and stabilize dissolved oxygen levels.

Rural Nonpoint Source Pollutants

- The Fish Creek Subwatershed contains 52 animal lots which contribute 1,367 pounds of phosphorus [organic] annually, which represents an estimated 15 percent of phosphorus loads from barnyards to the Duck, Apple and Ashwaubenon Creeks Watershed .

- The upland sediment delivery in the Fish Creek Subwatershed is 18,430 tons annually, or 19 percent of the entire watershed load; cropland is the major source in this subwatershed, contributing 98 percent of the load.

- Fifteen (15) percent of the sediment delivered from streambanks in the Duck, Apple and Ashwaubenon Creeks Watershed comes from the Fish Creek Subwatershed.

Trout Creek Subwatershed

The Trout Creek Subwatershed (Table 2-1; Map 2-3) consists of the mainstem of Trout Creek and a number of small unnamed intermittent tributaries. According to the Lower Fox River Water Quality Management Plan (1991), the perennial portion of Trout Creek is 8 miles long and drains 19.5 square miles of land. Trout Creek is classified as warm water sport fishery and there is some history of a marginal trout fishery (Surface Water Resources of Brown County, 1972).

This subwatershed is mostly rural, though residential areas are quite common. Land composition is 77 percen agricultural, 18 percent wetland and woodland, and 5 percent developed or urban.

Surface Water Resource Conditions

Trout Creek was one of the few streams in the project to have good flow throughout the year, probably due to sandier soils present in northern Brown County. These soils allow water to infiltrate and move through the ground easier than the heavy clay soils farther south. The lower and mainstem reaches have relatively steep topography, are well buffered by woodlands and have few nonpoint source impacts. The headwaters originate in areas with more gentle topography, poor buffering and evidence of agricultural nonpoint problems. The substrate is composed primarily of soft sediment, though gravel, rubble and boulders are also present.

Three of four habitat evaluations conducted on Trout Creek ranked the stream as "fair" and one ranked the stream as "poor". HBI's conducted at Western Drive indicated "good" water quality both in October 1994 and April 1995. EPT values were 83 percent and 38 percent, respectively. Dissolved oxygen readings taken at Trout Creek Road from July 12 through July 26, 1995 showed dissolved oxygen swings and standards violations. It is likely that intolerant aquatic life is stressed in this section of the stream.

The fishery of Trout Creek is composed of the redside dace (a state-threatened species), white suckers, johnny darters and other forage species. It is unlikely that a resident or native population of trout exists. Presumably other species like northern pike and perch migrate out of Duck Creek to spawn and feed.

Two areas on Trout Creek were used as IBI reference site locations for the Sheboygan River Priority Watershed Study: 90 meters downstream of Trout Creek Road ("fair" rating) and 179 meters downstream from Brookwood Drive ("poor" rating) (Fish Station Summary, 1995).

Water chemistry samples were collected from Trout Creek at CTH J after spring snowmelt and two other runoff events. The snowmelt sample was taken on March 14, 1995 and the only parameter that had a high reading was suspended solids (78 mg/l). The next sample was taken on April 19, 1995; again suspended solids were very high (138 mg/l). The last sample was taken on August 9, 1995 and showed no exceedingly high values.

Trout Creek would benefit from reduced sedimentation and nutrient loading , especially in the upper reaches of the subwatershed. Providing a buffer of vegetation along the stream in these sections would help improve overall water quality and aquatic life habitat.

Rural Nonpoint Source Pollutants

- The Trout Creek Subwatershed contains 12 animal lots which contribute 366 pounds of phosphorus [organic], annually. This represents an estimated 4 percent of the phosphorus from barnyards for the entire watershed.

- Upland sediment delivery in the Trout Creek Subwatershed is 4,648 tons annually, or 5 percent of the total load to the Duck, Apple and Ashwaubenon Creeks Watershed.Cropland is the major source of sediment in this subwatershed, contributing 98 percent of the load.

- Fourteen (14) percent of the sediment delivered from streambanks in the watershed originates in the Trout Creek Subwatershed.

Lancaster Brook Subwatershed

The Lancaster Brook Subwatershed (Table 2-1; Map 2-4) consists of the following streams: a stream locally known as Lancaster Creek, Beaver Dam Creek, a portion of Duck Creek and three unnamed tributaries. Twenty-three miles of stream drain 29.8 square miles of land. Duck Creek, Beaver Dam Creek and Lancaster Creek are all perennial streams. Duck Creek is classified as a warm water sport fishery; Beaver Dam Creek is classified as a warm water forage fishery, and Lancaster Creek and the other tributaries are not classified.

Land use in the subwatershed is approximately half agricultural and half developed. The entire village of Howard and a large portion of the city of Green Bay are in this subwatershed. The entire village of Howard has been platted and is likely to experience rapid growth in the near future. Land composition is approximately 37 percent agriculture, 13 percent wetland and woodland, and 50 percent urban or developed.

Surface Water Resources Conditions

Surface water resource conditions were much better in this subwatershed than in some of the other subwatersheds due to the presence of water throughout the summer. Aquatic life in these streams is dependant on Green Bay and the mainstem of Duck Creek to refuge when water quality conditions in the streams are poor .

Through the Water Action Volunteer Program students from Southwest High School and their teacher monitored Lancaster Creek. Students assigned each sample a Water Quality Rating (WQR) based on the number and type of aquatic insects collected. Samples were taken at Meadowbrook Park in the village of Howard, October 14, 1995. Twenty one (21) samples were collected, 5 indicated "good " water quality, 14 were "fair", and 2 represented "poor" water quality.

Other participants in the Water Action Volunteer Program monitored Duck Creek at Pamperin Park from fall, 1991 to spring, 1995. During that time, the Water Quality Rating dropped in water quality from good to medium. The WQR fell from good to barely fair at Brown County Park, and fell from excellent to fair at Pamperin Park over the sampling period. (Water Action Volunteer Program, 1994-1995 Progress Report)

In the early 1980s, fish surveys were conducted on a tributary to Lancaster Creek, locally known as Thornberry Creek, located in one of the headwater areas south of HWY 29/32 and west of CTH FF. At that time, brook trout were found. No surveys have been completed since that time (Northeast Region Fish Management Files, 1995).

Monitoring in Lancaster Creek produced "fair" to "poor" habitat ratings. HBI values taken at Glendale Avenue indicated "good" water quality in both spring and fall , 1995. EPT values were 12 percent and 23 percent, respectively. Dissolved oxygen levels at STH 29/32 from June 27 through July 11, 1995 rarely fell below the state standard and were sufficient to support intolerant aquatic life.

An IBI transect was developed on Lancaster Creek by students from St Norberts College at the first bridge crossing downstream from STH 29/32. Eleven species were discovered, with the most common being creek chubs, longnose dace and johnny darters. The overall warmwater IBI rating was "fair" (Cochran, 1996).

Beaver Dam Creek is almost entirely located in an urban setting. It starts as an intermittent drainage near Southwest High School and meanders its way north until it hits Duck Creek near Velp Avenue. The stream is very flashy and carries a considerable sediment load. Substrate is made up of gravel, cobble and some soft sediments.

Beaver Dam Creek had a "fair" habitat rating below Memorial Drive. Macroinvertebrates collected there in October 1994 rated water quality as "poor", in April 1995 water quality was

rated as "fairly poor". EPT values at this site were 0% for both sampling times indicating that none of the insects collected were in the Ephemeroptera, Plecoptera, or Tricoptera orders. Dissolved oxygen monitoring took place at Memorial Drive August 29 - September 20. Oxygen levels in Beaver Dam Creek never fell below 6 mg/l .

Beaver Dam Creek has had a history of fish kills occurring every 2 to 3 years since the 1970's. They have been caused by ammonia spills, discharges of blood (very high BOD) from a rendering plant and other, mostly industrial, practices. Fish kills are not normally severe in Beaver Dam Creek because there are not many resident fish present and most of the fish that are present can migrate downstream to Duck Creek and Green Bay. No fish surveys have been conducted in Beaver Dam Creek, though it is presumed that any fish living in Duck Creek can travel up Beaver Dam Creek.

Students from St. Norberts College in DePere conducted an IBI run on Beaver Dam Creek at Firemans Park. They found 6 species, with creek chubs and johnny darters being the most common. The overall warmwater IBI rating for this site was "poor" (Cochran, 1996).

One interesting note on Beaver Dam Creek is that the Surface Water Resources book of Brown County (1972) states that "[the creek] flows through pasture and agricultural land and cattle are causing considerable damage to the banks of this stream". In 23 years Beaver Dam Creek has changed from primarily an agriculturally impacted stream to an urban affected stream.

Water chemistry samples taken during three runoff events at Memorial Drive in Green Bay all showed increased levels of suspended sediments, nitrates and total phosphorus. A number of sewers drain into Beaver Dam Creek and have a tremendous impact on the water quality.

Beaver Dam Creek at Memorial Drive was sampled once in 1993 and several times in 1994 as part of a statewide Cryptosporidium spp. and Giardia spp. monitoring effort. In addition to the two protozoans, turbidity, suspended solids and E. coli bacteria were also monitored. (DNR PUBL-WR429-95, August 1995).

With the potential for the human population in this subwatershed to grow rapidly in the next few years, a stormwater management plan should be in place, as well as a plan to control growth and protect aquatic life habitat and water quality. The land use change from agriculture to residential/urban will stress not only the land, but the aquatic ecosystem as well.

Rural Nonpoint Source Pollutants

- The Lancaster Creek Subwatershed contains 3 animal lots which contribute 81 pounds of phosphorus [organic], annually, representing an estimated 1 percent of the phosphorus from barnyards to the entire Duck, Apple and Ashwaubenon Creeks Watershed.

- The upland sediment delivery in the Lancaster Creek Subwatershed is 5,457 tons, annually, or 6 percent of the entire watershed load. Cropland is the major source in this subwatershed, contributing 98 percent of the load.

- The Lancaster Creek Subwatershed delivers 1 percent of the sediment from streambanks to the Duck, Apple and Ashwaubenon Creeks Watershed.

Appleton Subwatershed

The Appleton Subwatershed (Table 2-1; Map 2-5) is made up of the headwaters of Apple Creek and two intermittent tributaries. Apple Creek begins on the north side of Appleton and runs easterly to the subwatershed boundary located less than a mile downstream of STH 55. Seventeen miles of stream drain 20.8 square miles of land in the subwatershed. Only the first 8 miles of Apple Creek are considered perennial; the last 4 miles are intermittent. Apple Creek is classified as a warm water forage fish community. The two intermittent streams are not classified.

The subwatershed is primarily rural, though the southern edge is the rapidly urbanizing area of Appleton and Little Chute. Land composition is 64 percent agricultural, 4 percent woodland and wetland, and 32 percent urban or developed.

Surface Water Resource Conditions

Surface waters in the subwatershed are degraded. During assessment monitoring water was present in small, isolated pools characterized by low dissolved oxygen levels and abundant algae growth. The only fauna observed were bullheads and crayfish.

Most streambanks are cropped or pastured right up to the stream with little or no buffering present. Streambank erosion and sloughing leave their condition in poor shape. Substrate is primarily soft sediments though rubble rip-rap areas exist near bridges and culverts. A fair amount of exposed bedrock exists on the bottom of Apple Creek , which contributes to its flashiness. Little scouring of substrate seems to occur, even during periods of high flows.

A water chemistry sample taken at STH 55 on April 19, 1995 showed high nitrate/nitrite levels (over 5 mg/l) and suspended solid levels (80 mg/l). On August 9, 1995 another runoff event was captured at CTH JJ; all parameters sampled were normal except for high suspended solids (52 mg/l).

Apple Creek habitat evaluations ranked the stream from "fair" to "poor". No macroinvertebrate data were collected. Dissolved oxygen readings taken at STH 55 from May 23 through June 8 show the state standard was violated nearly every day.

The southern edge of the subwatershed contains the rapidly urbanizing areas of North Appleton and a small portion of Little Chute. The majority of recent development has occurred in headwater areas that are often dry during the summer. Because they are dry when most construction takes place, erosion control measures are often neglected and water quality suffers when precipitation occurs. Good land use planning is needed to improve the water quality of Apple Creek.

Reducing nutrients and sediment reaching the surface water, as well as increasing stream baseflow, would have a positive effect on water quality along Apple Creek's entire length. Maintaining flow for longer periods into the summer allows more spawning opportunities . Ditching and subsequent warm water temperatures limit all aquatic life in the subwatershed.

Rural Nonpoint Source Pollutants

- The Appleton Subwatershed contains 18 animal lots that contribute 489 pounds of phosphorus [organic] annually, which represents an estimated 5 percent of phosphorus loads from barnyards to the entire Duck, Apple and Ashwaubenon Creeks Watershed.

- Upland sediment delivery in the Appleton Subwatershed is 5,068 tons annually, or 5 percent of the entire watershed load. Cropland is the major source of sediment , contributing 98 percent of the load

- The Appleton Subwatershed delivers 3 percent of the total sediment load from streambanks to the Duck, Apple and Ashwaubenon Creeks Watershed

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Freedom Subwatershed

The Freedom Subwatershed (Table 2-1; Map 2-6) consists of 12 miles of Apple Creek and 5 unnamed tributaries. There are 29 miles of streams in the subwatershed that drain 33.2 square miles of land. Apple Creek is the only perennial stream in the subwatershed; all others are intermittent. Apple Creek is classified as warm water sport fish. None of the tributaries are classified.

Land composition is approximately 76 percent agriculture, 4 percent woodland and wetland, and 20 percent urban or developed areas. This subwatershed contains the rapidly developing areas of Kaukauna and Little Chute and the village of Wrightstown.

Surface Water Resources Conditions

Low flow is a problem in this subwatershed. Reaches closest to the Fox River were the only places that had water during the summer of 1995. Due to the high degree of ditching in this subwatershed, the streams are very flashy after rain events. Water chemistry samples were conducted during or right after precipitation events at CTH U on April 19, 1995 and at CTH D on August 9, 1995. Elevated nitrate levels and suspended solids were found in the spring sample. The August sample had a slightly higher than average total phosphorus result.

Apple Creek habitat ratings in 1995 were mostly "poor" with a few that were "fair". Macroinvertebrate data from CTH D indicated "fairly poor" water quality when sampled in the Fall, 1994 and Spring, 1995; EPT values were 49 percent and 13 percent, respectively. Dissolved oxygen data was limited to a site downstream from Rosin Road near the mouth of the river. The meter was in the water from July 11 through July 26, 1995, which was a period of a period of no precipitation. Dissolved oxygen fell below 1 mg/l every night of the sampling run. This condition precludes intolerant species of aquatic life to exist in this stream segment.

A water chemistry sample taken at CTH U on April 19, 1995 showed high levels of nitrate plus nitrite and phosphorus, and very high suspended solids. Another sample taken at CTH D on August 8, 1995 had very high total phosphorus and only moderately high suspended solids.

The upper reaches of the subwatershed are characterized by low streambanks, poor buffering, clay soils and high erosion rates. The lower reaches have higher banks that are well vegetated due to their unsuitability for pasturing and cropping. Generally, bank slumping and high erosion rates are common in this subwatershed.

High turbidity from suspended materials, as well as high amounts of nutrients, results in poor dissolved oxygen levels and excessive sedimentation. A reduction in suspended materials and nutrients would increase dissolved oxygen and result in better water quality and habitat for aquatic organisms. Ditching and high water temperatures also limit the aquatic life in this subwatershed.

Rural Nonpoint Source Pollutants

- The Freedom Subwatershed contains 52 animal lots that contribute 1,839 pounds of phosphorus [organic] annually, representing an estimated 20 percent of phosphorus loads from barnyards to the entire Duck, Apple and Ashwaubenon Creeks Watershed.

- Upland sediment delivery in the Freedom Subwatershed is 7,399 tons annually, or 8 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed, contributing 98 percent of the subwatershed's load.

- The Freedom Subwatershed contributes 22 percent of the total sediment load from streambanks to the Duck, Apple and Ashwaubenon Creeks Watershed.

Hemlock Subwatershed

The Hemlock Subwatershed (Table 2-1; Map 2-7) is made up of mainstem Ashwaubenon Creek, the North Branch Ashwaubenon Creek, the South Branch Ashwaubenon Creek, a tributary locally known as Hemlock Creek and six unnamed tributaries. There are 49 miles of stream that drain 29.4 square miles of land. The mainstem of Ashwaubenon Creek is the a perennial stream; all other streams are intermittent. The first half of Ashwaubenon Creek's 15-mile length is classified as a warm water sport fishery. The last half is classified as a warm water forage fishery. The remaining streams in the subwatershed are not classified.

In this subwatershed rural land practices contribute to surface water problems by causing streambank erosion, organic loading and sedimentation. Low stream flow during critical mid-summer periods stress aquatic life. Also a problem is the loss of stream habitat due to livestock grazing in the stream.

Urban land use contributes sediment, nutrients, heavy metals such as lead, copper and zinc, pesticides and organic contaminants such as Polycyclic Aromatic Hydrocarbons and Volatile Organic Compounds (Bannerman, 1990).

The Hemlock Subwatershed is mostly rural, although a significant urban portion does exist within the cities of De Pere and Ashwaubenon. Approximately 75 percent of the land is agricultural, 12 percent is woodland and wetland, and 13 percent is developed or urban.

Surface Water Resource Conditions

The lack of water during most of monitoring season inhibited investigators' determination of surface water conditions in this watershed. However, sufficient water was present in early and late summer to collect water quality data. Habitat ratings for Ashwaubenon Creek ranged from "fair" at CTH F to "poor" at Grant Street. The HBI results at Grant Street indicated "fairly poor" water quality in Fall, 1994 and "poor" water quality in Spring, 1995. EPT values were 22 percent in fall and 5 percent in spring. A continuous dissolved oxygen meter was placed in Ashwaubenon Creek at CTH F from May 23 through June 11, 1995 and at CTH G from September 21 through October 2, 1995. State dissolved oxygen standard violations did not occur very often in the fall, but dissolved oxygen levels did not rise above the state standard for days in early summer.

Ashwaubenon Creek has small seasonal runs of some gamefish species. Perch and walleye runs are limited by the lack of suitable substrate for spawning. Since northern pike are more

tolerant of low dissolved oxygen, they normally have good runs and there is some evidence of a resident population in the stream. In 1992 a fish kill occurred upstream of CTH F, turning up forage species and a few northern pike. Good sucker runs still occur in the spring when dissolved oxygen is higher. Large numbers of rusty crayfish have been harvested from Ashwaubenon Creek for sale to local baitshops (Fish Management Pers. Comm., 1995)

Sampling was conducted on Ashwaubenon Creek by students from UW-Green Bay at Creamery Road, Parkview Road and a frontage road off HWY 41 in 1995. Data was gathered to compare urban and rural concentrations of phosphorus and suspended solids and their loads to the stream. Water samples were analyzed for suspended solids, ortho-phosphorus and total phosphorus. Combined with flow data, nutrient and sediment loads were determined. The first three samples in 1995 indicated concentrations and loads were highest during the first two runoff events of the year.

An IBI transect was run on Ashwaubenon Creek by students from St. Norberts College on August 24, 1995. Eight different macroinvertebrate species and 61 individuals were found . White suckers and creek chubs were the most common. The overall warmwater IBI rating was "very poor". A number of fish kills have occurred on Ashwaubenon Creek in recent years. White suckers and a few northern pike have normally been the victims of these kills. Probable causes of the fish kills are spawning stress, low dissolved oxygen and ammonia spills (Fish Management Fish Kill Files, 1996)

Creamery Road on Ashwaubenon Creek was sampled once in 1993 and several times in 1994 as part of a statewide Cryptosporidium spp. and Giardia spp. monitoring effort. In addition to the two protozoans, turbidity, suspended solids and E. coli bacteria were also monitored. There were no detections of Cryptosporidium spp. and three detections of Giardia spp. (Archer et al., 1995). The streams of this subwatershed are low gradient and slow moving. A large amount of ditching and channelization has taken place, contributing to turbidity, excess nutrients, and low dissolved oxygen levels, which are severe problems. The headwater areas are dry for much of the summer. The whole subwatershed would benefit from reducing sediment and nutrient loads, which would improve dissolved oxygen levels and habitat for aquatic life.

Rural Nonpoint Source Pollutants

- The Hemlock Subwatershed contains 32 animal lots that contribute 1,006 pounds of phosphorus [organic] annually, representing an estimated 11 percent of the phosphorus load from barnyards to the entire Duck, Apple and Ashwaubenon Creeks Watershed.

- Upland sediment delivery in the Hemlock Subwatershed is 19,122 tons annually, or 19 percent of the entire watershed load. Cropland is the major source of sediment within the subwatershed, contributing 98 percent of the load.

- The Hemlock Subwatershed contributes 34 percent of the total sediment load delivered from streambanks to the Duck, Apple and Ashwaubenon Creeks Watershed.

Dutchman Subwatershed

The Dutchman Subwatershed consists of the entire Dutchman Creek and two tributaries. A total of 22 miles of streams drain 30 square miles of land. Dutchman Creek is 17 miles long; the first 7 miles are classified warm water forage fishery and the remainder, a limited forage fishery. Both of the tributaries are unnamed, intermittent and neither are classified. During mid-summer low-flow conditions, most of the Creek and all its tributaries are dry.

Land composition in the subwatershed is 70 percent rural, 7 percent woodland and wetland, and 23 percent urban or developed. This subwatershed contains most of the city of Ashwaubenon and Austin Straubel Airport.

Surface Water Resource Conditions

Like the majority of streams in other subwatersheds, streams in this one had little or no flow for most of the summer. Flow occurred only in the upper reaches from June through early August after major rain events. Heavy ditching and draining of farm fields has caused extreme fluctuations in water levels and a convenient transport path for sediment and nutrients.

The substrate is comprised primarily of soft sediment. Riffle areas are rare and the stream bottom exhibits little scouring . Streambanks are generally in poor condition and buffering is limited or absent. Crops and livestock dominate the riparian zone in the upper reaches, while residential, commercial and industrial land uses dominate near the mouth. Dutchman Creek is channelized near the HWY 41 and HWY 172 interchange and also upstream and downstream from Oneida Street in Ashwaubenon.

Habitat ratings taken at two locations, Circle Drive and CTH G, assessed the stream as "poor". Dissolved oxygen measurements taken June 27 through July 11, 1995 at the Circle Drive location showed that conditions were favorable for tolerant aquatic life. Dissolved oxygen levels never rose above 2.5 mg/l. Upstream of Circle Drive at CTH G, from September 21 through October 2, 1995, dissolved oxygen dipped below the state standard a few times. Dissolved oxygen was much improved at this location due to the cooler water temperatures allowing more oxygen to be held in solution.

Fisheries resources are limited to the downstream reaches of Dutchman Creek by a sill, or dam, structure located on the west (upstream) side of Packerland Avenue. This structure is a

barrier to upstream migration of fish. The structure's function is unknown, but it is probable that its removal would restore spring spawning runs of suckers and northern pike.

Dutchman Subwatershed's streams are primarily low gradient. The lack of flow is a problem in mid-summer, when the stream becomes stagnant and low dissolved oxygen levels drop. Also during this time, ditching in rural areas and channelization in urban areas lead to rapid runoff rates and increased water temperatures. The entire subwatershed would benefit from more baseflow and decreased levels of sediment and nutrient inputs.

Sampling was conducted at Dutchman Creek by UW-Green Bay students at Hanson Road and Broadway. Data was gathered to compare urban and rural concentrations and loadings of phosphorus and suspended solids . Samples analyzed for suspended solids, ortho-phosphorus and total phosphorus were combined with flow data to determine loading rates Results indicated concentrations and loads were highest during the first two runoff events of the year.

Rural Nonpoint Source Pollutants

- The Dutchman Subwatershed contains 30 animal lots which contribute 1,834 pounds of phosphorus [organic] annually, representing an estimated 20 percent of phosphorus loads from barnyards to the Duck, Apple and Ashwaubenon Creeks Watershed.

- Upland sediment delivery in the Dutchman Subwatershed is 14,700 tons annually, or 15 percent of the entire watershed load. Cropland is the major source of sediment in this subwatershed, contributing 98 percent of the load.

- The Dutchman Subwatershed contributes 7 percent of the total sediment load delivered from streambanks to the Duck, Apple and Ashwaubenon Creeks Watershed.

Urban Appraisals, Stream by Stream Analyses, and Goals

This section builds upon the previous narratives that provide general descriptions of each subwatershed and rural nonpoint pollution and objectives. This urban section provides individual stream descriptions for waterbodies specifically targeted for urban pollution abatement. For greater detail concerning each stream and subwatershed, see the previous section entitled, "Subwatershed Discussions."

Table 2-5 Urban Management Goals for Selected Streams in the Duck Apple and Ashwaubenon Creeks Watershed

Creek (Subwatershed)	Management Goal	Steps to meet Goal
Beaver Dam (Lancaster Brook Subwatershed)	Moderate peak flow Control streambank erosion Alleviate instability in stream's fluvial processes Maintain or improve corridor	Reduce SS, TP, PAH's by 25%
Lancaster Brook /Thornberry Creek (Lancaster Brook Subwatershed)	Enhance the quality of the warm water fisheries of Lancaster Brook , Protect Thornberry Creek	No change alternative for future pollutant loadings, keep at 1996 levels
Trout Creek (Trout Creek Subwatershed)	Protect lower reaches which now hold warm water species	No change from 1996 loadings Maintain and improve corridor
Slough Creek, (Lancaster Brook Subwatershed)	Protect current uses	No change from 1996 loadings for SS, TP, Metals, PAH's, peak flows
Duck Creek (Fish Creek and Direct Drainage)	Enhance current use of stream	25 percent reduction in Direct Drainage to meet goal
Apple Creek (Appleton Subwatershed)	Maintain current condition of stream, protect current uses	No change from existing 1996 loads of urban and rural pollutants
Apple Creek (Freedom Subwatershed)	Enhance current use of stream	25 percent reduction in rural and urban pollutants from 1996 loads
All Streams (Ashwaubenon, Hemlock, & Dutchman's Subwatersheds)	Green Bay Remedial Action Plan goals established 1989	No change from 1996 loadings for SS, TP, Metals, PAH's, peak flows

Beaver Dam Creek, Lancaster Brook Subwatershed

This creek's potential use is as a warm water forage fish community; it only partially meets its potential due to degradation. The creek may have a seasonal use potential for runs of suckers and perch; this secondary use is not realized, either. This creek has aesthetic value.

Habitat is poor, mostly due to excessive streambank erosion (from Mason Street to downstream reaches) and also due to 'flashy' streamflows. The stream does maintain perennial flow, however. Based on fish species analyses, water quality is probably quite poor, which is to be expected in such a highly urbanized area.

The urban-related management goal for this stream should be to **enhance** the quality of the warmwater forage fish community, to **improve** the stream use for seasonal runs of warmwater sport fish, and to **enhance** the stream's aesthetic and recreational value.

To achieve these goals, nonpoint source controls need to:

- moderate peak flow discharges;
- control streambank erosion at critical sites;

- comprehensively alleviate instability in the stream's fluvial processes;
- maintain or improve the quality of the stream corridor along the creek;
- reduce 1996 urban pollutant loadings for SS, TP, metals, and PAHs by 25 percent during the planning period (1996-2020).

Lancaster Brook/Thornberry Creek, Lancaster Brook Subwatershed

Lancaster Brook has the potential to support a warmwater forage fish community but is slightly degraded and not fully meeting its use potential. Thornberry Creek probably has the potential to support a cold water sport fish community and may be close to meeting its potential.

Lancaster Brook is in good shape. Upstream of Howard, the creek has good substrate and fairly stable streambanks. Its flows are reasonably stable. Past construction at the AMS facility was probably responsible for heavy silt beds in portions of the stream. Little is known of Thornberry Creek, but the watershed is nearly all developed as large lot residences. Expansion of the golf course could pose problems due to pollutant discharges and stream warming.

The urban-related management goal for Lancaster Brook should be to enhance the quality of the warmwater forage fish community. The urban-related management goal for Thornberry Creek should be to protect the quality of the creek.

To achieve these goals, nonpoint source controls need to

- maintain future (year 2020) loading levels of all urban pollutants (SS, TP, metals, PAH's, peak flows, flow volumes if possible) at 1996 levels for both creeks;
- maintain or reduce connected imperviousness in the Thornberry Creek Watershed;
- maintain or improve the quality of the stream corridor along both Thornberry Creek and Lancaster Brook.

Trout Creek, Trout Creek Subwatershed

This stream has the potential to support warm water forage fish. It is meeting this potential in its lower reaches, but is not meeting this potential in its upper reaches. The stream has good baseflow in the urban reaches, where most of the land use is large lot residential. Streambanks are in good shape in these residential areas as well.

The urban related management goal for Trout Creek should be to **protect** the current uses in the lower sections of the stream. To achieve these goals, nonpoint source controls need to:

- maintain future (year 2020) loading levels of all urban pollutants (SS, TP, metals, PAHs, peak flows, flow volumes if possible) at 1996 levels;
- maintain or improve the quality of the stream corridor along the creek.

Slough Creek, Lancaster Brook Subwatershed

This stream has the potential to support warm water forage fishery; it seems to be meeting its potential.

American brook lamprey have recently been discovered to be inhabiting this stream in the vacinity of Brookfield Avenue.

The urban-related management goal for Slough Creek is to protect the current uses in this perennial section.To achieve these goals, nonpoint source controls need to:

- maintain future (year 2020) loading levels of all urban pollutants (SS, TP, metals, PAH's, peak flows, flow volumes if possible) at 1996 levels.

Apple Creek, Appleton and Freedom Subwatersheds

In the Appleton Subwatershed, Apple Creek is currently meeting its potential as a warm water forage fish community. Drainage ditching and construction site erosion are the biggest problems facing Apple Creek. The urban management goal is to maintain the condition of the stream. To achieve this goal, nonpoint source controls need to reduce future loading of urban pollutants by 'no change' from existing 1996 loads.

In the Freedom Subwatershed, Apple Creek is degraded due to agricultural runoff. Most of the problems in this subwatershed are agriculture related. Though ditching, channelization, and construction site erosion are major concerns in the southern part of the subwatershed. The urban management goal is to enhance the current uses of the stream. To achieve this goal, nonpoint source controls are needed to reduce future loading of urban pollutants by 25 percent, in addition to rural pollutants, from existing 1996 load levels.

Duck Creek, Fish Creek and Lancaster Creek Subwatersheds

The potential use of this creek is a warm water sport fish community; it is only partially meeting this use. The urban-related management goal is to enhance the current uses of this stream. To achieve this goal, nonpoint source controls need to:

- reduce the future loading of urban pollutants by 25% from the existing 1996 loads.

This goal should be applied to the Fish and the Direct Drainage Subwatersheds.

Ashwaubenon & Dutchman's Creeks, Hemlock Creek & Dutchman Creek Subwatersheds

Since both streams are so heavily affected by upstream rural land uses, the urban goal will be set based on reduction needs to achieve the goals for Green Bay and the Lower Fox River.

Green Bay/Lower Fox River The reduction goal will be based on needs identified in the Remedial Action Plan, which does not specify any particular goals for urban toxic materials. Either a "no change" goal or a "25% reduction" goal should be applied.

Watershed-Wide Conclusions

The surface water and aquatic life resources in the Duck, Apple and Ashwaubenon Creeks Watershed would benefit from more consistent year-round streamflow. Extensive tiling of agricultural land and ditching and channelizing of streambeds has caused rapid overland flow of runoff from the system. Nutrients and sediments are cause for concern because of their affect on dissolved oxygen levels and stream clarity. Land use planning, in both urban and rural areas, is critical because of the watershed's proximity to rapidly growing urban areas like Green Bay and Appleton. Erosion control and stormwater plans are two key management tools that should be part of any development plan in the watershed to maintain or improve water quality.

CHAPTER THREE
Rural Inventory Results, Nonpoint Source Pollutants, Reduction Goals, Cost Share Eligibility

This chapter describes the results of the nonpoint source inventories, objectives and cost-share eligibility criteria for each pollutant source. These sources include: barnyard runoff, agricultural nutrients, and sediments from upland areas, gully erosion and streambank erosion.This chapter also discusses existing ordinances aimed at reducing rural sources of sediment and nutrients.

Management Categories

Cost-share funds for installing pollutant control measures will be targeted at sites which contribute the greatest amounts of pollutants (urban runoff, barnyards, manure spreading, upland fields, streambank and shoreline erosion or streambank habitat degradation sites). Management categories define which nonpoint sources are eligible for financial and technical assistance; they are based on the amount of pollution generated by a source and the feasibility of controlling the source. Specific sites or areas within the watershed project are designated as "critical," "eligible," or "ineligible." Designation as a critical site indicates that controlling that source of pollution is essential for meeting the water quality objectives for the project. Nonpoint sources which are eligible but not critical contribute less of the pollutant load, but are included in cost sharing eligibility to further insure that water quality objectives are met. Landowners with eligible sites need not control every eligible source to receive cost -share assistance.

Management category eligibility criteria are expressed in terms of tons of sediment delivered to surface waters from eroding uplands and streambanks; pounds of phosphorus [organic] delivered to surface waters; feet of streambank trampled by cattle; and pounds of heavy metals and organics from urban areas. Any newly created sources requiring controls after the signing of a cost-share agreement must be controlled at the landowner's expense.

The Outagamie County LCD, the Brown County LCD and the Oneida Nation Planning Department will assist landowners in applying 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 will be tailored to specific landowner situations.

Critical Management Category

Nonpoint sources included in this category contribute a significant amount of the pollutants affecting surface waters. Critical sites are those sites where BMPs must be applied to have a reasonable likelihood of achieving water quality objectives. These sites may be designated by either numeric or descriptive criteria.

Nonpoint sources designated as critical are eligible for funding and technical assistance through the priority watershed project. Critical sites will receive written notification within 15 months of watershed plan approval to correct the problems. An on-site assessment will verify that they currently meet critical site criteria.

Eligible Management Category

Specific nonpoint sources of pollution in this category contribute less significantly to water quality. These sites are eligible for technical and cost-share assistance but are not as critical for reaching water quality objectives.

Ineligible Management Category

Other sites that do not contribute significant amounts of pollutants are not eligible for funding and/or technical assistance under the priority watershed project. Other DNR programs (e.g., wildlife and fisheries management) can, if warranted, assist county project staff in controlling these sources as part of an integrated resource management plan for this watershed. Other local, state, or federal programs may also be applicable to these lands.

Barnyard Runoff

Barnyards that deliver nonpoint source pollutants to surface water were identified during the inventory phase of the planning process (Tables 3-2, 3-3). Two-hundred seventy-six (276) animal lots were found to be the source of 9,034 pounds of phosphorus each year. This represents approximately 4 percent of the total estimated phosphorus delivered to the watershed's streams annually.

The objective for barnyard runoff control is to reduce phosphorus loading to streams by 50 percent. Based upon past experience, it was determined that a total of 75 percent of this 50 percent reduction will be obtained solely through voluntary participation. The top ranking 25 percent will be designated as critical sites.

Barnyard Critical Sites

Barnyard sites contributing 255 or more pounds of phosphorus annually have been designated critical sites (Table 3-1). Three barnyards in the Duck, Apple and Ashwaubenon Creeks Watershed fall within this critical management category. Collectively these sites deliver an estimated 1,263 pounds of phosphorus to surface waters annually.

Landowners with critical site barnyards will have two options to correct their runoff problem:

1) Landowners can correct the problem through their own initiative by installing practice(s) that will reduce the annual phosphorus load below the 255 pound target level. For the majority of these sites, this will only require the installation of low cost, clean water diversions and roof gutters. **Project staff will provide the necessary technical assistance.** *Landowners choosing this option will not be eligible for cost-share assistance but are obligated to operate and maintain any installed practice for the length of the project.*

2) Landowners with barnyard sites that contribute between 20 and 255 pounds of phosphorus annually are eligible for cost-share assistance. Landowners may only need to divert clean upland water and roof runoff away from animal lots. Landowners with barnyards that still exceed an annual phosphorus loading of 20 pounds after installation of these low cost controls are eligible for additional controls that bring them below 15 pounds.

Table 3-1 Critical Site Barnyards

Operator Identification Number	Yard Number	Phosphorus Load (pounds)
1722	1	711
710	1	297
OC113	1	256

Other Barnyard Sites

Landowners with barnyard sites that contribute between 20 and 255 pounds of phosphorus annually are eligible for cost-share assistance. Landowners may only need to divert clean upland water and roof runoff away from animal lots. Landowners with barnyards that still exceed an annual phosphorus loading of 20 pounds after installation of these low cost controls are eligible for additional controls that bring them below 15 pounds.

Project staff will provide the necessary technical assistance. Landowners choosing this option will be eligible for cost-share assistance and are obligated to operate and maintain all cost-shared practices for a period of 10 years from the date that the final practices on the agreement was installed.

Internally Drained Barnyards

Internally drained barnyards drain to surface depressions or wetlands rather than directly to surface waters. Nine (9) internally drained yards were identified as contributing phosphorus in the Duck, Apple and Ashwaubenon Creeks Watershed. Eligibility for internally drained animal lots is based on a site by site analysis where significant groundwater contamination is determined to be likely. However, due to the presence of clay soils, threats to groundwater from internally drained barnyards are unlikely.

Components of Waste Management System

Certain components of 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 that the waste may be spread on. 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 practices, optimally the development of both nutrient management and pest management (NRCS Std. 595) plans, including soil testing and crop scouting. See "Nutrient and Pest Management" later in this chapter for additional detail.

Table 3-2 Barnyards: Apple and Ashwaubenon Creek

Subwatershed	Inventory Results			Goal- 50 % reduction in P loading (2584 pounds)					
	# Barnyards	Lbs Phosphorus	% of total P from barnyards (AAC & DUK)	Critical ->255.0 lbs. P			Eligible - > 20 lbs. P		
				# Barnyards	Target - Pounds Reduced	% of Goal Reduced	# Barnyards	Target - Pounds Reduced	% Of Goal Reduced
Hemlock	32	1006	11	0	-	-	19	461	18
Dutchman	30	1834	20	1	711	27	11	518	20
Freedom	52	1839	20	1	297	12	23	716	28
Appleton	18	489	5	0	-	-	8	207	8
Total	132	5168	56	2	1008	39	58	1902	74

Table 3-3 Barnyards: Duck Creek

Subwatershed	Inventory Results			Goal- 50 % reduction in P loading					
	# Barnyards	Lbs Phosphorus	% of total P from barnyards (AAC and DUK)	Critical - >255.0 lbs. P			Eligible - > 20 lbs. P		
				# Barnyards	Target - Pounds Reduced	% of Goal Reduced	# Barnyards	Target - Pounds Reduced	% of Goal Reduced
Trout	12	366	4	0	-	-	7	173	9
Lancaster	3	81	1	0	-	-	1	29	2
Fish	52	1367	15	1	256	13	18	451	23
Burma	77	2052	23	0	-	-	30	884	46
Total	144	3866	43	1	256	13	56	1537	80

Agricultural Nutrients

Manure Spreading

An inventory was conducted to determine the number of critical acres spread with manure for each farm in the Duck, Apple and Ashwaubenon Creeks Watershed. Critical acres were defined as those lands which have greater than 6 percent slope or which are in a floodplain and receive manure applications. Because the upland inventory was conducted on a 20 percent sub-sample basis, a complete inventory of critical acres spread with manure during the winter is not available. This inventory will be conducted at the time of a farm visit.

Manure Storage as a Component of Nutrient Management

Nutrient management will be a significant component of manure management systems, barnyards and manure storage facilities. Cost-sharing eligibility for manure storage practices will be based on the development of a preliminary Nutrient Management Plan that is consistent with the NRCS 590 standard.

An operation is eligible for manure storage cost sharing if the preliminary nutrient management plan demonstrates that manure cannot be practically managed during periods of snow-covered, frozen and saturated conditions without the installation of storage practices. The nutrient management plan must also demonstrate that proper utilization of the manure can be achieved following adoption of the intended storage practice. Existing structures which are environmentally unsound due to leaking to surface and/or groundwater, or subject to flooding will also be eligible for abandonment and or repair. Critical site designation will not be a component of the management strategy for manure storage in the Duck, Apple and Ashwaubenon Creeks Watershed. Extrapolated inventory results, computed on the Manure Storage Rating Guide, show that 122 out of 276 (44 percent) of the livestock owners show a need for manure storage as a component of a nutrient management plan. An estimated 65 (53 percent) out of 122 eligible livestock owners will voluntarily install manure storage systems.

Cost sharing for manure storage facilities will be based on the least-cost system. These options may include manure stacks (in accordance with NRCS Std. 312), short-term storage (capacity for 30 to 100 days production in accordance with NRCS Std. 313), and long-term storage (capacity for up to 365 days production in accordance with NRCS Std. 313 or 425).

Sources of Sediment

Cropland and Other Rural Upland Sources

Sediment eroding from cropped fields (91,475 tons) is the largest source of phosphorus in the watershed, accounting for over 78 percent of the total phosphorus load. It is estimated that

each ton of sediment delivered contributes approximately 1.78 pounds of phosphorus. Therefore, to reach both the sediment reduction and phosphorus reduction objectives of the project, it is necessary to target a large amount of sediment reduction for control. The design target for eroding fields will be to control sediment delivery to surface water to a rate of .40 tons/acre/year or less, or a minimum of a 50 percent reduction in sediment delivery, whichever is greater. Landowners controlling upland sediment sources will be eligible for nutrient management plan development cost-share assistance.

Eligibility for upland cost-sharing is set at 0.1 tons/acre/year as an incentive to get more landowners to voluntarily participate in the watershed project. It also expands the use of the whole farm approach to reach the farm sediment reduction goal when dealing with highly eroded fields. In many previous watersheds, sign ups for conservation tillage was low because landowners who were eligible for only a small percentage of their land did not want two separate tillage systems on their row cropland. The higher the percent of a farmer's land that is eligible, the more likely he/she is to convert to conservation tillage. Past experience has shown that the target should be set no lower than .4 tons/acre/year so that highly eroded fields can meet the target without being taken out of production and without discouraging farmers from signing up.

Control of sediment to the level described will result in a decrease of 45,738 tons of sediment, and a decrease of 81,413 pounds of associated phosphorus, from agricultural fields.

A landowner can use one of three options to meet the upland sediment control requirements as defined in the above box:

1. Landowners can correct problem fields through their own initiative by installing the necessary practice(s) that will reduce the annual sediment load below the critical level of 5.50 tons delivered. **Project staff will provide the necessary technical assistance.** *Landowners choosing this option will not be eligible for upland cost-share assistance but are obligated to operate and maintain any installed practice for the length of the project.*

2. Best Management Practices (BMPs) may be implemented on Critical Site fields to meet the design target of 0.40 tons/acre/year or a 50% reduction in sediment delivery for fields that deliver 0.80 tons/acre/year or less, (eligible fields may install BMPs and be cost-shared, although it is not required).

3. The "Whole Farm" approach may be used in meeting the critical upland sediment control requirements for a landowner. Under this system, the amount of sediment to control through meeting the critical sites criteria listed in the following box is calculated for a landowner. This "farm target number" must then be met through any combination of sediment control measures applied to any of the eligible lands on the farm. This method can also be used for any landowner that has some fields that deliver 0.8 tons/ acre/year sediment or greater.

One of these alternatives may be used throughout the watershed depending on which system best suits the needs of participating landowners. The number of acres eligible for funding of control practices, the tons of sediment controlled, and the percent reduction for each management category is shown in Table 3-4 below.

Table 3-4 Criteria for Eligibility - Upland Source-Sediment Control†

Delivery Management Target Category	Sediment Delivery (tons/ac/yr)	Design Target (tons/ac/yr)
Critical	> = 5.50	< 5.50 if achieved at landowner's expense
		= < 0.4 if achieved with cost sharing *See the 3 options above*
Eligible	> = 0.10 and < 5.50	0.40 tons/acre/year OR 50 % reduction from sites that contribute = < 0.8 tons/acre/year
Ineligible	< 0.10	N/A

† All land with sediment delivery rates greater than or equal to 0.10 tons/acre/year (according to the WINHUSLE model) will be eligible for cost sharing and must be brought down to a delivery rate of .40 tons/acre/year or less, or if the original loading rate is < .81 tons/acre/year, the load must be reduced by at least 50 percent. Controls on fields meeting this condition are optional for a participating landowner. Lands with a sediment delivery of 5.50 tons/acre/year or more will be considered critical and must also be controlled.

Table 3-5 Summary of Upland Land Use: Duck, Apple and Ashwaubenon Creeks Watershed

Subwatershed		Cropland	Developed	Trees/Grass	Wetland	Totals
Lancaster Creek Duck Cr. WS	Acres	3,802	9,635	3,309	2341	19,087
	Percent	20	50	18	12	100
Trout Creek Duck Cr. WS	Acres	7,402	1,272	3,050	732	12,456
	Percent	59	10	25	6	100
Fish Creek Duck Cr. WS	Acres	18,124	3,995	6,108	5,878	34,105
	Percent	53	12	18	17	100
Burma Swamp Duck Cr. WS	Acres	20,708	4,261	4,261	2,493	31,723
	Percent	66	13	13	8	100
Dutchman Creek Apple & Ashw.	Acres	12,505	4,608	1,585	483	19,181
	Percent	65	24	8	3	100
Hemlock Creek Apple & Ashw.	Acres	16,990	958	493	357	18,791
	Percent	90	5	3	2	100
Freedom Apple & Ashw.	Acres	12,234	6,800	1,798	439	21,271
	Percent	58	32	8	2	100
Appleton Apple & Ashw.	Acres	7,562	4,951	647	136	13,296
	Percent	57	37	5	1	100
TOTALS	Acres	99,327	36,480	21,251	12,852	169,91
	Percent	58	22	13	7	1 100

Based on rural inventory, WINHUSLE, Brown and Outagamie County LCDs.

Table 3-6 Upland Sediments - Inventory and Targeted Reduction Goals

Subwatershed	Inventory Results				Goal- 50 % reduction in rural sediment delivered						
					Category Critical >5.5 sediment delivered			Category Eligible <5.5 and > 0.1 sed. del			Acres Not Eligible
	Total Area (acres)	Tons per year of sediment delivered (Rural)	Percent from water-shed	objective reduction (percent)	Number RURAL Acres	Target RURAL Tons Reduced	Percent Original Load Reduced	Number RURAL Acres	Target: RURAL Tons Reduced	Percent Original Load Reduced	<0.1 t/ac/yr Sediment Delivered
Lancaster*	19,087	1,060	1	50	-	-	-	3,802	530	100	0
Trout *	12,456	2,054	2	50	-	-	-	7,402	1,027	100	0
Fish *	34,105	19,646	21	50	254	1,646	17	17,821	8,147	39	49
Burma Swamp*	31,723	39,569	43	50	1,283	8,132	41	19,385	11,651	24	41
Dutchman	19,181	4,256	5	50	-	-	-	12,473	2,128	50	32
Hemlock	18,791	5,528	6	50	13	99	4	16,977	2,665	96	0
Freedom	21,271	10,705	12	50	76	427	8	12,158	4,926	92	0
Appleton	13,296	8,657	10	50	150	1,100	25	7,412	3,229	75	0
TOTAL	169,910	91,475	100	N/A	1,776	11,434	25	97,430	34,303	75	122

* = Subwatersheds with an asterisk (*) are include the Duck Creek Watershed.

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Gully Erosion

Gully erosion has not been identified as a significant problem in this watershed, therefore, a complete field inventory of gully erosion was not conducted. Gullies adjacent to streams were recorded during the streambank inventory. Gullies next to streambanks deliver an estimated 1,000 tons of sediment to streams annually in the Duck, Apple and Ashwaubenon Creeks Watershed. Additional gullies identified during implementation will be evaluated to determine their eligibility for cost-sharing.

1. Eligibility

   Those sites with (a) evidence of active erosion, (b) direct connection with surface waters via channelized flow, and (c) reasonable access to machinery necessary for installing BMPs are eligible for cost-sharing.

2. Critical Sites

   Sites which deliver 100 tons of sediment annually to surface waters and are determined by watershed staff to be feasible and cost-effective for control.

3. Water Resource Objectives

   If an onsite evaluation of an active gully leads local staff to the conclusion that the installation of structural practices would not be cost-effective, that site will be deemed as ineligible for those specific practices.

See Table 3-6 for rural uplands targeted for sediment control.

Streambank Erosion

Eroding streambanks contribute an estimated 1.5 percent of the total annual sediment load reaching surface waters in the Duck, Apple and Ashwaubenon Creeks Watershed. Although the overall sediment contribution from streambank erosion is small, specific stream reaches have been severely degraded by bank erosion. Areas adjacent to streams, or riparian areas, have generally also been degraded by erosion and sedimentation. Protection of these areas is vital for the health of the entire stream corridor system and are of value due to their potential for providing or enhancing aquatic habitat, upland wildlife habitat and water quality.

Streambank Sites

Approximately 200 miles of streams in the watershed were evaluated. An estimated 7040 tons of sediment are eroding into streams annually from this source.

Livestock Access to Streams

Livestock have access to less than 1 percent of the total stream length in the watershed. Trampled banks and associated sediment delivery has been determined to be insignificant. This is due in part to good pasture and grazing management by watershed landowners and from conservation through state and federal cost-share programs, the Brown County Streambank Ordinance and the Farmland Preservation Program.

Livestock access has not been identified as a significant problem in this watershed; therefore, critical area streambanks for livestock access have not been designated.

Additional sites on intermittent streams which meet the criteria above may be identified. See Table 3-7 for streambank eligibility criteria and additional information.

Critical Sites

Those sites which deliver 100 tons of sediment annually to surface waters and are determined by watershed staff to be feasible and cost effective for control. There are 6 sites inventoried that meet this criteria. Six (6) watershed landowners are affected by this designation.

Eligibility (cost-effectiveness)

Those sites eroding at a rate greater than 5 tons/acre/year could receive consideration for cost sharing. There are 240 sites with 7,045 feet of eligible streambank owned by 87 watershed landowners that meet this criteria. Eligibility will be based on onsite evaluations. If an onsite evaluation leads watershed staff to the conclusion that installation of structural practices to correct the problem would not be cost effective, the site will be deemed ineligible. Generally, streambank sites located within woodland and wetland areas are inaccessible and installation of structural practices would not be cost effective. Bioengineering will be the preferred management tool for solving streambank problems where staff determine that it is feasible.

Table 3-7 Streambank Eligibility

Management Category	Sediment Delivery Tons/Yr	Reduction Objective	# of Landowners Affected
Critical	100 Tons/Yr	5 Tons/Yr	6
Eligible	more than 5 Tons/Yr	5 Tons/Yr	87
Not Eligible	less than 5 Tons/Yr	NA	NA

Table 3-8 **Streambank Inventory Results: Duck, Apple and Ashwaubenon Creeks Watershed Streambank Erosion and Degraded Habitat**

Subwatershed	Inventoried Streambank Length (feet)	Eroded Sites (feet)	Trampled Sites (feet)	Slumped Sites (feet)	Cattle Access (feet)	Total Sediment Loss Tons/Yr	% Bank Degraded From E,T,S	% of Total Bank Erosion in Watershed
Fish Creek	510,988	63,740	800	5,485	800	1,210	14	24
Burma Swamp	221,110	25,125	540	720	540	287	12	9
Hemlock	294,960	43,505	3,105	10,196	3,105	2,703	19	19
Freedom	304,148	69,572	2,600	8,635	3,200	1,809	27	27
Appleton	144,788	19,005	-	-	-	250	14	7
Dutchman	116,160	8,220	-	915	-	541	8	3
Lancaster	121,440	2,150	-	-	-	54	2	1
Trout	42,240	30,037	-	-	-	1,072	71	10
Totals	1,755,834	261,354	7,045	25,951	7,645	7,926	-	100%

Source: Outagamie and Brown County LCDs

Table 3-9 Streambank Erosion - Inventory and Target Goals

Subwatershed	Inventory Results			Goal and Eligibility criteria							
	Inventoried stream length (ft)	Total Sediment Loss - Tons per year	percent of total contributed	Critical - severe erosion = > 100 tons/acre/year				Eligible - moderate erosion = > 5 tons/acre/year			
				# owners - no cattle access	feet	# owners - cattle access	feet	# owners - no cattle access	feet	# owners - cattle access	feet
Fish Creek	510,988	1,210	15	1	-	-	-	25	8,137	1	800
Burma Swamp	221,110	287	4	-	-	-	-	7	104	1	540
Hemlock	294,960	2,703	34	1	306	-	-	20	24,400	1	825
Freedom	304,148	1,809	22	1	150	1	1,200	18	14,956	-	-
Appleton	144,788	250	3	-	-	-	-	3	57	-	-
Dutchman	116,160	541	7	-	-	-	-	7	8,670		
Lancaster	121,440	54	1	1	575			3	6,450		
Trout	42,240	1,072	14		75			8	10,292		
Total	1,755,834	7,926	100	4	1,100	1	1,200	81	73,066	3	2,165

Source: Outagamie and Brown County LCDs

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Ordinances

Manure Storage Ordinance

Surface water and groundwater resources are at risk when animal waste storage facilities are improperly located, designed or constructed. Manure overflows and storage facility failures are a serious threat to aquatic life. Counties adopt animal waste 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/or major repair of animal waste storage facilities.

Outagamie and Brown County enacted a animal waste storage ordinance in 1986.

Brown County Streambank and Shoreline Protection Ordinance

1. A minimum of 35 feet of land free of row crops and seeded to grass , alfalfa, or other close-growing crop shall be maintained between the farmed area and the edge of the navigable stream: navigable stream crossings shall be permitted for livestock and shall be of a design deemed appropriate by the County Land Conservation Department. A farmer may be exempt from this section if soil and water conservation practices are deemed sufficient and no pollution is occurring in the opinion of the County Land Conservation Department.

2. If there is a pollution problem resulting from the grazing or pasturing of livestock, the farmer/operator will be required to erect a fence no closer than 16-1/2 feet of the edge of the navigable stream or otherwise abate the plltion in such a manner as may be determined by the County Land Conservaton Department. If a fence has to be erected, provision will be allowed for watering livestock in the navigable stream which is acceptable.

Reduction Goals and Project Objectives for Rural Nonpoint Sources

Goals for water quality in the Duck, Apple and Ashwaubenon Creeks Watershed were identified earlier in the chapter as protection, enhancement, and restoration of water resources. In rural areas these will be achieved through project objectives for sediment and phosphorus.

The following is a summary of reductions to be targeted for the entire watershed.

Sediment Objective: Reduce overall sediment delivered by 50 percent.

To meet the overall delivery goal, the following is needed:

- 50 percent reduction in sediment reaching streams from agricultural uplands in all subwatersheds.
- 25 percent reduction in sediment reaching streams from gully erosion in all subwatersheds.
- 10 percent reduction in sediment reaching streams from streambank erosion in all subwatersheds.

Phosphorus Objective: Reduce overall phosphorus load by 50 percent to meet this, the following is needed:

- 50 percent reduction in P from barnyards in all subwatersheds.
- 50 percent reduction in P from landspread manure.
- 50 percent reduction in upland sediment and its attached phosphorus.

In addition, this plan calls for a *significant* effort to restore degraded or prior converted wetlands.

Tables 2- and 2- summarize the sediment and phosphorus reduction goals for the Duck, Apple and Ashwaubenon Creeks Priority Watershed Project.

Table 3-10 Phosphorus Mass Balance and Reduction Goals - Rural and Urban Sources

Phosphorus Sources	Loading (pounds (lbs)/year)	Percent of Total Annual Load	Reduction Goal (% source load)	Reduction Goal (pounds (lbs))	Percent of Total Phosphorus Goal
Agricultural Upland/Cropland	162,826	72	50	81,413	78
Barnyards	9,034	4	50	4,517	4
Agricultural Winterspread Manure	36,563	16	50	18,828	18
Urban Nonpoint	19,382	8	NA[4]	NA	NA
Annual Totals	227,805	100	50%	104,758	100

[4]Unquantifiable. Varies by subwatershed between "no change" and 25%.

Table 3-11 Sediment Mass Balance and Reduction Goals - Rural and Urban Sources

Sediment Sources	Loading (tons / year)	Percent of Total Annual Load	Reduction Goal (% source load)	Reduction Goal (Tons)	Percent of Total Sediment Goal
Cropland	91,475	82	50	45738	98
Gully Erosion	1,000	1	25	250	.5
Rural Streambank	7,040	6	10	704	1.5
Urban Streambank	2,000	2	NA	NA	NA
Urban Runoff (Appleton Area)	540	2	NA	NA	NA
Urban Runoff (Green Bay Area)	2,161	<1	NA	NA	NA
Urban Construction Site Erosion	6,800	6	NA	NA	NA
Annual Totals	111,016	100	50[5]	46,692	100

Duck Creek = 59% of entire watershed

adding number = 51.4% of sediment load

[5]Unquantifiable. Additional control will come from urban areas.

Eligibility for Wetland Restoration and Easements

Wetland Restoration

There will be no critical areas for wetland restoration. All wetlands will be classified as eligible for restoration if the sites meet the criteria described below.

Wetland restoration is considered a BMP for the purpose of controlling nonpoint sources of pollution. Wetland restoration includes: plugging or breaking up of existing tile drainage systems, 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. Secondary benefits of wetland restoration may be enhancement of fish and wildlife habitat.

Wetland restoration is an available option to address any of the following:

1. *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 either by establishing permanent vegetation or altering the drainage system.

2. *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.

3. *Prior converted wetlands downslope or upslope from fields identified as Critical Management Area upland sediment sources through the WINHUSLE model.* Restoration of wetlands in these situations will do one of two things:

    1) create a wetland filter which reduces the pollutants from an upslope field(s) to a water resource, or

    2) reduces the volume and/or velocity of water flowing from an up-slope wetland to a down-slope critical field.

Two eligibility conditions must be met to use wetland restoration in this situation:

- All upland fields draining to the wetland must be controlled to a soil loss rate that is less than or equal to the soils' "T" value.

- Wetland restoration costs must be the **least-cost** practice to reach sediment reduction goals.

Land Easements

Nonpoint source program funds may be used to purchase land easements in order to support specified BMPs. These practices, all of which involve establishing 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 well heads 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 that:

- Riparian easements can provide fish and wildlife habitat along with the pollutant reduction function.

- Easements are generally perpetual, so the protection is longer term than a management practice by itself.

- 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.
- 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 slopes with excessive erosion.

3. To support eligible wetland restorations. Easements are strongly recommended.

4. When a barnyard or animal feedlot is located within the floodplain and:

   - a permanent easement is the least-cost alternative to provide adequate pollution reduction, or

   - 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.

2. If there is a pollution problem resulting from the grazing or pasturing of livestock, the farmer/operator will be required to erect a fence no closer than 16-1/2 feet of the edge of the navigable stream or otherwise abate the plltion in such a manner as may be determined by the County Land Conservaton Department. If a fence has to be erected, provision will be allowed for watering livestock in the navigable stream which is acceptable.

CHAPTER FOUR
Urban Inventory Results, Nonpoint Source Pollutants, Reduction Goals, and Cost-Share Eligibility

An urban nonpoint source inventory and analysis was conducted to identify and prioritize major and minor constraints to achieving water quality goals in the watershed. This section describes the urban nonpoint source pollutants as well as the management needs and reduction objectives for each pollutant in the Duck, Apple and Ashwaubenon Creeks Watershed. This section includes assessments for stormwater conveyance, sediment from construction site erosion and streambank erosion, pollution prevention practices, and urban toxic pollutants carried in runoff. The section ends with a summary of the pollutant reduction goals and project objectives for urban nonpoint sources.

Description of Urban Runoff

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

- Loadings 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.

Urban Pollutants

Urban areas produce a wide variety of pollutants which can degrade water quality. There are six constituents that are commonly found in urban runoff: sediments, nutrients, pathogens, organic enrichment, toxic pollutants, and salts.

Sediments can be made of either organic or inorganic material. Elevated levels of total suspended solids, turbidity and dissolved solids result from such urban sources as construction site runoff,

urban runoff, landfill leachate and septic field leakage, and urban streambank erosion. The effects of excess sediment on surface water include turbidity, habitat alteration, recreational and aesthetic loss, and contaminant transport.

Excess nutrients can lead to algae blooms in shallow water and ammonia toxicity. Nutrient parameters include: nitrate, nitrite, ammonia, organic nitrogen, phosphate and total phosphorus. Urban sources of nutrients include: runoff, landfill leachate, septic field leakage, atmospheric deposition and streambank and construction site erosion.

Pathogens can have many and varied effects ranging from ear and intestinal infections, if consumed directly, or by contact exposure from swimming. Green Bay, the receiving waterbody for the watershed streams, has been closed to beach swimming since 1935. Pathogenic parameters include total and fecal coliform, fecal streptococci, viruses, cryptosporidium, and E. coli. Urban sources for these pathogens include runoff, leaking septic systems, and illicit sanitary connections.

Organic enrichment can be described as biochemical and chemical oxygen demand (BOD_5 and COD, respectively) and total organic carbon (TOC). Urban sources of organic enrichment include runoff, landfill leachate and septic systems. In excess, organic enrichment can lead to low dissolved oxygen levels or anoxic conditions, which can lead to odor problems and fish kills. Excess organic enrichment is inextricably linked to the process of eutrophication, or excess production, in lakes and streams and has disturbing effects on an aquatic system's balance.

Pollutants with toxic properties can have deleterious effects on aquatic resources. Heavy metals such as lead, zinc, chromium, copper, cadmium and arsenic and organic compounds, such as polychlorinated biphenyls (PCBs) are responsible for chronic toxicity impacts. They can bioaccumulate in the food chain, leading to toxic build up and disruption of normal growth and reproduction in aquatic and terrestrial life. Acute toxicity can also occur from urban runoff. Runoff monitored from commercial and high density residential areas in Madison and Milwaukee during 1990 was found to exceed acute toxicity standards developed for point sources as defined in NR 105 and NR 106 Wis. Adm. Code. Sources of potentially toxic compounds may come from pesticide and herbicide runoff, leaking underground storage tanks, landfill leachate, illegal oil disposal, industrial effluent, automobile combustion byproducts, and particulates from wearing of tires.

Salts, such as sodium chloride used as a deicing agent, are present in runoff and snowmelt. Potential effects include vehicle corrosion, contamination of drinking water and harm to freshwater organisms, both plants and animals.

Stream Hydrology

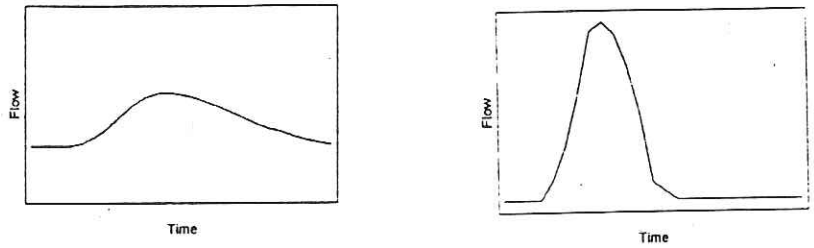
A stream hydrograph (see Figure 1 below) is a two-dimensional representation of water flow used to show changes in streamflow over time. Base flow is that flow generated by groundwater discharge to the stream. The level of base flow for some streams is zero because flow only occurs

during rain events. Other streams have year-round base flow from groundwater discharge from seeps or springs. Peak flows are levels of stream flow recorded during rain events when surface runoff contributes to the existing stream flow.

Land use that promotes over-land runoff rather than infiltration of rain has been shown to greatly affect hydrographs. A hydrograph showing a gradual and even rise in water levels during and immediately after a rain event represents a stream where infiltration of rain in the surrounding watershed occurs. Higher base flow is shown by the higher in-stream water level. The gradual rise and fall of the hydrograph line represents additions to that baseflow water level from increased infiltration and direct precipitation.

A hydrograph with a steep, sharp peak during and immediately after a rain event followed by a steep drop in water level corresponds to a stream with little or no baseflow and watershed infiltration. The stream's little or no baseflow and sharp, sudden increase in level during and immediately after a storm event (higher peak flow) represents a "flashy" hydrograph. A reduction in base flow may result in a stream drying up during parts of the year which has a direct effect on fish survival. Low base flow during non rain events also means the instream temperature will rise above historic levels, affecting all aquatic life. During rain events, the sudden increase in flow may be associated with flash flooding on some streams. The energy of this peak flow is dissipated by thrashing action against streambanks, which may result in streambank erosion, especially along poorly vegetated banks. Instream habitat is also disturbed by high peak flows which often carry sediment that eventually settles to cover "clean" substrate (rocky, pebbly stream bottoms) needed by fish and aquatic insects. The hydrologic instability of a flashy stream affects water temperature and bank structure and aquatic community health. In addition to these adverse effects, road culverts may experience surcharging if undersized for these peak flows.

Figure 1: Hydrograph Figures



Land Use Characteristics

A great many studies have been conducted on the effects of urbanization on surface and groundwater. Urban land uses vary in their significance as pollutant source areas. Table 4-1 shows unit area loads associated with different land uses. These values represent an average for that land use from modeling efforts conducted in urban areas of Brown County. For a given pollutant, it is clear that the land use plays an important role in the amount generated on a per acre basis.

Vehicle traffic density and the type and density of industrial activity are important determinants of many heavy metal (lead, copper, zinc) and PAH loadings to waterbodies or the atmosphere. Generally, metals found in runoff are generated from tire and brake lining wear, oil, antifreeze, grease and gasoline. Generally, PAHs in runoff are delivered by atmospheric deposition from sources of incomplete combustion of hydrocarbons, such as vehicles and coal-fired power plants (both municipal and industrial). Residential, commercial and industrial land uses are major sources of fertilizers and pesticides, which generally contribute excess nutrients and complex organic compounds, respectively. Domestic pets are likely urban sources of bacteria in runoff, although urban wildlife such as rabbits and squirrels are also responsible.

Significance of Pollutant Concentrations

Table 4-1 (below) illustrates the variability of unit area loads from different land uses. Land uses that contribute a comparatively small unit load but which currently or in the future will occupy a large proportion of the total land acreage should be evaluated and managed closely. Table 4-2 shows the estimated pollutant loads in lbs/year from subwatersheds in the priority watershed area. Strategies to reduce mass loads are generally applied watershed or community wide. Table 4-2 highlights the mass loads of suspended solids, total phosphorus, total copper, total zinc and total PAHs for each subwatershed in the Duck, Apple, Ashwaubenon Watershed Area. These mass loads were the result of a modelling effort using SLAMM (Source Loading and Management Model). The loads for the Outagamie County Study Area were calculated by applying unit area loads from Table 4-1 with acreage figures from Table 1-4.

Table 4-1 Pollutant generation Unit Area Loads from Urban Land Uses (lbs/ac/yr)

Unit Area Load lbs/ac/yr	Residential[1]	Commercial	Industrial	Institutional	Open Space	Freeway[2]
suspended solids	161	974	493	176	50	86
phosphorus	1	1.4	1.2	.6	.2	.3
copper	.015	.13	.05	.04	.006	.03
zinc	.08	1.02	.91	.18	.044	.09
PAHs	.02	.58	.33	.2	.02	.04

[1] These values are an average of all residential land uses from single family to multi-family residential.

[2] The value for freeways is lower than traditional freeway unit area loads because of the amount of grass swales present in the urban area. Grassed swale drainage includes both sides of the freeway as well as in the median.

These values were calculated from data specific to the watershed, using Green Bay rainfile files and parameter files calibrated from monitoring data collected for the Marquette, MI and Duluth, MN/Superior, WI binational study. Source: DNR

Table 4-2 Specific Annual pollutant loads (lbs/yr) by Subwatershed, 1995

Pollutant loads (lbs/yr) -->	Suspended Solids	Total Phosphorus	Total Copper	Total Zinc	Total PAHs
Beaver Dam Creek	1,071,466	3,118	128	1,245	563
Direct Drainage	326,565	1,539	29	195	67
Dutchman's Creek	1,468,370	3,843	181	1,457	784
Fish Creek	197,461	1,439	16	89	17
Hemlock Creek	431,032	990	55	655	278
Lancaster Brook	480,9000	2,596	50	318	117
Slough Creek	197,247	600	19	382	95
Trout Creek	149,884	1,275	10	59	7
Appleton	751,968	2,261	88	866	389
Freedom	520,084	1,401	62	601	276
Burma Swamp	51,520	320	5	26	6
Watershed Total	5,646,497	19,382	643	5,893	2,599

Currently, no state standards exist for the concentration or mass of pollutants discharged through stormwater outfalls. However, the level of pollution discharged through stormwater outfalls can be evaluated by comparing the "end of pipe" (point where the storm sewer discharges into a water course) concentrations with discharge limits in place for municipal and industrial effluent. From the 1990 Madison and Milwaukee monitoring effort, event mean concentrations of copper and zinc were found to exceed NR 105 and NR 106 standards 45 percent of the time. Event mean concentrations of PCBs exceeded the human cancer criteria 100 percent of the time, and PAH concentrations exceeded the toxicity standard 60 percent of the time. Stormwater outfalls may exceed phosphorus and suspended solids limits that are required of municipal and industrial wastewater treatment plants, although no such limits are set for stormwater outfalls. Ultimately, however, the potential for this level of contamination to occur depends upon the mix of contributing land uses. While an equivalent monitoring effort was not performed on sewersheds in the DAA Priority Watershed Area, we would expect to find similar results, given the existing land uses.

The *Watershed Approach* to reduce total pollutant loads will require setting long range goals for the water resource and for target pollutant reductions. The Watershed Approach accommodates the transpolitical nature of natural resources and includes the analysis of offsite

impacts, such as, in this case, the affect urban pollutants have outside the watershed's boundaries -- on the bay of Green Bay. The Lower Green Bay Remedial Action Plan 1993 Update estimates that significant pollutant loadings reach the lower Fox River. If efforts are made to focus existing technical and human resources toward enhanced street sweeping, construction site erosion control inspections, stormwater management planning for new development and information and education of urban landowners, these loads could be reduced to an acceptable level.

Urban Inventory Results

Methods

The Source Loading and Management Model (SLAMM) was used to estimate annual mass loadings to surface waters of five pollutants: suspended solids, total phosphorus, total copper, total zinc, and total PAHs. These pollutants were chosen because they are either conventional pollutants of general concern or toxic materials known to occur widely in relatively high concentrations in urban runoff. See Appendix G, "Probability of Event Mean Concentration Exceeding Wisconsin Surface Water and Groundwater Quality Standards".

In the Duck, Apple, Ashwaubenon Priority Watershed, two urban study areas exist. The Fox Valley area, including the cities of Appleton and Kaukauna, the village of Little Chute, and the town of Freedom, covers approximately 6 square miles. This area at present has substantially less urban acres than the Brown County study area, around the mouth of the Fox River, which covers 27 square miles. This second area, which was the study area evaluated using SLAMM, includes the cities of De Pere and Green Bay; the villages of Ashwaubenon and Howard; and the townships of Hobart and Lawrence. Because of ongoing land acquisition, property owned by the Oneida Nation is included in the above mentioned municipal divisions.

Land development characteristics necessary to run the model were recorded in the field at 32 locations representing a variety of commercial, residential, institutional and open space land uses in De Pere, Ashwaubenon and Howard (Appendix H, sample field sheet). These characteristics include: street conditions, drainage conveyance and parking density. A management questionnaire was also used to determine present levels of street sweeping and the extent of grass swales in the area (Appendix F).

Loadings were then modeled for existing and anticipated land uses. Anticipated urban land growth areas were identified in the draft Brown County Planning Land Use Plan, which projects growth through the year 2020. From the results of the SLAMM runs for the Brown County Study Area, unit area loads were developed for the urban area in Outagamie County.

Pollutant loadings were compiled by land use (residential, commercial, industrial, institutional, open space), subwatershed, and municipality (v. Ashwaubenon, c. DePere, c. Green Bay, t. Hobart, v. Howard, WDOT). These loading data were developed for both the

existing urban land cover and the increment of urban land cover anticipated to be created over the next few decades. A limited amount of data was also compiled by source areas (existing rooftops, parking lots and streets).

The effectivenesses of existing street sweeping and drainage controls were incorporated into all calculations of pollutant loadings. SLAMM automatically reduces pollutant loadings for source areas that drain across landscaped areas as opposed to being directly connected to the conveyance system. All pervious areas were assigned to a soil type in the "C" and "D" hydrologic soil grouping (or 'soil horizon') for purposes of these calculations (USDA, 1978) Grassed swale densities for urban land uses were estimated based on municipal questionnaires and for freeways were estimated from measurements taken from typical cross-sections for this area supplied by WDOT. All swales were assigned an infiltration rate of 0.25 inches/hour. This figure is based on taking 50% of the median infiltration rate measured during 1989 at 8 sites (CD soils) located in Green Bay. All swales were assigned a wetted perimeter of 5 feet. Street sweeping frequencies were determined by a municipal questionnaire.The effectiveness of street sweeping in reducing pollutant loadings from the various land uses was assumed to be as follows:

Sweeping Frequency of Once/Week Spring, Summer, & Fall
20% suspended solids, 15% other pollutants
Sweeping Frequency of Once/Week Summer, Twice Month Spring & Fall
15% suspended solids, 10% other pollutants
Sweeping Frequency Once/Month Spring, Summer, & Fall
5% all pollutants
Sweeping Frequency Once in Spring, Once in Fall
3% all pollutants.

This assumes communities were using standard, mechanical broom, street sweepers. The effect from existing detention ponds and wetland areas on pollutant loadings are not reflected in these data.

Stormwater Runoff Pollutant Loads from Existing Urban Areas

Tables 4-3 and 4-4, *Magnitude and Distribution of Pollutant Loads*, shows key contributors to the subwatersheds in this analysis. Beaver Dam Creek and Direct Drainage receive large inputs from the City of Green Bay; Dutchman's Creek, from the Village of Ashwaubenon; Lancaster and Slough subwatersheds, from the Village of Howard; and Fish and Trout Creeks, from the township of Hobart. Depending on the present health of the stream, this distribution is significant for management considerations in the respective municipalities.

Table 4-3 Magnitude and Distribution of urban pollutant loads (lbs/yr) by subwatershed for the Brown County Portion of the DAA PWS Project

Subwatershed	Suspended Solids	Total Phosphorus	Total Copper	Total Zinc	Total PAHs
Beaver Dam Creek	1,071,466	3,118	128	1,245	563
% from V. Ashwaubenon	6%	4%	7%	4%	8%
% from C. Green Bay	63%	73%	60%	55%	55%
% from V. Howard	30%	21%	31%	40%	37%
% from WDOT*	1%	1%	2%	1%	1%
Direct Drainage	326,565	1,539	29	195	67
% from C. Green Bay	66%	64%	64%	64%	65%
% from V. Hobart	3%	5%	5%	3%	1%
% from V. Howard	33%	32%	32%	33%	33%
Dutchman's Creek	1,468,370	3,843	181	1,457	784
% from V. Ashwaubenon	65%	70%	65%	74%	66%
% from C. Green Bay	3%	6%	3%	2%	1%
% from V. Hobart	30%	22%	30%	23%	32%

Subwatershed	Suspended Solids	Total Phosphorus	Total Copper	Total Zinc	Total PAHs
% from WDOT*	1%	1%	2%	1%	1%
Fish Creek	197,461	1,439	16	89	17
% from C. Green Bay	20%	15%	28%	25%	29%
% from T. Hobart	80%	85%	72%	75%	71%
Hemlock Creek	431,032	990	55	655	278
% from V. Ashwaubenon	55%	45%	54%	64%	62%
% from C. DePere	39%	47%	35%	33%	35%
% from WDOT*	6%	9%	11%	3%	4%
Lancaster Brook	480,900	2,596	50	318	117
% from T. Hobart	27%	35%	22%	19%	10%
% from T. Howard	73%	65%	78%	81%	90%
Slough Creek	197,247	600	19	382	95
% from V. Howard	97%	97%	93%	99%	98%
% from WDOT*	3%	3%	7%	1%	2%
Trout Creek	149,884	1,275	10	59	7
% from T. Hobart	100%	100%	100%	100%	100%

* The contributions from WDOT are for US HWYs 41 and 29 and State HWYs. Their low percent contribution is a reflection of the increased grassed swale drainage for these highways.

Table 4-4 Magnitude and Distribution of Urban Pollutants - Brown County Portion of Duck Apple and Ashwaubenon Creeks Watershed - by Civil Division

Watershed	Suspended Solids 4,322,925 lbs/yr	Total Phosphorus 15,400 lbs/yr	Total Copper 488 lbs/yr	Total Zinc 4,400 lbs/yr	Total PAHs 1,928 lbs/yr
% from V. Ashwaubenon	29%	21%	32%	35%	38%
% from C. DePere	4%	3 %	4 %	5 %	5%
% from C. Green Bay	23%	24%	22%	20%	19%
% from T. Hobart	21%	28%	18%	12%	15%
% from V. Howard	22%	22%	22%	27%	22%
% from WDOT*	1 %	1%	3 %	1 %	1%

* The contributions from WDOT are for US HWYs 41 and 29 and State HWYs. Their low percent contribution is a reflection of the increased grassed swale drainage for these highways.

Table 4-5 Projected Increase in Urban Loads (1995-2020), Brown County Portion - Duck, Apple and Ashwaubenon Creeks Priority Watershed.

Subwatershed	Existing Planned(lbs/yr) Planned Inc.(%)	Suspended Solids	Total Phosphorus	Total Copper	Total Zinc	Total PAHs
Beaver Dam Cr	Existing Planned(lbs/yr) Planned Inc.(%)	1,071,466 16,800 2%	3,118 100 3%	128 2 2%	1,245 8 1%	563 2 0%
Direct Drainage	Existing Planned(lbs/yr) Planned Inc.(%)	326,565 92,400 28%	1,539 261 17%	29 10 34%	195 73 37%	67 32 48%
Dutchman's Ck	Existing Planned(lbs/yr) Planned Inc.(%)	1,468,370 1,650,920 112%	3,843 3,209 84%	181 169 93%	1,457 2,390 164%	784 963 123%
Fish Ck	Existing Planned(lbs/yr) Planned Inc.(%)	197,461 426,900 216%	1439 740 51%	16 45 281%	89 482 524%	17 214 1259%
Hemlock Cr	Existing Planned(lbs/yr) Planned Inc.(%)	431,032 261,300 61%	990 799 81%	55 27 49%	655 240 37%	278 97 35%
Lancaster Bk	Existing Planned(lbs/yr) Planned Inc.(%)	480,900 710,150 148%	2,596 3,294 127%	50 70 140%	318 436 137%	117 143 122%
Slough Ck	Existing Planned(lbs/yr) Planned Inc.(%)	197,247 253,120 128%	600 1,050 175%	19 25 132%	382 167 44%	95 61 64%
Trout Ck	Existing Planned(lbs/yr) Planned Inc.(%)	149,884 72,450 48%	1,275 431 34%	10 7 70%	59 35 59%	7 7 100%
Watershed	Existing Planned(lbs/yr) Planned Inc.(%)	4,322,925 3,484,040 81%	15,400 9,884 64%	488 355 73%	4,400 3,831 87%	1,928 1,519 79%

197,461 + 480,900 + 149,884 + 1,520 = 879,765 lb/yr = 440 tons

426,900 + 710,150 + 72,450 + 90,350 = 1,300,150 lb/yr = 650 tons

Table 4-6 **Pollutant Loads by Subwatershed, Outagamie Portion -- Existing (1996) and [Planned (2020)] Land Uses**

Subwatershed	Suspended Solids	Total Phosphorus	Total Copper	Total Zinc	Total PAHs
Appleton	751,968 [852,030]	2261 [3267}	88 [94]	866 [790]	389 [337]
Freedom	520,084 [662,593]	1401 [2422]	62 [70]	601 [746]	276 [291]
Burma Swamp	51,520 [97,350]	320 [391]	4.8 [10.9]	26 [73]	6.4 [33.3]
Total	1,323,572 [1,611,973]	3982 [6079]	154.1 [175.4]	1493 [1610]	671.5 [662.1]

Stormwater Runoff Pollutant Loads from Planned Areas

Table 1-8 and 1-9 shows the anticipated development in the Duck, Apple, Ashwaubenon Watershed. The anticipated land use increases represent a full build-out scenario. The model analysis, based on this scenario, may therefore overestimate the actual loads that will occur in 2020. Table 4-5 and 4-6 show the results of future loadings due to increased growth in the watershed.

Table 4-7 shows the results of a limited analysis done on source area contributions. Source areas include roofs, driveways, streets, sidewalks, lawns, etc. Only one subwatershed was evaluated because this type of analysis is very time consuming. The subwatershed selected was the Dutchman's Creek in the Village of Ashwaubenon, because this area was relatively large and included a good cross section of urban land uses.

From this table it is clear that the source area contributions vary with the pollutant and with the land use. For suspended solids, the largest contributor from a residential land use is lawns and then streets, whereas parking/storage exceeds all other sources in commercial, industrial and institutional land uses. Zinc, however, is contributed by the rooftops in industrial settings, but by streets, parking and roofs in the other land uses.

For the entire watershed area, the commercial land uses produce significant portions of the sediment, metals, and PAH loads while occupying less than 10% of the urban land area. Within that land use, the sources of these pollutants are parking and storage primarily and then streets and rooftops. Knowing where the pollutants come from allows a municipality to target significant source areas where a large reduction in pollutant loading can be accomplished with a set of smaller BMPs.

Table 4-7 Proportion of Annual Loads Estimated to Originate from Source Areas by Land Use

Land Use Type	Source Area	Runoff Volume	Suspended Solids	Total Phosphorus	Total Copper	Total Zinc	Total PAHs
Residential	Parking/Storage	3%	2%	1%	4%	5%	52%
	Streets	30%	30%	15%	35%	26%	37%
	Driveways	14%	17%	13%	26%	15%	7%
	Rooftops	20%	6%	3%	14%	32%	3%
	Lawns/Other	30%	44%	68%	19%	15%	0.00
	Sidewalk/Other	4%	1%	1%	3%	6%	1%
Commercial	Parking/Storage	52%	60%	39%	54%	46%	93%
	Streets	16%	26%	20%	20%	17%	5%
	Driveways	2%	4%	8%	4%	2%	0.00
	Rooftops	23%	6%	17%	18%	28%	1%
	Lawns/Other	1%	3%	11%	1%	0.00	0.00
	Sidewalk/Other	5%	1%	4%	4%	6%	0.00
Industrial	Parking/Storage	46%	79%	50%	74%	25%	96%
	Streets	11%	7%	8%	12%	3%	2%
	Driveways	3%	2%	5%	4%	1%	0.00
	Rooftops	33%	7%	10%	8%	69%	2%
	Lawns/Other	6%	15%	27%	3%	1%	0.00
	Sidewalk/ Other	1%	0.00	0.00	0.00	1%	0.00
Institutional	Parking/Storage	46%	53%	25%	48%	43%	96%
	Streets	11%	15%	9%	13%	7%	2%
	Driveways	3%	10%	14%	9%	4%	0.00
	Rooftops	33%	5%	10%	15%	24%	1%
	Lawns/Other	6%	12%	34%	3%	2%	0.00
	Sidewalk/Other	1%	4%	8%	13%	21%	1%

Open Space	Parking/Storage	4%	11%	4%	9%	13%	72%
	Streets	13%	50%	23%	38%	34%	25%
	Driveways	1%	5%	5%	3%	3%	1%
	Rooftops	0.00	0.00	0.00	1%	2%	0.00
	Lawns/Other	90%	31%	63%	41%	27%	0.00
	Sidewalk/Other	4%	3%	4%	8%	21%	2%

[1]This table is based on an analysis of land uses in the Village of Ashwaubenon, Dutchman's Creek Subwatershed.

Municipal Questionnaire Summary

In 1995 a survey was distributed to various muncipalities in the Duck, Apple and Ashwaubenon Watershed. The table below summarizes the results of this survey, which was designed to gather information concerning actions that affect the quality of stormwater, groundwater and surface water at the time of the questionnaire. The next section, "Local Stormwater and Erosion Controls", summarizes the results of two sets of questions related directly to stormwater and construction erosion control. The survey summary (Appendix F) details the questions behind each box in the following matrix:

Municipality	Street Sweeping	Storm water controls	Leaf Collection	Grass & Brush Collection	Snow & Salting Policy?	Fertilizer & Pesticides	Public Works Facilities	Education Activities	Pet Waste Ordinance
Appleton	1/wk	DP[6]	1/10 days	2/yr	Yes	Yes	None	Yes	Yes
Ashwaubenon	1/wk	None	1/wk	None	Yes	Yes	Yes	Yes	No
DePere	2/mo	DP	1/6 wks	all year	No	Yes	None	Yes	Yes
Green Bay	1/wk	None	1/8 days	all year	Yes	Yes	Yes	No	Yes
Howard	2/yr	DP	2/yr	1/wk	No	Yes	Yes	No	Yes
Kaukauna	1/wk	Pump Station	1/wk	grass 2/yr brush 12/yr	No	No	NA	No	Yes
Little Chute	1/wk	DP	1/wk	1/wk	Yes	No	Yes	Yes	Yes

[6]Detention ponds

Local Stormwater and Erosion Controls

- All respondents had at least two or more positive local controls in place for the abatement of stormwater and erosion.

- Appleton, Ashwaubenon, Kaukauna and Little Chute have post-construction runoff controls in place, while Depere, Green Bay, and Howard do not.

- All municipalities have development requirements that affect the volume and quality of stormwater.

- Appleton, Kaukauana and Little Chute require stormwater management plans as part of the development approval process; DePere, Green Bay, and Howard do not.

- In all municipalities, enforcement of construction erosion controls via the Uniform Dwelling Code takes place through the local building inspector. For commercial buildings, the state enforces applicable codes in Appleton only; all other municipalities have local enforcement.

- Most municipalities have at least some type of local ordinance that covers erosion control on sites not regulated by the Department of Commerce or the Department of Natural Resources; Appleton and Kaukauna do not, however.

- All municipalities except Kaukauna and Little Chute are dissatisfied with the level of compliance with erosion control provisions at the state and local level. These same municipalities believe that adding staff would help as well as more training and education.

Urban Nonpoint Source Control Needs

Alternatives for Managing Urban Nonpoint Source Pollution

To meet the project's urban pollution goals, urban BMPs must:

1) Reduce the mass loading of urban pollutants so that the loading in 2020 is 25% less than the 1995 load in selected subwatersheds and a "no change" from the 1995 load in others. (See water resources table)

2) Educate the public to recognize and subsequently reduce contaminants entering surface waters. (See information and education chapter)

3) Integrate Non-Structural Best Management Practices (BMPs) into the site-by-site planning process for new development.

4) Maintain the hydrologic characteristics of surface waters so that base flows are not significantly reduced below 1995 levels, and so that stream discharge flows under the average annual flood are not significantly increased over 1995 levels. In order to accomplish this, the goal for new development is to maintain runoff characteristics under the 2-year, 24-hour rainfall conditions at levels that are consistent with pre-development conditions under good land management.

5) Construction site erosion control (CSEC). This plan seeks to fully implement adequate ordinances for CSE control. It also seeks to have the local units of government intensify efforts to review erosion control plans and provide site inspection for compliance on all construction sites.

Selection of Management Alternatives

Management Alternatives are defined as the application of one or more best management practices in different locations for the purpose of controlling urban stormwater pollution. This plan quantitatively and qualitatively evaluates the effectiveness of alternative management strategies for reducing mass loadings from existing and planned urban areas. Existing areas are as of 1995 and the planned are through the year 2020. Construction sites, though significant, will be controlled and are not included in the alternative analysis.

Management alternatives for meeting pollutant reduction goals will be a combination of control in the existing and planned urban areas. Varying levels of control, on a percentage basis, were applied to both the existing and planned urban areas. It is assumed that BMPs in the existing urban areas will require significant retrofitting; therefore, control combinations were assessed and the alternative with the least amount of retrofitting was chosen for cost projections. Structural best management practices for urban areas include wet detention ponds, retrofitting existing dry or wet ponds, constructed wetlands, street sweeping, rooftop disconnection and infiltration and filtration devices, bioretention zone, buffer, and snow disposal site management. BMPs in planned urban areas will include the above practices as well as grassed swales.

Two practices used for this analysis are wet detention ponds and street sweeping; these were selected because control effectiveness, size requirements and cost can be quantified with reasonable certainty. This does not though preclude the use of other control methods, such as structural practices including grass swales, vegetative buffers, infiltration and filtration devices, and nonstructural practices such as information and education, and establishing buffer corridors.

Table 4-8 shows how various levels of control in combination, for both the existing and planned areas, can be used to achieve the *25 percent pollutant reduction* goal within the Direct Drainage, Beaver Dam, Freedom and Green Bay subwatersheds.The remaining subwatersheds (Fish Creek, Slough Creek, Lancaster Brook, Trout Creek, and Appleton), will have a *no*

change alternative from the 1995 loads. Even though this is labeled a *no change* goal, reductions are still needed in the developing and critical areas. A goal of *no change* from 1995 loads recognizes that new development will increase that total load unless it is controlled 100%. Knowing that this is not possible, control of the existing area will be necessary to offset this increase. The significant areas that produce high unit area loads (see table 4-1) are as follows: industrial and commercial land uses (parking lots & rooftops), large parking lots in other land uses, construction sites, and streets. Having these significant designations within the existing urban lands helps to focus management in an otherwise expensive retro-fit area. Tables 1-5 and 4-7 show that the distribution of pollutants for Dutchman's subwatershed are dominated by loads from parking and storage areas (in this largely commercial land use watershed). Table 1-5 shows that Dutchman's Creek is dominated by commercial areas and in fact has the largest commercial area of any subwatershed. Table 4-7 shows that parking and storage areas is the largest source contributor of urban pollutants within the commercial area category. The parking and storage areas, then, will be the focus of reduction efforts within this subwatershed.

Table 4-8 illustrates the trade-offs between putting BMPs in planned or existing areas. These tables will be helpful for municipalities during future stormwater management planning efforts and when deciding where to target urban efforts in existing development.

Table 4-8 Ability of Urban Pollution Control Options to Meet '25%' or '*No Change*' Goal

Watershed/Drainage Area Being Considered								
Control Options		Beaver Dam Creek	Dutchman's Creek	Hemlock Creek	Lancaster Creek	Slough Creek	Trout Creek	Direct Drainage
Planned Area	Existing Area	25% Reduction	No Change	No Change	No Change	No Change	No Change	25% Reduction
No Controls	current swales, street sweeping	No	No	No	No	No	No	No
25% Control	10% add'l control	No	No	No	No	No	No	No
25% Control	20% add'l control	Yes	No	No	No	No	No	No
25% Control	40% add'l control	Yes	No	Yes	No	No	Yes	No
25% Control	60% add'l control	Yes	No	Yes	No	Yes	Yes	Yes
25% Control	80% add'l control	Yes	--	--	--	--	--	Yes
50% Control	10% add'l control	No	No	No	No	No	No	No
50% Control	20% add'l control	Yes	No	Yes	No	No	No	No
50% Control	40% add'l control	Yes	No	Yes	No	No	Yes	Yes
50% Control	60% add'l control	Yes	Yes	Yes	Yes	No	Yes	Yes
50% Control	80% add'l control	Yes	--	--	--	--	--	Yes
70% Control	10% add'l control	No	No	Yes	No	No	Yes	No
70% Control	20% add'l control	Yes	No	Yes	No	Yes	Yes	No
70% Control	40% add'l control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
70% Control	60% add'l control	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Watershed/Drainage Area Being Considered								
Control Options		Beaver Dam Creek	Dutchman's Creek	Hemlock Creek	Lancaster Creek	Slough Creek	Trout Creek	Direct Drainage
Planned Area	Existing Area	25% Reduction	No Change	NoChange	No Change	No Change	No Change	25% Reduction
50% Control	80% add'l control	Yes	--	--	--	--	--	Yes
80% Control	10% add'l control	No	--	--	--	--	--	No
80% Control	20% add'l control	Yes	--	--	--	--	--	No
80% Control	40% add'l control	Yes	--	--	--	--	--	Yes
80% Control	60% add'l control	Yes	--	--	--	--	--	Yes
80% Control	80% add'l control	Yes	--	--	--	--	--	Yes

Non-structural BMPs (Best Management Practices)

Another management alternative is the incorporation of non-structural BMPs. These include: watershed-based land use planning, protecting sensitive areas, establishment of a buffer corridor, reduction of impervious cover, limiting erosion during the construction phase, and maintaining stream protection measures (Schueler, 1995). Unfortunately, these are less quantifiable but none-the-less will provide a benefit to water quality. The education of municipal staff, developers, homebuilders and the general public is critical to the success of non-structural BMPs.

Protecting existing sensitive areas and encouraging watershed-based planning for future developments is the focus of this section. In the past, communities throughout the country gave little attention to issues such as imperviousness, lot geometry and storm sewers -- as far as their impacts on surrounding natural areas were concerned. More emphasis was placed on physical properties of water and less on environmental engineering. Environmental engineering goes one step further by considering the natural landscape and the mechanisms that promote environmental stability. These considerations in turn provide greater benefits to water quality and stormwater management. In the past 20 years, considerable research has become available that describes practices singly or in combination in a variety of situations. Based on this research, new ideas that range from simple pond designs all the way to comprehensive conservation subdivision designs are constantly gaining support and popularity for their consideration of community concerns that revolve around financial, safety and aesthetic issues.

Conservation design (Arendt, 1996) is a watershed-based, comprehensive approach that uses a modified version of traditional subdivision designs. It takes a more critical look at design considerations like lot geometry, buildable areas, natural areas, percent imperviousness, and infrastructure needs. It integrates these components in such a way as to decrease impacts on waterways while optimizing the relationship between natural areas and subdivision developments. Another term for this type of planning is *cluster development* (Scheuler, 1995). If appropriately planned, a developer's restrictions and financial obligations can be minimized while investments in the site are maximized. Site planning and design on a site-by-site basis is an important aspect of conservation design.

To take these ideas one step further, Scheuler (1995) developed a set of seven strategic criteria which echo this concept of conservation design. These criteria are:

- initiate watershed-based zoning as a safeguard to future development;
- protect sensitive areas through various mechanisms like ordinances;
- enhance waterway corridors with a vegetative network that acts as a buffer against possible contamination;
- use all necessary planning tools to minimize impervious cover;
- emphasize construction site erosion control;

- integrate appropriate stormwater management practices to treat the quality and quantity of water; and
- maintain stream protection infrastructure to maintain balance between all criteria. This point emphasizes that these criteria work in cooperation with each other and any breakdown in the system could be detrimental.

For existing and future development, there are five underlying principles that these range of practices are aimed at accomplishing:

- maintain vegetative contact with water as long as possible;
- keep clean water clean;
- reduce peak stormwater flows;
- increase time of concentration and detention time within the watersheds and basins respectively; and
- use site specific planning concepts with integrated hydrological landscaping to maximize the land use efficiency.

These principles will help set into motion the kind of proactive development that will meet the needs of our natural areas. At the current rate of development, future generations will be faced with some very difficult decisions that could have been avoided at the planning level. With a lengthy list of practices available and a genuine sense of responsibility to the environment and to our communities, meeting the needs of all parties should be a reasonable task.

Stormwater Conveyance

Stormwater is most commonly conveyed to streams through a combination of storm sewers, roadside ditches, grassed swales, and ponds. Storm sewers transport runoff rapidly with no pretreatment or filtering of the runoff before it enters streams. Properly designed grassed swales generally reduce runoff volume because of infiltration, and sod vegetation serves to remove some pollutants from runoff before it flows into streams and storm sewer systems.

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 normally these areas are drained by storm sewers that discharge directly to a stream or lake. Pollutants from lawns or rooftops may travel across pervious areas such as grassed swales, where infiltration can occur, so their contribution is lessened by their indirect connection to the lake or stream.

Reducing pollutant transport to surface waters involves reducing the amount of urban storm water reaching streams, primarily from impervious surfaces. This is accomplished by increasing the infiltration of storm water into the soil and ground layers. Storm water infiltration on a suitable site can effectively reduce nonpoint pollution. In addition, infiltration

can help stabilize the hydrology of small urban streams by replenishing groundwater, much of which is ultimately discharged to surface water. Infiltration can reduce bank erosion and the need for expensive, highly engineered drainage structures such as concrete lined channels. The soils in the DAA Watershed are generally considered to be "tight" for infiltration practices. This alternative may only be feasible in a relatively few locations. The greatest potential for reducing pollutants from rooftops is in the industrial areas. If land is available, disconnection of rooftops from the storm sewer system will allow infiltration to occur.

Management Needs and Alternatives

Two factors were used to identify critical urban land uses: the yield of pollutants from each land use (pounds/year), and the portion of the total urban pollutant load (%) produced by each land use. Hydrologic analyses have not been conducted to investigate the effect of management alternatives on reducing and preventing streambank erosion and bed scour, or on maintaining stream base flows. These studies will need to be conducted as part of future feasibility studies for nonpoint source control in established urban areas.

Table 4-9 Urban management alternatives for existing and planned urban areas in the DAA Watershed

Existing Urban Areas

1. Continue existing management only
2. Detain runoff from 100 percent of the land uses that include significant source areas (these include commercial and industrial rooftops, commercial streets, commercial and industrial parking and storage areas.)
3. Detain runoff from 50 percent of the land uses that include significant source areas.
4. Control the significant source areas with source area controls (these include infiltration devices, street sweeping, other practices such as Stormceptor, Multi-Chambered-Treatment-Tanks, Pressurized Sand Filtration, as well as disconnection of rooftops onto appropriately vegetated pervious surfaces.)
5. A combination of detention and source area controls.

Planned Urban Areas

1. Do nothing.
2. Detain runoff from 50 percent of all new land uses.
3. Detain runoff from 100 percent of all new land uses.
4. Apply a combination of source area controls and detention on all new land uses.

The analysis of management alternatives assumes that wet ponds will trap all sediment particles of 5 microns or larger. This will result in about an 80 percent control of suspended sediment and about 60 percent control of phosphorus and heavy metals in urban runoff. The analysis assumes an infiltration rate of 0.25 inches per hour for infiltration basins and grassed swales. This is a moderate rate of infiltration that will provide less control of pollutants than wet

detention ponds. Higher infiltration rates of about 2.5 inches per hour would provide excellent control of pollutants. Existing levels of street sweeping and grassed swale drainage are accounted for in evaluating these alternatives. An increased frequency of street and parking lot sweeping with a high efficiency sweeper assumes a removal rate of 50% control of suspended solids from swept surfaces, and 40% control of phosphorus and heavy metals. Source area controls for parking, storage and streets using high efficiency sweepers is acceptable in areas where detention or other structures are not feasible or space is not available.

Feasibility studies will be needed to select the site specific 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. Assistance available to communities under the priority watershed project to develop nonpoint source controls in established urban areas is presented in Chapter Six.

Objectives

Analysis of storm water management techniques shows that certain best management practices (BMPs), such as infiltration basins and storm water detention ponds, can significantly reduce sediment and other pollutant loadings to lakes and streams. However, not all practices can be retrofitted into existing development. As a result, smaller source area control practices or street sweeping must be considered. Adoption of storm water management ordinances and use of storm water management and source area control practices will be a priority in the implementation of this plan.

The long-term management goal for the watershed is a 25% reduction of urban pollutants in some subwatersheds and a "no change" goal in others. This has been divided up into different pollutant reduction goals for existing and new development based on the land use in the subwatershed. Pollutant reduction can be best achieved by targeting significant land uses such as industrial and commercial areas and constructing new detention ponds or enhancing the efficiency of existing ones. Ponds will only be cost-effective if land is available near the significant land uses. The construction of ponds for drainage areas where the majority of the acreage is a significant area will still be acceptable. This program does not encourage construction of detention ponds for existing areas draining medium-low density residential land uses, parks or large pervious areas if these land uses are the dominant land use.

If detention is not feasible, source area controls for parking lots and streets such as street sweeping with a high efficiency sweeper or infiltration or filtration devices should be considered. Finally, consideration should be given to the acceptability of disconnection of rooftops in commercial and industrial areas, so that they drain onto pervious surfaces before discharging to a stream or storm sewer.

Redeveloped urban areas should have storm water quality and flow control practices included as part of the development.

Identification of Significant Land Uses

Tables 4-10 and 4-11 are an analysis of the subwatersheds in the Brown County study area. For two pollutants, the significant sources of these pollutants by land use are identified. Focusing efforts around the significant sources of a contaminant encourages a cost-effective approach to pollutant reduction.

Table 4-10 Land uses associated with the highest proportion of the Total Zinc annual load for the Brown County Study Area

Subwatershed	Land Use	Residential	Commercial	Industrial
Beaver Dam Cr	Parking/storage		X	X
	Roofs		X	X
Direct Drainage	Streets	X		
	Roofs	X		X
Dutchman's Cr.	Parking/storage		X	
	Roofs		X	X
Fish Creek	Streets	X		
	Roofs	X		
Hemlock Ck.	Parking/storage		X	X
	Roofs			X
Lancaster Br.	Parking/storage		X	
	Streets	X		
	Roofs	X	X	X
Slough Ck.	Roofs			X
Trout Ck.	Streets	X		
	Roofs	X		
WATERSHED	Parking/storage		X	X
	Roofs		X	X

The land uses marked with an X represent more than 10% of the load for this pollutant. Other land uses may also be contributing pollutant loads but to a lesser degree. For the purpose of a cost-effective analysis, sources contributing greater proportions of the load should be targeted for first consideration when constructing best management practices.

Table 4-11 Land uses associated with the highest proportion of the Total PAH annual load for the Brown County Study Area

Subwatershed	Land Use	Residential	Commercial	Industrial
Beaver Dam Cr	Parking/storage		X	X
Direct Drainage	Parking/storage	X	X	X
Dutchman's Ck	Parking/storage		X	X
Fish Creek	Parking/storage	X		
	Streets	X		
Hemlock Ck.	Parking/storage		X	X
Lancaster Br.	Parking/storage	X	X	X
Slough Ck.	Parking/storage			X
Trout Ck.	Parking/storage	X		
	Streets	X		
WATERSHED	Parking/storage		X	X

Zinc and PAH were chosen because they represent two of the primary pollutants found in urban stormwater. Other pollutant sources of concern include copper, suspended solids and phosphorus. PAH is closely associated with particulates found on streets and parking lots, as are copper and suspended solids. Zinc is more frequently found in roofing material and phosphorus is related to lawn and pervious surface management. Zinc and PAH were selected to reflect the known sources of urban pollution. Phosphorus will be addressed through information and education efforts in municipalities.

For cost-effective control, a municipality should concentrate their efforts on providing source area control on the significant land uses identified above. Source area controls may include roof top disconnection, street and parking lot sweeping or sophisticated oil/grit separators at individual sites. End-of-pipe practices, such as detention or infiltration basins, will provide mixed land use pollutant control, "peak shaving" and volume control. However, it may not be practical or socially feasible to construct these practices on existing development because of site constraints, high land values or topography. It also will not be practical to construct detention ponds only on the significant land uses if no land is available. The nonpoint program can pay for the portion of a detention pond that serves a significant area even if non-significant areas also drain to the same pond. In this scenario, the pond may drain both significant and non-significant areas resulting in a pollution reduction that is lower, but because land is available, the cost to build is lower also. Future stormwater management planning would evaluate the cost-effectiveness of such trade offs.

The following is a breakdown of the subwatersheds, their significant land uses, and appropriate best management practices to consider first, given the sources of pollution. The management alternatives proposed represent the low cost/low technology options available in an urban setting. In some cases these may be insufficient to achieve the reduction goal and larger, more sophisticated practices need to be considered. In some subwatersheds, the significant land uses are commercial and industrial, whereas, residential dominates in other subwatersheds. This affects the menu of practices available at those sites. New development will be addressed through stormwater management planning and can utilize a wider array of practices.

Beaver Dam Creek Subwatershed

Beaver Dam Creek subwatershed includes portions of the communities of Ashwaubenon (v.), Green Bay (c.), and Howard (v.). This subwatershed is nearly all built out with only a 2% increase in urban development over the next 20 years. The goal for this subwatershed is a 25% reduction of urban pollutants. Even though new development is small, an 80% control on that development means the subwatershed needs a 20% reduction of pollutants from the existing development in order to meet the overall reduction goal of 25%. Targeting the significant land uses and applying source area controls, will result in a significant reduction of pollutants. For this subwatershed the first effort for control should be through sweeping of the commercial parking lots with a high efficiency sweeper and disconnection of the industrial roofs. Additional benefit will come from pollution prevention efforts completed in the industrial areas for the Industrial Stormwater Permit process. If insufficient control is realized through these sources then the possibility of constructing or retrofitting detention ponds in the commercial and industrial areas must be considered, where land is available. A stormwater management plan would determine the feasibility of these practices.

Direct Drainage Subwatershed

Direct Drainage includes part of Green Bay (c.), Hobart (t.) and Howard (v.). This subwatershed will experience greater growth than Beaver Dam Creek at a 10% increase. The reduction goal is again 25% with a cost-effective breakout of 80% control on the new development and 40% on existing development. The critical land uses are again commercial and industrial, but residential streets and roofs contribute a significant portion of the pollutant loads as well. A regimen of street and parking lot sweeping with a high efficiency sweeper, as well as disconnection of industrial and residential roof tops to control zinc, would achieve a modest level of pollutant control. Adding stormwater pollution prevention at industrial stormwater sites, as well as an information and education effort to encourage downspout disconnection in residential areas will result in less than a 40% reduction of existing urban pollutants. Stormwater management planning needs to consider the cost-effectiveness of building stormwater detention ponds in the significant land areas, or modification of existing dry ponds to add a water quality component.

Dutchman's Creek Subwatershed

Dutchman's Creek is affected by urban areas of Ashwaubenon (v.), Green Bay (c.) and Hobart (t.). Growth over the next 20 years will be substantial, increasing the developed acres by 60%. The reduction goal for Dutchman's Creek will be "no change", requiring a 40% level of control on the existing urban area and 70-80% on new development. Commercial and industrial parking and storage again contribute a significant amount of the total PAH and zinc loads. Commercial and industrial rooftops also add to the zinc load. Disconnection of industrial roofs and sweeping of commercial and industrial parking areas with a high efficiency sweeper, along with a stormwater pollution prevention plans at industrial sites will reduce the pollutant load but not to the level needed. For this subwatershed, consideration of end of pipe detention where land is available at existing development, is necessary if the subwatershed is to meet its goal.

Fish Creek Subwatershed

Fish Creek is dominated by residential land uses in Green Bay (c.) and Hobart (t.), with an expected increase in development of 35% over the next 20 years. Fish Creek also has a 25% reduction goal which would require very high control of existing and new urban development, which is not likely to happen. This area should consider sweeping the streets with a high efficiency sweeper, rooftop disconnection, and pollution prevention by residential landowners, as well as end-of-pipe detention. More importantly, this subwatershed should consider developing new areas using the non-structural BMPs. Reducing the amount of impervious surfaces during development and then adding detention achieves the highest rate of pollution reduction of any management alternative.

Hemlock Creek Subwatershed

Hemlock Creek subwatershed drains portions of Ashwaubenon (v.), and De Pere (c.). This subwatershed is expected to increase development by 34%. The highest contributors of total PAH and zinc include the commercial and industrial parking and storage areas, with industrial roofs contributing large portions of the zinc load. The reduction goal for this area is "no change", requiring a 10% rate of control on existing development, along with a 70-80% control on new development. Industrial rooftop disconnection and sweeping of commercial and industrial parking lots with a high efficiency sweeper, along with pollution prevention stormwater permitting efforts on industrial sites would account for a level of pollutant control sufficient to meet the overall goal.

Lancaster Brook Subwatershed

Lancaster Brook has the highest projected increase in urban land use at 100%. This subwatershed has contributions from Hobart (t.), and Howard (v.), with most of the new development expected to be residential. The reduction goal for this subwatershed is "no

change" from existing conditions. This will require a 40% reduction goal on existing development and a 70-80% goal for new development. Parking and storage in all land uses is contributing to the total PAH load, with commercial being the most significant. Zinc is coming from many sources as well, including commercial parking lots, residential streets and residential, commercial and industrial roofs. Sweeping the parking lots, especially commercial parking, with a high efficiency sweeper will reduce the PAH load effectively, but not the zinc. Disconnection of rooftops in all land uses will help but an overall consideration of end of pipe detention is the only way to get a truly significant reduction in pollutant loads.

Slough Creek Subwatershed

Slough Creek subwatershed will also be growing at a 93% rate for new urban acres. Howard (v.) is the principle urban community contributing to this drainage area. For Slough Creek a "no change" reduction goal will mean 20% control on the existing development and 70-80% control on all the new acres of urban development. The critical land uses are strictly industrial parking areas for PAH and industrial rooftops for zinc. Any attempt to disconnect roofs or sweep parking lots will succeed in reducing the pollutant loads. Through the industrial stormwater pollution permitting process, pollution prevention measures will also reduce the pollutant load. If stormwater management planning and implementation is added for new development, this subwatershed will be able to achieve its goal.

Trout Creek Subwatershed

Trout Creek subwatershed drains land that is primarily residential from Hobart (t.). The expected increase in urban land use acres is 35%. A "no change" reduction goal can be met cost-effectively with 10% control on existing development and 70-80% control on new development. Stormwater management planning for new development, sweeping streets and disconnecting rooftops of existing residential landowners should achieve the goal.

Appleton Subwatershed

The Appleton Subwatershed will be growing at a 140% rate for new urban acres, with one third of those new acres developed as commercial or industrial. The principle urban areas are Appleton (c.), Little Chute (v.) and the towns of Center, Freedom, Grand Chute and Vandenbroek. For Appleton subwatershed, the reduction goal is "no change" from 1996 pollutant loads. Given the high growth rate, emphasis must be placed on an 80% control of new development through stormwater management planning and ordinance development for construction sites and stormwater. Existing commercial and industrial areas should be targeted for detention ponds if land is available or existing ponds can be enhanced to include water quality benefits. Efforts should also be made toward establishing regional treatment as large areas develop and to consider non-structural best management practices during planning.

Freedom Subwatershed

The Freedom Subwatershed is expected to experience a 183% increase in urban acres over the next 20 years, with a little more than one-quarter of the increase in commercial and industrial development. The urban areas in the Freedom subwatershed include Kaukauna (c.), Little Chute (v.) and the towns of Freedom, Kaukauna and Vandenbroek. The goal for this subwatershed is a 25% reduction of 1996 pollutant loads. With a high growth rate, an 80% control on new development will be necessary. However, this will still mean an additional 20% increase in loads from new development. A fairly high reduction goal will be needed in existing areas as a result. Accelerated sweeping and disconnection of downspouts in commercial and industrial areas will not be sufficient to meet the goal. Modifications of existing ponds or new ponds needs to be considered.

Burma Swamp Subwatershed

This subwatershed is expected to see growth primarily in residential development. The existing urban area of this subwatershed is fairly small. Planning for new development, especially if new acres are commercial, industrial or high density residential is important to reduce future loads by 80%. No specific goal has been set for the urban portion of this subwatershed.

Summary

The management alternatives analysis indicates that structural BMPs for nonpoint source control in existing developed areas are needed in several areas of the watershed project to achieve urban pollutant reduction goals. In addition, each community will be expected to conduct the "core" activities of the plan described in Chapter Six, including urban pollution prevention and educational activities.

Construction Site Erosion

Description

Construction sites are those areas in any phase of construction that involves disturbing the soil through grading or excavation. Construction sites in the project area entail new development and renovation or redevelopment. The renovation and redevelopment activities include utility replacement, street replacement, bridge reconstruction, or rehabilitation of commercial, industrial, or residential areas.

Construction site erosion is a major water quality concern in the watershed. Uncontrolled construction site erosion can devastate aquatic communities in 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 40 tons/acre/year can occur. This rate of erosion is greater than occurs on the most severely eroding croplands and many times the sediment loading rate 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.

Management Needs and Alternatives

The goal of this plan for Construction Site Erosion Control is to fully implement adequate ordinances. The plan also seeks to have the local units of government intensify efforts to review erosion control plans and provide site inspection for compliance on all construction sites.

Average annual sediment loading to streams from construction erosion for 1996-2020 conditions was determined by multiplying the amount of land planned for construction (7,800 acres) by an average of 20 tons per acre per year. 20 tons per acre per year was selected to reflect the effectiveness of current regulations on construction site erosion. This rate of erosion and sediment control is also based on observed land development patterns and generalized climatic conditions. It is estimated that in the years between 1996 and 2020, construction erosion will contribute about 6,800 tons per year of sediment (about 2 percent of total sediment load from nonpoint sources) to streams in the project area.

Enforcing state and local ordinances can be an effective means to reduce construction site erosion and its adverse water quality impacts. In 1986, the DNR and the League of Wisconsin Municipalities cooperatively developed a model ordinance for the control of construction site erosion (DNR, 1987). It contains provisions for planning, designing, installing and maintaining erosion control practices. It also contains guidance for administering and enforcing the ordinance. In addition, developers are governed by state regulations (Ch. 144 Wis. Stats.) set forth by the Department of Commerce (formerly the Department of Industry, Labor and Human Relations, DILHR) for erosion control on sites with one and two family dwellings; and the DNR Wisconsin Pollutant Discharge Elimination System (WPDES) permit regulations for sites greater than five acres.

Despite these regulations, several potential impediments to effective erosion control exist. For example, developers sometimes perceive erosion control as an add-on cost and not a built-in cost of construction, enforcement is often done only in response to complaints, maintenance of erosion control is often poor, unnecessary grading and excavation is commonplace, soil is routinely tracked onto roads because preventative measures are not a high priority for builders, and there is often confusion about who is responsible for installing and maintaining erosion control practices. Local ordinances must meet the applicability and content requirements of NR 120.16 dealing with erosion control. Erosion control practice standards and applicability

criteria should be consistent with those set forth in the Wisconsin Construction Site Best Management Practice Handbook (DNR, 1989).

The following is a list of specific recommendations that units of government and developers should address in developing an effective construction site erosion control program.

- Municipalities should review (and modify where needed) their existing ordinances to assure effective penalties for non-compliance and responses to concerns of citizens, inspection staff and developers.

- Municipalities should evaluate staffing and training needs for effective ordinance administration and enforcement.

- Municipalities should evaluate their permit fee schedule to investigate ways to raise revenue to support effective enforcement activities.

- Developers and contractors need to know what is expected of them, and they need better access to technical information through seminars and other educational activities and materials.

- Erosion control inspectors need specific guidelines for documenting ordinance violations in order to provide for more consistent and effective legal action.

Communities within the watershed will be asked to improve their ordinances or adopt ordinances as part of the core activities. A municipal survey addressed the issue about what activities existing ordinances cover. From the survey results it would appear that Appleton and Kaukauna especially need to implement a management strategy to address construction site erosion control. The villages of Little Chute, Howard, Ashwaubenon, and the city of Green Bay are encouraged to review the following discussion and make appropriate amendments to fully address erosion that is not regulated by DNR or the Department of Commerce.

Communities, in order to receive funds through the nonpoint program, will be required to adopt ordinances with the following minimum standards for construction site erosion control and shall provide for the regulation of any construction activity which;

1. Involves the grading, removal of protective groundcover or vegetation, excavation, land filling or other land disturbing activity which affects an area of 4,000 ft^2 or more.
2. Involving the excavation or filling or a combination thereof which affects 400 yd^3 or more of dirt, sand or other excavation or fill material.
3. Involves street, highway, road, or bridge construction, enlargement, relocation or reconstruction.

4. Involves the laying, repairing, replacing or enlarging of an underground pipe or facility for a distance of 300 feet or more.
5. Requires a subdivision plat approval or a certified survey.

Construction Site Erosion Control Ordinance

A number of local governments recognize that the cost of *preventing* damage from erosion and sedimentation is often less than the cost of *correcting* damage from erosion. Also, many believe that the cost of preventing erosion damage should be borne by those benefiting from the development rather than by taxpayers paying to remove sediment from ditches, culverts, streets, harbors, lakes, and streams. These local governments are developing or amending subdivision ordinances, zoning ordinances, and other local ordinances to include runoff and erosion control requirements for developing land areas.

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 state standards. Several of these government units have included runoff and erosion control provisions in their ordinances. These ordinances 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.

The DNR suggests that the Wisconsin Construction Site Erosion Best Management Handbook (DNR Publication WR-222-93) be used as a reference for any development that occurs in the Duck, Apple and Ashwaubenon Creeks Watershed. Outagamie County, Brown County and the Oneida Nation are encouraged to adopt construction site erosion control ordinances.

Objectives

High priority items to improve compliance include more consistent issuance of citations, hiring of additional inspection staff where needed, new fee structures to cover the cost of improved staffing, and more effective court action when ordinance violations occur.

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

Urban Streambank Erosion

Description

Streambank erosion occurs along much of the rivers in the Duck, Apple and Ashwaubenon Creeks Watershed. This erosion is caused primarily by channelization, 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. A detailed inventory of urban streams was not conducted as part of this watershed project. Table 4-12 summarizes the stream miles in the two major areas. Beaver Dam Creek, particulary from Mason Street on down, has excessive streambank erosion. However, the estimate of sediment produced has not been completed.

Table 4-12 Urban Streambank Erosion Inventory Results For the Duck, Apple and Ashwaubenon Creeks Watershed

Subwatershed	Urban Stream Miles
Lancaster Creek	75
Appleton/Freedom (combined)	11
Total	86

SOURCE: WDNR

As in the rural setting, those sites which deliver 100 tons of sediment annually to surface waters and are determined by watershed staff to be feasible and cost effective to control shall be considered regulatory critical sites. The streambank inventory in urban areas will be completed and the critical sites identified. It is estimated that there is going to be at least one urban critical site.

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 assign the site a management recommendation. Eligibility of these sites for technical and financial assistance will be consistent with the criteria in Table 4-13.

Easements are also encouraged as a means of controlling streambank erosion.

Objectives

Reduce streambank erosion by 10 percent and restore and prevent erosion in critical areas.

Table 4-13 Eligibility criteria for urban streambank erosion will be identical to the criteria for rural streambank erosion.

Management Category	sediment delivery tons/year	reduction objective to	# of landowners affected
critical	> 100 tons/year	5 tons/year	unknown
eligible	> 5 tons/year	5 tons/year	unknown
not eligible	< 5 tons/year	NA	NA

Pollution Prevention Practices

Description

Pollution prevention practices are conducted to remove pollution at its source and prevent the need for treatment once they enter the resource. Practices include street sweeping, yard waste collection, recycling programs, and a variety of behavioral changes.

These factors affect the amount of pollutants from urban surfaces carried to lakes and streams by runoff. 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 especially in the early spring, to remove winter accumulation of sand and street dirt, in the fall, to remove leaves, and twice a week in between, provides the greatest benefit. The potential for lawn care chemicals to be carried by runoff to nearby streams and drainageways is also a concern. Fertilizer residues can enrich surface waters with nutrients and promote algae growth. Pesticides can add to toxic pollution.

Many benefits can be gained through changes in lifestyle by urban residents such as reducing the amount of automobile traffic and adopting erosion control practices. There are many actions individuals can take; the following is a partial list:

- Reduce or eliminate the use of galvanized roof materials and gutters, a primary source of zinc in urban runoff. Revise municipal building codes where possible.
- Remove pet wastes immediately from lawns, sidewalks, and streets to reduce bacterial contamination of urban runoff. 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. Utilize 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 development and redevelopment through zoning which, in part, considers on-site suitability for storm water management practices to meet water quality, habitat, and flood prevention objectives.

- Control construction site erosion.

- Minimize use of street de-icing compounds.

- Reduce the amount of motorized traffic.

- Reduce the areal extent of parking lots.

- Buffer the snow disposal sites.

Objectives

Encourage the use of pollution prevention practices, such as those listed through local programs. Encourage the use of Non-Structural Best Management Practices into the site-by-site planning process for new development. These goals tie together closely with the information and education component of the project.

Urban Toxic Pollutants

Description

One of the most important means for improving water quality in the Duck, Apple and Ashwaubenon Creeks Watershed is to reduce the concentrations of toxic materials in urban runoff. Five (5) pollutants (sediment, phosphorus, copper, zinc, and PAHs) were chosen to characterize the type and severity of urban nonpoint pollution. Through modelling, it is estimated that Beaver Dam Creek, Direct Drainage, Dutchman's Creek, Hemlock Creek, Lancaster Brook, Appleton and Freedom subwatersheds contribute 90 percent of the estimated sediment, phosphorus, zinc, copper and PAH loading to lakes and streams coming from urban sources in the watershed.

Stormwater Management Ordinances

A municipal stormwater management ordinance is intended to manage the long-term, post-construction storm water discharges from land development activities. The best way to do this is to address stormwater management problems and needs through the preparation of a comprehensive storm water management plan for subwatershed areas. These plans would include performance standards for storm water management measures for all land development activities. If plans have not been developed and approved by a governing body, then a stormwater management ordinance will set forth generic storm water management standards. The Department, through the Nonpoint program will fund stormwater management planning for new development and for existing development that requires more detailed study than provided during the Priority Watershed Plan. This program would also recommend that a governing body develop a stormwater management ordinance for all areas not included in stormwater management plans and as an appropriate enforcement mechanism for areas with plans.

The Department is required to develop a state model stormwater ordinance. That ordinance is currently in draft form. When an approved state model ordinance is available, Priority Watershed Plans will begin to require, as part of the core program, the passage of ordinances. Until then, it is only a recommendation.

Wetlands Eligibility

See Chapter Three cost-share eligibility section for wetlands.

Objectives for Pollutant Reduction for Urban Nonpoint Sources

To meet the project's urban pollution goals, urban BMPs must:

1) Reduce the mass loading of the 1995 pollutants so that the loading in 2020 is 25% less in selected subwatersheds and a "no change" goal in others.

2) Educate the public to recognize and subsequently reduce contaminants entering surface waters.

3) Integrate Non-Structural Best Management Practices (BMPs) into the site-by-site planning process for new development.

4) Maintain the hydrologic characteristics of surface waters so that base flows are not significantly reduced and so that stream discharge flows under the average annual flood are not significantly increased. In order to accomplish this, the goal for new development is to maintain runoff characteristics under the 2-year, 24-hour rainfall conditions at levels that are consistent with pre-development conditions under good land management.

5) Fully implement adequate ordinances for CSE control. Have the local units of government intensify efforts to review erosion control plans and provide site inspection for compliance on all construction sites.

The adequacy of these objectives will be reviewed after five years or sooner if future water quality data indicate a need for revision as determined by the watershed project Technical Advisory Committee.

CHAPTER FIVE
Rural Implementation

This chapter identifies the means for implementing the rural management actions for nonpoint source pollution control described in the previous chapter. The success of this priority watershed project depends on aggressive implementation of these nonpoint source pollution control strategies. This chapter identifies:

- BMPs needed to control nonpoint sources of pollution as described in Chapter Two.
- Cost containment policies.
- Cost-share agreement procedures.
- Schedules for implementing the project.
- Estimated project budget for cost-sharing, staffing and other support.

Agricultural Best Management Practices (BMPs)

BMPs Eligible For Cost-Sharing And Their Rates

BMPs control nonpoint sources of pollution and are identified in NR 120. Design and installation of all BMPs must meet 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. Applicable specifications for each BMP can be found in NR 120.14. The DNR may also approve other alternative best management practices and design criteria based on the provisions of NR 120.15.

If the installation of BMPs destroys significant wildlife habitat, NR 120 requires that habitat will be recreated to replace the habitat lost. The DNR Regional 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 5-1 and 5-2 below; the BMPs listed in Table 5-1 can either be cost-shared at 50 percent or at the flat rates listed.

Table 5-1 Best Management Practice Flat Rates

BEST MANAGEMENT PRACTICE	FLAT RATE
Contour Farming	$ 9.00/ac[1]
Contour Stripcropping	$ 13.50/ac[1]
Field Stripcropping	$7.50/ac
High Residue Management	$ 18.50/ac[2]
Cropland Protection Cover	$ 25.00/ac[3]
Riparian Buffer Areas	$100.00/ac[4]

1 Wildlife habitat restoration components of this practice are cost-shared at 70 percent.

2 $18.50 per acre for a maximum of 6 years for reduced tillage which leaves a minimum of 30 percent residue after planting. Payments may be nonconsecutive based on crop rotation. Contingent upon NR120 revision.

3 Up to three years, may be nonconsecutive depending on rotation.

4 $100.00 per acre for five years or an upfront payment of $500.00/ac for buffers planted to NRCS perennial grass mixture. Contingent upon approval by WI Standards Oversight Committee.

Table 5-2 State Cost-Share Rates for Best Management Practices

BEST MANAGEMENT PRACTICES	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% [2]
Manure Storage 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%
Animal Lot Relocation	70%
Roofs for Barnyard Runoff Management & Manure Storage Facilities	70%
Structural Urban BMPs	70% [2,3,4]
Milking Center Waste Control	70%
Street Sweeping	50% [5, 6]
Cattle Mounds	70%

1 To a maximum of $2,000 per watering system

2 Maximum cost share amount is $35,000 for manure storage including manure transfer equipment

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, & removal of structures necessary to install structural urban BMPs is 50%.

5 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, industrial, parking, major streets, and arterials. Modifications to existing ponds to control runoff from areas where a small portion is not critical may also be available.

6 This is an interim best management practic not listed in NR 120 of the Wisconsin Administrative Code. A pilot effort is underway and will be evaluted for effectiveness in the next two years in the Osceola Creek Watershed. Purchase of a sweeper or cost-sharing for opertors on a start-up basis may be added to the eligible practices.

Best Management Practices - Narrative Descriptions

The following are brief descriptions of commonly used BMPs listed in Table 5-2 above. A more detailed description of these practices can be found in NR 120.14.

Contour Farming. The farming of sloped land so that all operations from seed bed preparation to harvest are done on the contour.

Contour Stripcropping. Growing crops in a systematic arrangement of strips or bands, on the contour, in alternate strips of close grown crops, such as grasses or legumes, and row-crops.

Field Diversions. The purpose of this practice is primarily to divert water from areas it is in excess or is doing damage to where it can be transported safely.

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 or 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.

Wetland Restoration. The construction of berms or destruction of the function of tile lines or drainage ditches to create conditions suitable for wetland vegetation.

Barnyard Runoff Management. Structural measures to redirect surface runoff around the barnyard, and collect, convey or temporarily store runoff from the barnyard.

Animal Lot 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.

Easements. Easements are legally binding restrictions on land titles. Easements are purchased to provide permanent vegetative cover.

Vegetated Riparian Buffer. Riparian Buffers are permanently vegetated areas immediately adjacent to intermittent or perennial streams that function as a filter to delay, absorb, or purify contaminated runoff before it enters watershed streams.

Good Steward. The good steward incentive is a positive , innovative, cost-effective approach to encourage landowners to develop and accomplish a "holistic farm plan" in order to control all nonpoint sources of pollution generated on their owned acres.Note: while DNR endorses the concept of "Good Steward", budgetary and statutory restraints existing at the time of plan approval prohibit DNR funding of this BMP.

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 interim 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 interim best management practice.

Conservation Tillage Incentive System[7]

Conservation Tillage Incentive Systems (CTIS) are defined as those combinations of cost-share incentive packages that are developed within the watershed plan for a specific watershed project. CTIS's utilize the High Residue Management System components to address the upland sediment reduction goals of the project.

The purpose of this incentive system is to provide the program flexibility required to meet the sediment reduction goals of a project where upland sediment sources have been identified by the surface water appraisal as essential sources requiring control to meet the sediment reduction goals of the project. The added incentives offered by CIS are necessary components to asssure the highest level of voluntary participation by key landowners.

Conditions:

- Cost-sharing may be provided on a per-acre basis to convert to high residue management systems (including no-till).
- Cost-sharing may not exceed $18.50 per acre per year.
- Cost-sharing may be provided for eligible fields that meet the conditions of the High Residue Management BMP for a maximum of six years during the grant period.
- Upland sediment must account for a miniumum of 50% of the sediment education objective within the watershed plan for this practice to be eligible.

Vegetated Riparian Buffers[8]

Riparian buffers are permanently vegetated areas immediately adjacent to intermittent or perennual streams that function as a filter to delay, absorb, or purify contaminated runoff before it enters watershed streams.

The preedominant sources of nonpoint source pollutants in the watershed originate from croplands in the form of excess phosphorus and sediment. Establishment of Vegetated Riparian Buffer strips will provide significant protection of the water resource and increase the likelihood of achieving the water quality objectives identified in this nonpoint source plan.

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[7]This description is intended to clarify the existing BMP of high residue management. At the time of plan approval, NR120 was being revised to allow 50% cost-sharing on high residue management, effectively allowing cost-share payment of $18.50/acre for up to six years. The use of this BMP is contingent upon the revision of NR120.

[8]At the time of plan approval, this interim BMP was expected to soon be officially approved as a full BMP by the Wisconsin Standards Oversight Committee (SOC). Once SOC approves the BMP, it will be eligible for cost-sharing. However, the standard as approved by SOC will superscede the BMP as written in this watershed plan.

All watershed participants will also be eligible for NPS corridor easement acquisition where the establishment of a vegetated riparian buffer is necessary to meet nonpoint source program objectives.

Eligibility Parameters for Buffer Establishment

1. To be eligible for an annual payment, the establishment of a 35 foot-wide buffer strip will be required as a minimum, although a 66 foot-wide buffer is preferred.

- All perennial and intermittent streams delineated in the USGS 7.5 minute quadrangle are eligible for buffer establishment. Approval from the DNR Regional Coordinator will be required to establish eligibility for streams not delineated on a USGS map .

- The measurable width of a buffer begins at the centerline of an intermittent stream and at the edge of the bank of a perennial stream (ordinary high water mark). Those intermittent streams which have a defined bed and bank will be measured from the bank.

- Acres funded will be basedon cropable acres (not brush, trees, etc.)

- Buffers of greater than 35 feet wide must retain, at a minimum, 35 feet of NRCS grasses or hay adjacent to the upland field. The remainder of the buffer in excess of 35 feet will be eligible for tree/wildlife plantings. These tree/wildlife areas would not need to be mowed or harvested.

  If a landowner voluntarily extends a buffer beyond 66 feet, and is 100 feet or greater, a minimum 35 feet grassland buffer will still need to be maintained adjacent to any cropable acres, but annual mowing and removal of grasses is not required.

- If the buffer rating sheet indicates a necessity for a NRCS grass/hay buffer greater than 35 feet adjacent to an upand field, the width determined by the buffer rating sheet will be the minimum requirement for annual payment.

- Vegetated buffer widths may be extended to cover floodplain areas to meet nonpoint source program objectives.

2. At minimum, buffers must be maintained in permanent grassland or NRCS approved perennial grass mixture for a period of 10 years from the installation date of the final practice listed on the cost-share agreement.

   - Once a landowner with an established vegetated riparian buffer (that is located within the boundaries of Brown County) has fulfilled the operation and maintenance period requirements for this practice, the buffer will then be maintained in accordance with ordinance 22.24(3)(a)(1)(2).

3. Buffers will be allowed to be harvested as hay. The mowing and removal of grasses will be required at a miimum of once per year between July 15 and September 1 to maintain grasses.

   - Soil disturbance within the established buffer area during reseeding shall be held to a minimum. When soil disturbance becomes necessary due to streambank or gully repair, the appropriate actions shall be taken to limit the disturbance and protect all exposed areas.

4. Wildlife and environmental considerations must be given when designing this practice.

5. A cost-share agreement must be signed by the landowner.

6. Cost-share eligibility for the establishment of vegetated riparian buffers is dependent upon the cost-effectiveness and the ability to produce a sheet flow (Laminar) condition throughout the width of the buffer.

7. Before a landowner is to receive payment for this practice, the sediment delivery rate of fields immediately adjacent of the proposed vegetated riparian buffer shall be planned down to the sediment delivery goals specified on pages 71-75 of this plan.

8. Installation of the vegetated riparian buffer must be verified by the watershed staff before the initial payment to the landowner is made.

9. Buffer strip boundaries shall be delineated in an identifieable manner. Acceptable methods would be fencing or sign placement every 100 feet. Buffers will be marked with lath at a minimum.

10. At a minimum, a status review of established buffers shall be conducted by the watershed staff every three years for the life of the watershed project. If a riparian buffer is rendered ineffective due to circumstances beyond the cost-share recipient's control during the grant period, the local unit of government may amend the cost-share agreement to make the necessary repairs.

    While conducting a status review of a riparian buffer, the watershed staff shall inspect for the following conditions:

    - encroachment within the delineated boundary.
    - the presence of rills or gullies.
    - sparse vegetative cover and the presence of invasive species.
    - buffer degradation due to cattle or machinery access.

11. Outstanding flat-rate payments for the vegetated riparian buffer practice will be taken into account during the easement appraisal process for those landowners interested in selling a nonpoint source corridor easement.

B. Authorized Cost-Sharing

1. At a rate of 70% for the grading and shaping of the buffer area to eliminate concentrated flow.

2. At a rate of 70% for permanent fencing or boundary delineation.

3. At a rate of 70% for the planting of trees or an NRCS approved perennial gras mixture.

4. At a flat rate of $100 per acre per year for a maximum of 5 years or an upfront payment of $500 per acre for buffers planted to a NRCS approved perennial grass mixture that does not contain Reed Canary grass.

C. Not Authorized Cost-Sharing

1. Areas with pre-established vegetated buffers that meet the requirements listed under Condition A(1).

2. The establishment of buffer areas for/or in conjuntion with another program such as the Conservation Reserve Program or Federal 'set-aside' acreage.

3. The establishment of vegetated buffers in areas inwhich the landowner or operator will allow livestock access.

4. Sites where there is no direct benefit to protecting the surface water resource.

D. Sediment and Phosphorus Crediting Parameters

1. The establishment of vegetative riparian buffers that comply wit the aforementioned conditions can be credited at a 50 percent sediment and phosphorus buffer removal rate. Upland practicies will reduce the amout of sediment and phosphorus entering the buffer (refer to A.7) on the previous page). Due to varying soils and site conditions, removal credits and conditions wil only bapply to the Duck, Apple and Ashwaubenon Creeks Priority Watershed.

2. Cropland within 300 feet of a vegetated riparian buffer that has a slpe greater than 10 percent is not eligible for a sediment and phosphorus reduction credit.

3. Sediment and phosphorus removal credits for vegetative buffer strips of 35 to 66 feet wide is limited to the area where sheet flow occurs, measured perpendicular to the buffer.

Corn Silage and Fragile Crop Residue[9]

A. Name of Interim Best Management Practice

Corn Silage and Fragile Crop Residue Management

B. Definition

Corn silage and fragile crop residue management is a practice applied to corn silage and fragile crop fields to promote increased residue amounts during critical erosion periods and management by means of conservation tillage.

C. Purpose

The purpose of corn silage and fragile crop residue managment is to reduce sediment delivery from corn silage and fragile crop fields, increase soil infiltration and help attain watershed project goals. The current Conservation Tillage Incentive System (CTIS) requirement of 30% residue is not achievable from corn silage fields because nearly all of the corn plant is harvested (all but 4-12 inches generally) and utilized as feed. The feed value of corn silage is very high making it an intricate part of a complete dairy ration. The idea of leaving enough residue in the field to get 30% residue from corn silage would be economically unacceptable in the project area. Supplementing corn silage with additional alfalfa is also difficult (and unpopular) because cold, wet weather conditions in conjunction with the clay soils in the area make establishing quality alfalfa difficult. The corn acreas are also needed to safely dispose of the large amounts of manure in this area.

Fragile crop fields produce smaller amounts of residue and therefore would require different managment to achieve soil loss reductions. This incentive would promote a change in harvest and tilling operations creating higher levels of residue versus clean tilled fields from moldboard plowing.

Providing a corn Silage and Fragile Crop Residue Management incentive will significantly increase residue left on participationg fields While participating fields will not obtain current target residue levels of 30% and a corresponding 50% reduction in soil loss as described in the conservation tillage BMP, they will obtain 15% residue levels which equates to approximately

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[9]At the time of plan approval, the NRCS standard for residue management was under revision to allow less than 30% residue. No cost-benefit analysis had yet been completed, and therefore, no cost-share rate is included here. Contact DNR for further details. The description for this BMP contained in this plan is intended to capture the ideas as they were developed in June, 1997, rather than to guarantee eligibility for this BMP.

25% reduction in soil loss (calculated estimates based on SCS Standard 344 and Section I-C of the Field Office Technical Guide). Considering that there are 20,761 acres of corn silage and fragile crops each year in the project area, (48% of actual qualifying acres and 27% of total eligible acres), this incentive will achieve a higher participation rate of landowners by making residue goals obtainable on these corn silage acres. This will continue the effort to achieve better water quality as identified in the Duck, Apple, and Ashwaubenon Creeks Watershed nonpoint source control plan.

D. Conditions for Eligibility

To be eligible for cost-sharing the landowner/producer must:

1. Achieve 15% residue cover measured after planting on fields that were in corn silage or fragile crops in the previous year.

2. Cost-sharing will be provided for eligible fields that meet the conditions of the corn silage and fragile crop residue management BMP for a maximum of six years during the grant period.

3. Fragile crops are defined as: soybeans, sunflowers and vegetable crops.

E. Authorized Cost-Sharing

1. No cost-share rate had been established at time of plan approval. Cost-share rate will be determined by DNR after a cost-benefit analysis has been completed.

Good Steward Incentive

The Good Steward Incentive is a positive innovative, cost-effective approach to encourage landowners to develop and accomplish a 'holistic farm plan' in order to control all nonpoint sourcesof pollution generated on their owned acres.

The purpose of the Good Steward Incentive (GSI) is to create model farms through the implementation of comprehensive farm plans. It will serve to promote increased commitment by landowners in adopting their farm plans and will also keep local staff costs down because of increased cooperation and partnerships created with the private sector. Note: while DNR endorses the concept of "Good Steward" budetary and statutory restraints existing at the time of plan approval prohibit DNR funding of this BMP.

A. Eligibility Parameters for Incentive Payment

1. To be eligible to receive payments under the GSI provision of the program,the following parameters would be required to be addressed:

- All cropped fields need to meet the sediment delivery goals as set forth in this plan.
- Buffers would need to be established on all mapped perennial and intermittent streams (USGS 7.5 min Quads) where applicable.
- The Four Prohibitions for livestock facilities must be satisfied:

  1. No overflow of manure storages
  2. No unconfined manure stacking (piling) within water quality management areas.
  3. No direct runoff from feedlots or stored manure to waters of the state.
  4. No unlimited livestock access to waters of the state where high concentrations of animals prevent sod cover maintenance.

- An Integrated Crop Management (ICM) Plan must be followed. ICM includes nutrient and pest management planning.
- Gullies must be addressed where cost of control is feasible and where the gully directly discharges into intermittent or perennial waters.
- Streambank erosion must be addressed where cost of control is feasible.
- Milkhouse waste discharges must be controlled.
- A cost-share agreement must be signed by the landowner.
- All of the aforementioned provisions will be required to be listed on the cost-share agreement either as a cost-shared or non-cost-shared practice. Those provisions which do not apply to the farming operation will be justified under the special provisions section of the contract.
- If practices are rendered ineffective due to circumstances beyond the cost-share recipient's control during the grant period, the local unit of government may amend the cost-share agreement to make the necessary repairs.

B. Proposed Cost-Sharing, Not Funded by DNR

1. At a flat rate of $20 per acre at the time all provisions of the cost-share agreement are implemented and established.

2. Limited to cropland, farmstead and pasture acreage only. Wetland acreage would be included only if the wetland was constructed, improved or restored to benefit water quality.

3. Limited to a maximum payment of $5,000 per landowner.

4. Limited to a total expenditure of $300,000 over the life of the project.

5. Payment will be made only to landowners who have previously installed BMPs on their own (non-cost-shared practices must be equal to or greater than the good steward payment made in order that consistancy is maintained with the state code regarding cost-share percentage maximums).

C. Not Authorized Cost-Sharing

1. Cost-share agreements that do not satisfy all the parameters in Section A (above).

Activities and Sources of Pollution Not Eligible For Cost-Share Assistance

Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically listed as ineligible in NR 120.10(2). The following is a partial list of those ineligible activities:

- Operation and maintenance of cost-shared BMPs
- Actions which have drainage of land or clearing of land as the primary objective
- Practices already installed, with the exception of repairs to practices which were rendered ineffective due to circumstances beyond the control of the landowner
- Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of Wis. Stats., which includes livestock operations with more than 1,000 animal units or livestock operations issued a notice of discharge under ch. NR 243
- Septic system controls or maintenance
- Dredging activities
- Silvicultural activities
- Bulk storage of fertilizers and pesticides
- Activities and structures intended primarily for flood control
- Practices required to control sources which were adequately controlled at the time the cost-share agreement was signed, with the exception of those that were beyond the control of the landowner
- Other practices or activities determined by DNR to not meet program objectives.

Practices Not Cost-Shared

Practices not cost-shared, *but which shall be included on the cost-share agreement if they are necessary to control 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
- Nonstationary manure spreading equipment
- Practices needed for land use changes during the cost-share agreement period
- Other practices determined necessary to achieve the objectives of the watershed project
- Minimum levels of street sweeping and leaf collecting

Rural Cost-Share Budget

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 5-3. 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 BMPs is approximately $ 19.1 million, assuming 100 percent participation. At 75 percent participation the capitol cost is $ 14.3 million.

- State funds necessary to cost-share this level of control would be approximately $13.5 million.

- The local share provided by landowners and other cost-share recipients would be approximately $2.5 million.

Easement Costs

Chapter Two 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 5-3. At 75 percent participation, the estimated purchase price of easements on eligible lands would be $ 7,000. Easements are funded at 100 percent and will be purchased by the Wisconsin DNR.

Cost Containment

Cost Containment Procedures

Chapter NR 120 requires that the Land Conservation Departments and/or Tribal Planning Department, as grantors of cost-share agreements, identify and agree to use one or more of the following cost containment procedures described below to control the costs of installing BMPs. The cost containment procedure to be used by Outagamie County, Brown County and the Oneida Nation will frequently involve the determination of average costs and range of costs. However, any of the procedures listed below may be employed to contain costs.

Average Costs: Based on past cost information, the Land Conservation Departments or Oneida Nation Planning Department determines an average cost per unit of materials and labor for the installation of a BMP which may not be exceeded.

Range of Costs: Based on past cost information, the Land Conservation Departments or Oneida Nation Planning Department established a cost range for the installation of a BMP. Eligible costs may not exceed the maximum cost of the range.

Bidding: The Land Conservation Departments or Oneida Nation Planning Department requires the landowner or land operator to request bids from contractors for the installation of BMPs. The cost share payment shall be calculated based on the lowest bid received.

Flat Rates: BMPs using flat rates are shown in Table 5-1. The rates shown are the State's share of the practice installation costs.

Maximum Cost share Limit: The Land Conservation Departments or Oneida Nation Planning Department shall establish a maximum cost share rate limit not to exceed the rates specified in s. NR 120.18 for installation of a best management practice.

Municipal Work Group: The Land Conservation Departments or Oneida Nation Planning Department hires or assigns its employees to install a BMP for a number of landowners and land operators if the employees are able to perform the work at a cost lower than the private sector.

Wisconsin Conservation Corps: The Land Conservation Departments or Oneida Nation Planning Department uses the Wisconsin Conservation Corps to install BMPs for landowners and land operators.

Other cost containment procedures: If the Land Conservation Departments or Oneida Nation Planning Department determines another cost containment procedure would be more effective than the cost containment procedures described in this subsection, it shall include the alternative in the detailed program for implementation portion of the watershed plan.

Payments for "in kind" contributions will be based on the county's guidelines. Cost-share recipients who wish to install a BMP using their own labor, material and equipment must submit a quote plus one quote from a qualified contractor for the practice installation.

Cost-share payments will be based on actual installation costs. If actual installation costs exceed the amount of cost sharing determined by cost estimates, the amount paid the grantee shall be documented in writing with an explanation of the unusual circumstances attached to the cost-share agreement or amendment and attached to the request for reimbursement submitted to the DNR by the Land Conservation Department(s) or Oneida Nation Planning Department.

Table 5-3 Cost-Share Budget Needs for Management Practices for the Duck, Apple and Ashwaubenon Creeks Watershed

BMP	Number				Cost/ Unit ($)	Total Cost	75% Participation			
	Outagamie	Brown	Oneida	total			State Share	Local Share	Hrs/ Unit	Total Hours
Upland Control										
ChangeCrop Rotation(1)	14,880	2,700	3,000	20,580	0	0	0	0	.1	1,619
Contour Cropping(1)	200	100	0	300	9	2,700	2,025	0	.3	68
ContourStrip Cropping(1)	1,000	0	0	1,000	13.5	13,500	10,125	0	.5	375
Conservation Tillage(1)	204,085	108,000	9,360	321,445	18.5	5,946,733	2,702,004	0	.1	24,342
Corn Silage and fragile Crop Tillage(6)	188,387	30,000	8,640	227,027	9	2,043,243	931,123	0	.1	17,243
Green Manure(1)	5,000	10,000	2,000	17,000	25	425,000	331,250	0	.04	630
Rotational Grazing	4	2	2	8	4,000	32,000	13,000	13,000	15	98
Critical Area Stabilization	150	500	300	950	270	256,500	148,838	63,788	.5	394
Grass Waterways	30	15	5	50	3,000	150,000	102,255	34,875	22	853
FieldDiversion/ Terraces	2,000	1,500	2,178	5,678	3	17,034	10,087	4,323	.04	192
Grade Stabilization	5	2	4	11	4,000	44,000	25,900	11,100	50	463
Ag. Sediment Basin	15	4	6	25	10,000	250,000	141,750	60,750	90	1,823
Veg. Riparian Buffers(4)(1)	132	425	358	915	500	457,500	387,875	0	2	1,552
Nutrient Mgmt (2a)	25,000	15,000	0	40,000	6	240,000	90,000	90,000	.1	3,080
Nutrient/Pest Mgmt (2b)	25,000	10,000	12,000	47,000	10	470,000	191,250	191,250	.1	7,200
Spill Control Basin	6	3	1	10	15,000	150,000	81,375	34,875	40	310
Wetland Restoration	80	15	100	195	2,000	390,000	239,750	102,750	34	5,823
Good Stewardship (7)	8,750	6,250	3,000	18,000	20	360,000	0	0	.01	143
Livestock Exclusion, Woods	6,000	2,000	0	8,000	1	8,000	3,000	3,000	.01	60
									Subtotal	66,268

BMP	Number				Cost/ Unit ($)	Total Cost	75% Participation			
	Outagamie	Brown	Oneida	total			State Share	Local Share	Hrs/ Unit	Total Hours
Barnyard Runoff Control										
Filter Strip/ Wall (8)	84*	12	2	98	16,000	1,568,000	593,600	254,400	95	5,035
Roof Gutters (8)	86*	10	2	98	1,500	147,000	55,125	23,625	2	105
Clean Water Diversion (8)	22*	12	2	36	2,500	90,000	35,875	15,375	21	462
Roofs	0	0	0	0	25,000	0	0	0	25	0
Manure Storage (3,6)	108*	12	2	122	25,000	3,050,000	1,072,500	552,500	80	5,200
Manure Storage Abandonment	0	1	3	4	10,000	40,000	28,500	11,500	80	360
Cattle Mounds	4	5	0	9	3,000	27,000	14,175	4,050	15	101
Animal lot Abandonment/ Relocation	4	1	0	5	60,000	300,000	157,500	67,500	80	300
Well Abandon.	10	3	10	23	500	11,500	6,913	2,963	20	240
Milking Waste Control	50	3	0	53	7,000	371,000	194,775	83,475	20	930
									Subtotal	12,733
Streambank Erosion Control										
Shape and Seeding	7,045	4,000	1,000	12,045	10	120,450	64,986	27,851	.1	928
Fencing	7,045	2,000	0	9,045	1	9,045	3,692	2,035	.06	407
Rock Riprap	500	4,000	1,000	5,500	30	165,000	91,875	39,375	.2	875
Bio-Bank Stabilization	750	4,000	800	5,500	25	138,750	76,344	32,719	.2	873
Crossing	5	3	5	13	2,000	26,000	15,400	6,600	18	199
Remote Watering Sys.	4	1	3	8	2,000	16,000	7,000	7,000	15	101
									Subtotal	3,383
Subtotal						17,335,955	7,829,867	1,742,704		82,384
Easements	6	1	0	7	1,000	7,000	7,000	0	30	210
Total						17,342,955	7,836,867	1,742,704		82,594

(1) Local share consists of labor and equipment costs. Also see flat rates in Table 5-1.
(2a) Nutrient Management is cost shared per acre over a 3-yr period; number of acres shown represents 3 times the eligible acres.
(2b) Nutrient & Pest Mgmt will be cost-shared per acre over a 5-yr period; number of acres shown represents five 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.
(4) Buffers flat rate at $100/ac for up to 5 years contingent upon interim BMP approval.
(5) 75% participation, 60% actual payment
(6) At the time of plan approval, a cost-benefit analysis had not been completed, and no cost-share rate had been agreed upon. The estimate of $9.00/ac used in this table does not represent DNR's acceptance of this as a cost-share rate.
(7) Due to statutory and budgetary constraints, DNR is unable to fund this practice.
(8) 50% participation in Outagamie County for barnyards and manure storage

Source: Wisconsin DNR, DATCP, the Oneida Nation, Outagamie and Brown Counties

Table 5-4 Cost-Share Budget Needs for Management Practices in Outagamie County

BMP	Number		Cost/Unit ($)	Total Cost	75% Participation		
					State Share	Local Share	Hrs/Unit
Upland Control							
Change in Crop Rotation(1)	14,880	ac	NA	0	0	0	.1	1,116
Contour Cropping(1)	200	ac	9	1,800	1,350	0	.3	45
Contour Strip Cropping(1)	1,000	ac	13.5	13,500	10,125	0	.5	375
Conservation Tillage Incentive System (1)	204,085	ac	18.5	3,775,573	1,699,008	0	.1	15,306
Corn Silage and Fragile Crop Tillage (6)	188,387	ac		1,695,483	762,967			14,129
Cropland Protection Cover (Green Manure)(1)	5,000	ac	25	125,000	93,750	0	.04	150
Intensive Grazing Management (Rotational Grazing)	4	ea	4,000	16,000	6,000	6,000	15	45
Critical Area Stabilization	150	ac	270	40,500	21,263	9,113	.5	56
Grass Waterways	30	ac	3,000	90,000	68,130	20,250	22	495
Field Diversions and Terraces	2,000	ft	3	6,000	3,150	1,350	.04	60
Grade Stabilization	5	ea	4,000	20,000	10,500	4,500	50	188
Agricultural Sediment Basin	15	ea	10,000	150,000	78,750	33,750	90	1,013
Vegetative Riparian Buffers (4)(1)	132	ac	500	66,000	49,500	0	2	198
Nutrient Management (2a)	25,000	ac	6	150,000	56,250	56,250	.1	1,875
Nutrient and Pest Management (2b)	25,000	ac	10	250,000	93,750	93,750	.1	1,875
Spill Control Basin	6	ea	15,000	90,000	47,250	20,250	40	180
Wetland Restoration	80	ea	2,000	160,000	84,000	36,000	34	2,040
Good Stewardship (7)	8,750	ac	20	175,000	0	0		66
Livestock Exclusion, Woods	6,000	ft	1	6,000	2,250	2,250	.01	45
						Subtotal		39,257

BMP	Number		Cost/Unit ($)	Total Cost	75% Participation			
					State Share	Local Share	Hrs/ Unit	Total Hours
Barnyard Runoff Control								
Filter Strip/ Filter Wall(8)	84	ea	16,000	1,344,000	470,400	201,600	95	3,990
Roof Gutters(8)	86	ea	1,500	129,000	45,150	19,350	2	86
Clean Water Diversion (8)	22	ea	2,500	55,000	19,250	8,250	21	231
Roofs	0	ea	25,000	0	0	0	25	0
Manure Storage Facility (3)(8)	108	ea	25,000	2,700,000	891,000	459,000	80	4,320
Manure Storage Facility Abandonment	0	ea	10,000	0	0	0	80	0
Cattle Mounds	4	ea	3,000	12,000	6,300	2,700	15	45
Animal Lot Abandonment/Relocation	4	ea	60,000	240,000	126,000	54,000	80	240
Well Abandonment	10	ea	500	5,000	2,625	1,125	20	150
Milking Center Waste Control	50	ea	7,000	350,000	183,750	78,750	20	750
						Subtotal		9812
Streambank Erosion Control								
Shape and Seeding	7,045	ft	10	70,450	36,786	15,851	.1	528
Fencing	7,045	ft	1	7,045	2,642	1,585	.06	317
Rock Riprap	500	ft	30	15,000	7,875	3,375	.2	75
Bio-Bank Stabilization	750	ft	25	18,750	9,844	4,219	.2	113
Crossing	5	ea	2,000	10,000	5,250	2,250	18	68
Remote Watering Systems	4	ea	2,000	8,000	3,000	3,000	15	45
						Subtotal		1146
Subtotal				11,795,101	4,898,065	1,138,518		50,215
Easements	6	ac	1,000	6,000	6,000	0	8	24
Total				11,801,101	4,904,065	1,138,518		50,239

(1) Local share consists of labor and equipment costs. Also see flat rates in Table 5-1.
(2a) Nutrient Management is cost shared per acre over a 3-yr period; number of acres shown represents 3 times the eligible acres.
(2b) Nutrient & Pest Mgmt will be cost-shared per acre over a 5-yr period; number of acres shown represents five 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.
(4) Buffers flat rate at $100/ac for up to 5 years contingent upon interim BMP approval.
(5) 75% participation, 60% actual payment
(6) At the time of plan approval, a cost-benefit analysis had not been completed, and no cost-share rate had been agreed upon. The estimate of $9.00/ac used in this table does not represent DNR's acceptance of this as a cost-share rate.
(7) Due to statutory and budgetary constraints, DNR is unable to fund this practice.
(8) 50% participation in Outagamie County for barnyards and manure storage

Source: Wisconsin DNR, DATCP, the Oneida Nation, Outagamie and Brown Counties

Table 5-5 Cost-Share Budget Needs for Management Practices in Brown County

BMP	Number		Cost/Unit ($)	Total Cost	75% Participation			
					State Share	Local Share	Hrs/ Unit	Total Hours
Upland Control								
Change in Crop Rotation(1)	2,700	ac	NA	0	0	0	.1	203
Contour Cropping(1)	100	ac	9	900	675	0	.3	23
Contour Strip Cropping(1)	0	ac	13.5	0	0	0	.5	0
Conservation Tillage Incentive System (1)	108,000	ac	18.5	1,998,000	899,100	0	.1	8,100
Corn Silage and Fragile Crop Tillage (6)	30,000	ac	9	270,000	121,500	0	.1	2,250
Cropland Protection Cover (Green Manure)(1)	10,000	ac	25	250,000	187,500	0	.04	600
Intensive Grazing Management (Rotational Grazing)	2	ea	4,000	8,000	3,000	3,000	15	23
Critical Area Stabilization	500	ac	270	135,000	70,875	30,375	.5	188
Grass Waterways	15	ac	3,000	45,000	23,625	10,125	22	248
Field Diversions and Terraces	1,500	ft	3	4,500	2,363	1,013	.04	45
Grade Stabilization	2	ea	4,000	8,000	4,200	1,800	50	75
Agricultural Sediment Basin	4	ea	10,000	40,000	21,000	9,000	90	270
Vegetative Riparian Buffers (4,1)	425	ac	500	212,500	159,375	0	2	638
Nutrient Management (2a)	15,000	ac	6	90,000	33,750	33,750	.1	1,125
Nutrient & Pest Mgmt (2b)	10,000	ac	10	100,000	37,500	37,500	.1	750
Spill Control Basin	3	ea	15,000	45,000	23,625	10,125	40	90
Wetland Restoration	15	ea	2,000	30,000	15,750	6,750	34	383
Good Stewardship (7)	6,250	ac	20	125,000	0	0	.01	47
Livestock Exclusion, Woods	2,000	ft	1	2,000	750	750	.01	15
						Subtotal		15,073
Barnyard Runoff Control								
Filter Strip/ Filter Wall	12	ea	16,000	142,000	100,800	43,200	95	855
Roof Gutters	10	ea	1,500	15,000	7,875	3,375	2	15
Clean Water Diversion	12	ea	2,500	30,000	15,750	6,750	21	189
Roofs	0	ea	25,000	0	0	0	0	0
Manure Storage Facility (3)	12	ea	25,000	300,000	148,500	76,500	80	720
Manure Storage Facility Abandonment	1	ea	10,000	10,000	7,500	2,500	80	120
Cattle Mounds	5	ea	3,000	15,000	7,875	3,375	15	56
Animal Lot Abandonment/Relocation	1	ea	60,000	60,000	31,500	13,500	80	60
Well Abandonment	3	ea	500	1,500	788	338	20	45
Milking Center Waste Control	3	ea	7,000	21,000	11,025	4,725	20	180
						Subtotal		2,439

BMP	Number		Cost/Unit ($)	Total Cost	75% Participation			
					State Share	Local Share	Hrs/ Unit	Total Hours
Streambank Erosion Control								
Shape and Seeding	4,000	ft	10	40,000	21,000	9,000	.1	300
Fencing	2,000	ft	1	2,000	1,050	450	.06	90
Rock Riprap	4,000	ft	30	120,000	63,000	27,000	.2	600
Bio-Bank Stabilization	4,000	ft	25	100,000	52,500	22,500	.2	600
Crossing	3	ea	2,000	6,000	3,150	1,350	18	41
Remote Watering Systems	1	ea	2,000	2,000	1,000	1,000	15	11
						Subtotal		1,642
Subtotal				4,153,400	2,075,276	358,626		18,955
Easements	1	ac	1,000	1,000	1,000	0	8	6
Total				4,154,400	2,076,276	358,626		18,961

(1) Local share consists of labor and equipment costs. Also see flat rates in Table 5-1.
(2a) Nutrient Management is cost shared per acre over a 3-yr period; number of acres shown represents 3 times the eligible acres.
(2b) Nutrient & Pest Mgmt will be cost-shared per acre over a 5-yr period; number of acres shown represents five 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.
(4) Buffers flat rate at $100/ac for up to 5 years contingent upon interim BMP approval.
(5) 75% participation, 60% actual payment
(6) At the time of plan approval, a cost-benefit analysis had not been completed, and no cost-share rate had been agreed upon. The estimate of $9.00/ac used in this table does not represent DNR's acceptance of this as a cost-share rate.
(7) Due to statutory and budgetary constraints, DNR is unable to fund this practice.
(8) 50% participation in Outagamie County for barnyards and manure storage

Source: Wisconsin DNR, DATCP, the Oneida Nation, Outagamie and Brown Counties

Table 5-6 Cost-Share Budget Needs for Management Practices in the Oneida Nation Reservation

BMP	Number		Cost/Unit ($)	Total Cost	75% Participation			
					State Share	Local Share	Hrs/ Unit	Total Hours
Upland Control								
Change in Crop Rotation(1)	3,000	ac	NA	0	0	0	.1	300
Contour Cropping(1)	0	ac	9	0	0	0	.3	0
Contour Strip Cropping(1)	0	ac	13.5	0	0	0	.5	0
Conservation Tillage Incentive System (1)	9,360	ac	18.5	173,160	103,896	0	.1	936
Corn Silage and Fragile Crop Tillage (6)	8,640	ac	9	77,760	46,656	0	.1	864
Cropland Protection Cover (Green Manure)(1)	2,000	ac	25	50,000	50,000	0	.04	80
Intensive Grazing Management (Rotational Grazing)	2	ea	4,000	8,000	4,000	4,000	15	30
Critical Area Stabilization	300	ac	270	81,000	56,200	24,300	.5	180
Grass Waterways	5	ac	3,000	15,000	10,500	4,500	22	110
Field Diversions and Terraces	2,178	ft	3	6,534	4,574	1,960	.04	87
Grade Stabilization	4	ea	4,000	16,000	11,200	4,800	50	200
Agricultural Sediment Basin	6	ea	10,000	60,000	42,000	18,000	90	540
Vegetative Riparian Buffers (4)(1)	358	ea	500	179,000	179,000	0	2	716
Nutrient Management (2a)	0	ac	6	0	0	0	.1	0
Nutrient and Pest Management (2b)	12,000	ac	10	120,000	60,000	60,000	.1	1,200
Spill Control Basin	1	ea	15,000	15,000	10,500	4,500	40	40
Wetland Restoration	100	ea	2,000	200,000	140,000	60,000	34	3,400
Good Stewardship (7)	3,000	ac	20	60,000	0	0	.01	30
Livestock Exclusion, Woods	0	ft	1	0	0	0	.01	0
						Subtotal		8683

BMP	Number		Cost/Unit ($)	Total Cost	75% Participation			
					State Share	Local Share	Hrs/ Unit	Total Hours
Barnyard Runoff Control								
Filter Strip/ Filter Wall	2	ea	16,000	32,000	22,400	9,600	95	190
Roof Gutters	2	ea	1,500	3,000	2,100	900	2	4
Clean Water Diversion	2	ea	2,500	5,000	3,500	1,500	21	42
Roofs	0	ea	25,000	0	0	0	0	0
Manure Storage Facility (3)	2	ea	25,000	50,000	33,000	17,000	80	160
Manure Storage Facility Abandonment	3	ea	10,000	30,000	21,000	9,000	80	240
Cattle Mounds	0	ea	3,000	0	0	0	15	0
Animal Lot Abandonment/ Relocation	0	ea	60,000	0	0	0	0	0
Well Abandonment	10	ea	500	5,000	3,500	1,500	20	45
Milking Center Waste Control	0	ea	7,000	0	0	0	20	0
						Subtotal		681
Streambank Erosion Control								
Shape and Seeding	1,000	ft	10	10,000	7,000	3,000	.1	100
Fencing	0	ft	1	0	0	0	.06	0
Rock Riprap	1,000	ft	30	30,000	21,000	9,000	.2	200
Bio-Bank Stabilization	800	ft	25	20,000	14,000	6,000	.2	160
Crossing	5	ea	2,000	10,000	7,000	3,000	18	90
Remote Watering Systems	3	ea	2,000	6,000	3,000	3,000	15	45
						Subtotal		595
Subtotal				1,202,454	856,526	245,560		9,959
Easements	0	ac	1,000	0	0	0	8	0
Total				1,212,454	856,526	245,560		9,959

(1) Local share consists of labor and equipment costs. Also see flat rates in Table 5-1.
(2a) Nutrient Management is cost shared per acre over a 3-yr period; number of acres shown represents 3 times the eligible acres.
(2b) Nutrient & Pest Mgmt will be cost-shared per acre over a 5-yr period; number of acres shown represents five 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.
(4) Buffers flat rate at $100/ac for up to 5 years contingent upon interim BMP approval.
(5) 75% participation, 60% actual payment
(6) At the time of plan approval, a cost-benefit analysis had not been completed, and no cost-share rate had been agreed upon. The estimate of $9.00/ac used in this table does not represent DNR's acceptance of this as a cost-share rate.
(7) Due to statutory and budgetary constraints, DNR is unable to fund this practice.
(8) 50% participation in Outagamie County for barnyards and manure storage

Source: Wisconsin DNR, DATCP, the Oneida Nation, Outagamie and Brown Counties

Cost-Share Agreement and Contact Strategy

Money for cost-share agreements will be distributed by the Outagamie County, Brown County LCD and the Oneida Nation Planning Department from a Nonpoint Source Grant provided by the DNR. The LCD receives additional grant money to support administrative responsibilities. Cost-share agreements are binding contracts between landowners and the LCD. Landowners must meet eligibility requirements defined in Chapter Two. The following procedure will be used to make landowner contacts.

- During the first three months of the implementation period, all landowners or operators with eligible nonpoint sources will receive a mailing from the county or the Oneida Nation explaining the project and how they can become involved.

- During the first year of implementation, county and Oneida Nation staff will make personal contacts with all landowners that have been identified as having *Critical* nonpoint sources of pollution.

- The county and Oneida Nation will continue to make contacts with eligible landowners and operators until a definite decision is made regarding participation.

- The county and Oneida Nation will contact all eligible landowners not signing cost-share agreements by personal letter 6 months prior to the end of the sign-up period.

Critical Sites

NR 120 provides both a timeline and a methodology for determining how many landowners and operators will be listed as critical sites. The watershed inventory will produce a ranked list of critical sites based on the highest ranked sites that cumulatively equal 25% of the total pollutant reduction goal. Once this list is determined, of those sites the highest ranked sites to meet a cumulative reduction of 25% of the potential reduction for all the critical sites will receive notification from the DNR.

The Notification Process

Notification is preceded by a site visit, an analysis whether the site still meets the critical site criteria, and a report to DNR if the landowner does not either agree to fix the problem or sign a cost-share agreement. "Notification" takes place only for landowners or operators who refuse to participate within the scheduled time of contact.

The following procedure will be used to make landowner contacts.

- During the first three months of the implementation period, all landowners or operators will eligible nonpoint sources will receive a mailing from the county LCD staff explaining the project and how they can become involved. County LCD staff will give priority to the workload associated with owners of critical sites, since these sites are most important for the success of the project.

- The process of notification to landowners of critical sites will begin wihtin six months of the date that the project receives approval from DNR and the state Land and Water Conservation Board. The department may grant up to three 90-day extensions beyond the six-month notification period to allow the counties sufficient time to verify that all sites meet the critical site criteria.

- During the first year of implementation, county LCD staff will also make personal contacts with all additional landowners whose fields meet all or most of the characteristics believed to be associated with high sediment delivery rates. These characteristics were identified during the initial inventory in preparing the plan.

As part of the annual inventory work, county LCD staff expect to identify fields that meet the criteria for critical sites. The county LCD staff will complete the verification for all sites identified each year and send a report to DNR. The annual schedule for the verification process will be linked to the county workload schedule as well as the optimum time for field checks. The DNR and county LCD staff propose to implement the following cycle each year until the inventory and notification process is completed for all sources:

- April - November: conduct site visits and inventory work
- Prepare report and send to DNR implementation coordinator by February 1. DNR would send the notification to the critical site landowners within 60 days of receiving the report.

The above schedule may be adjusted with work planning at annual meetings with the DNR.

- In addition to the inventory work each year, the county LCD will make contacts with eligible landowners and operators until they have made a definite decision regarding participation in the program.

Verification Process

For critical site landowners who refuse to either fix the site or who fail to meet any of the reasons for postponing the notification listed in NR 120.09(4), then the county or the Oneida Nation sends a report stating that the site meets the notification criteria to DNR. DNR then sends out the notification letters.

Landowners to who refuse to sign up will receive a notification letter and 36-months to decide to sign a cost-share agreement. If after this time period, they continue to refuse signup, the DNR may begin enforcement action.

Appeal Process with the Land Conservation Committee

The owner or operator of a site designated as a critical site may appleal 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, now called the appellant, must write to the LCC to ask for an informal hearing. The appeal must be received by the LCC within 60 days of the day that the notification letter was received.

The Land Conservation Committee shall:

- provide the appellant with a hearing and give reasonable notice of the hearing to the appellant, the DNR and the DATCP.
- conduct the hearing as an informal hearing. Chapter 68.11(2), Wis.stats., does not apply to this hearing. This language describes the conduct of the hearing.
- hold the hearing in a place that is convenient for the appellant.

The appellant and project staff will present information about the site to the LCC to enable members to make a decision. Representatives of DNR and DATCP may attend the hearing. DNR is required to submit a report and recommendations to the LCC wthin 60 days after the hearing. DATCP has the option to submit a report and recommendation within 60 days.

The LCC shall:

- provide a decision in writing within 45 days of receiving:

    1. DNR and DATCP reports and recommendations,
    2. Notification by the DNR and DATCP that no report or recommendations would be submitted, or
    3. 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. To make its decision, the LCC shall use the consideration whether or not the critical site designation is consistent with the critical site criteria established in the project's priority watershed plan. The LCC shall also consider whether governmental representatives erred in their verificaiton of the site conditions or management. Loss of profit is not grounds for support of an appeal. Violations by or appeals granted to other appellants shall not justify support of an appeal.

The owner or operator of a site designated 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 Board.

Budget and Staffing Needs

This section estimates funding and staffing required to provide rural technical assistance.

Staff Needs and Costs

Table 5-7 lists the total estimated staff in all areas of the watershed needed to implement the project, assuming a 75 percent level of participation by eligible landowners. A total of approximately 183,918 staff hours are required to implement this plan. This includes 22,960 staff hours to carry out the information and education program.

Currently, 6 full-time, 1 half-time and 1 two-thirds time positions are funded on the project. The LCD and agencies will determine the need for additional staff based on annual workload analyses. Estimated costs for staff in all areas of the watershed for a 75 percent participation rate is approximately $ 4,849,760. These costs will be paid by the state through the Local Assistance Grant Agreement. Tables 5-7 through 5-14 breakdown these staff hours and costs by civil division (Brown, Outagamie counties and the Oneida Nation).

Table 5-7 Staff Needs for 10 Years of Project Implementation for the entire Duck, Apple and Ashwaubenon Creeks Watershed

Activity	Staff Hours (based on 75% participation)
Project and Financial Management	24,000
Information and Education Program	22,960
Pre-Contact Office Inventory; Landowner Contracts and Progress Tracking	12,200
Conservation Planning and Cost-Share Agreement Development	16,800
Plan Revisions and Monitoring	12,200
Practice Design and Installation:	
Upland Sediment Control	63,013
Animal Waste Management	12,932
Streambank Erosion Control	3,383
Easements	30
Training	6,400
Urban	10,000
Total:	**183,918**
Estimated Staff Required per year	9
Hours per year	18,392

Source: DNR, DATCP, Outagamie Cty LCD, Brown County LCD, Oneida Nation Planning Dept

Table 5-8 Rural Project Costs at 75 percent Landowner Participation in the Duck, Apple and Ashwaubenon Creeks Watershed

Item	State share of Costs
Cost-Share Funds: Practices	7,836,867
Cost-Share Funds: Easements	7,000
Local Assistance Staff Support*	4,849,760
Information/Education Direct	240,000
Other Direct (travel, supplies, etc.)	391,000
Engineering Assistance	12,000
* Salary + Indirect = $1,893,988/year **Total**	**13,336,627**

Source: DNR, DATCP, Outagamie Cty & Brown Cty LCDs, Oneida Nation

Table 5-9 Outagamie County Staff Needs for 10 Years of Project Implementation

Activity	Staff Hours (based on 75% participation)
Project and Financial Management	11,000
Information and Education Program	5,000
Pre-Contact Office Inventory; Landowner Contracts and Progress Tracking	8,000
Conservation Planning and Cost-Share Agreement Development	9,000
Plan Revisions and Monitoring	5,000
Practice Design and Installation:	
Upland Sediment Control	39,257
Animal Waste Management	9,812
Streambank Erosion Control	1,416
Easements	24
Training	3,200
Total:	**91,439**
Estimated Staff Required per year	5
Hours per year	9,144

Source: DNR, DATCP, Outagamie County LCD

Table 5-10 Outagamie County Project Costs at 75 percent Landowner Participation Rate

Item	State share of Costs
Cost-Share Funds: Practices	4,898,065
Cost-Share Funds: Easements	6,000
Local Assistance Staff Support*	2,400,000
Information/Education Direct	60,000
Other Direct (travel, supplies, etc.)	240,000
Engineering Assistance	0
* Salary + Indirect = $1,163,506/year **Total**	**7,604,065**

Source: DNR; DATCP and Outagamie County LCD

Table 5-11 Brown County Staff Needs for 10 Years of Project Implementation

Activity	Staff Hours (based on 75% participation)
Project and Financial Management	7,000
Information and Education Program	8,960
Pre-Contact Office Inventory; Landowner Contracts and Progress Tracking	3,000
Conservation Planning and Cost-Share Agreement Development	6,000
Plan Revisions and Monitoring	4,200
Practice Design and Installation:	
Upland Sediment Control	15,073
Animal Waste Management	2,439
Streambank Erosion Control	1,642
Easements	6
Training	1,600
Urban (Preliminary)	10,000
Total:	**59,920**
Estimated Staff Required per year	3
Hours per year	5,992

Source: DNR; DATCP and the Outagamie County LCD

Table 5-12 Brown County Project Costs at 75 percent Landowner Participation Rate

Item	State share of Costs
Cost-Share Funds: Practices	2,075,276
Cost-Share Funds: Easements	1,000
Local Assistance Staff Support*	1,576,560
Information/Education Direct	90,500
Other Direct (travel, supplies, etc.)	84,000
Engineering Assistance	12,000
* Salary + Indirect = $571,104/year Total	3,839,339

Source: DNR; DATCP and the Brown County LCD

Table 5-13 Oneida Nation Staff Needs for 10 Years of Project Implementation

Activity	Staff Hours (based on 75% participation)
Project and Financial Management	6,000
Information and Education Program	9,000
Pre-Contact Office Inventory; Landowner Contracts and Progress Tracking	1,200
Conservation Planning and Cost-Share Agreement Development	1,800
Plan Revisions and Monitoring	3,000
Practice Design and Installation	
Upland Sediment Control	8,683
Animal Waste Management	681
Streambank Erosion Control	595
Easements	0
Training	1,600
Total	32,559
Estimated Staff Required per year	1.7
Hours per year	3,256

Source: DNR; DATCP and the Oneida Nation

Table 5-14 Oneida Nation Project Costs at 75 percent Landowner Participation Rate

Item	State share of Costs
Cost-Share Funds: Practices	856,526
Cost-Share Funds: Easements	0
Local Assistance Staff Support*	873,200
Information/Education Direct	90,000
Other Direct (travel, supplies, etc.)	67,000
Engineering Assistance	0
* Salary + Indirect = $67,000 /year Total	1,886,726

Source: DNR, DATCP and the Oneida Nation

Grant Disbursement and Project Management Schedule

Implementation of this project shall begin upon both approval of this plan and receipt of the nonpoint source grant. The plan must be approved by the Wisconsin DNR, Outagamie County, Brown County, Oneida Nation Board and Wisconsin Land and Water Conservation Board. Implementation cannot begin until a nonpoint source grant has been formally awarded.

The project implementation period is 10 years. During the first 9 years of implementation, cost-share agreements with eligible landowners may be signed. Practices listed on any cost-share agreement must be installed before the end of the implementation phase. The implementation phase of this project is scheduled to conclude in 2007.

The initial nonpoint source grant will cover the cost of practices over the entire 10-year implementation phase. The amount of the nonpoint source grant is calculated at 75 percent participation by eligible landowners. This grant may be amended due to changes needed for time of performance, funding levels or scope of work.

Local assistance grants (LAGs) will be disbursed annually to Outagamie County, Brown County and the Oneida Nation to cover the cost of personnel, operating expenses and equipment. The eligible costs for LAGs are specified in NR 120.2. The DNR will conduct a workload analysis and evaluate the grant application submitted by Outagamie County, Brown County and the Oneida Nation.

Rural Project Cost

The total state funding required to meet the rural nonpoint source pollution control needs at 75 percent level of landowner participation is presented Table 5-3. This figure includes the capital cost of practices, staff support and easement costs described above. The estimated cost to the state is $13.3 million. The estimated cost to landowners and others is $1.7 million, for a total project cost of approximately $15 million.

This cost estimate is based on projections developed by agency planners and local staff. Historically, the actual expenditures for projects are less than the estimated costs. Factors affecting expenditures for this project might include: participation rate; amount of cost sharing expended; number of staff working on the project; and amount of support costs..

CHAPTER SIX
Urban Implementation

Project Participants: Roles and Responsibilities

The roles and responsibilities of landowners, land operators, local units of government, DNR, and UWEX in implementing the urban management recommendations, parallel those identified for rural areas. The following discussion highlights some additional points concerning urban implementation.

Land Owners and Operators

Towns, cities, the Oneida Nation, and villages will have a more prominent role here. The managing entity for instance, might provide a municipal service that could collect stormwater runoff from a myriad of land owners. In this role the entity will work directly under grant agreements with the Department of Natural Resources to design and install BMPs. These local governing bodies (Table 6-1) will provide the local share of the installation, as well as the operation and maintenance cost. If the governing entity enters into a cost share agreement with a private landowner, the individual land owner will pay the portion of the installation cost, consistent with the cost share guidelines. In addition to the municipalities listed here, any organization or unit of government that meets eligibility requirements listed in NR120 is eligible for cost-sharing.

Local Units of Government

In this role the above mentioned governmental entities will develop cost-share agreements with individual land owners for the installation of BMPs, and provide technical and financial assistance to individuals with funds obtained from the state nonpoint program. These governments will conduct planning and administrative services such as stormwater planning and engineering feasibility investigations, as well as the administration and enforcement of construction site erosion and stormwater management ordinances. Lastly, these governmental entities will develop and conduct urban housekeeping and information/education programs.

Department of Natural Resources

The department will provide administrative and financial support and also maintain a staff of stormwater management engineers and technical specialists who will provide guidance and

review of plans directly to municipal staff. There also exists a regional nonpoint source coordinator in the Northeast Region Headquarters who will provide guidance to towns, cities, villages and the Oneida Nation in interpreting and implementing this plan.

Table 6-1. Municipalities eligible for funding

Village of Ashwaubenon
City of Appleton
City of DePere
Town of Hobart
Village of Howar
Village of Little Chute

Village of Kaukauna
Town of Grand Chute
Town of Vandenbroek
Town of Kaukauna
Town of Freedom
City of Green Bay

University of Wisconsin-Extension

UWEX maintains an urban education specialist at its office in Green Bay. This individual is a regional resource to urban municipalities who are responsible for implementing the recommendation in this plan. In addition, UWEX sponsors training courses in construction site erosion and stormwater management. DNR provides financial assistance to local units of government for sending staff and administrators to appropriate training sessions.

Relationship of this Project to the Federal Stormwater Permit Program

Introduction

In 1990, the federal government enacted regulations for attenuating urban runoff pollution. The Wisconsin Department of Natural Resources is the designated state agency to carry out this federal mandate.

NR 216

In 1994, the State of Wisconsin adopted NR 216, Storm Water Discharge Permits, to address the discharge of pollutants from highly urbanized areas. There are three subchapters in NR 216 which cover stormwater discharges from 1) Municipalities, 2) Industry and 3) Construction Sites. The following abbreviated discussion outlines what communities must do in order to comply with this permitting.

Municipal Stormwater Discharge Permits

The cities of Green Bay and De Pere as well as the village of Ashwaubenon have been identified in this chapter as needing municipal stormwater discharge permits. These communities may petition the DNR to designate additional municipalities for permitting if present conditions indicate surrounding communities are contributing to urban surface water degradation. The petition shall contain information which explains how the entities you have listed for designation meet the criteria listed in NR 216.02(4). These criteria include:

a) Physical interconnection between the municipal separate storm sewers of your municipality and a designated municipality.

b) Location of the discharge from a designated municipality relative to your municipal separate storm sewer system.

c) The quantity and nature of pollutants discharged to waters of the state.

d) The nature of the receiving water. (For example, if the discharge is to a sensitive receiving stream, or within a priority watershed).

e) Protection of the watershed or basin drainage area receiving the municipal discharge.

f) Population of the municipality.

g) Other relevant factors.

The preapplication requirements for a municipal permit include:

1. General Information - background information and if a group permit is sought, then a copy of intermunicipal agreements.
2. Legal Authority - description of existing local ordinances for discharge control.
3. Urban Stormwater Planning Area - considers drainage basins and affected watersheds in the development areas.
4. Designated Municipalities - a petition to designate surrounding municipalities for permitting.
5. Fiscal Resources - a description of financial resources to complete stormwater management permit applications, budgets and sources of funds.

Next, each applicant must outline the legal authority, existing management programs, discharge characterization, present pollutant loadings, proposed monitoring and management programs and provide a fiscal analysis to address stormwater management.

Industrial Permits and the Business Partners Program

Concurrent with the municipal permits are those necessary for the industrial sectors within the watershed. Tier 1 and 2 industries at this time are being contacted by the Bureau of Wastewater Management, WDNR, for permitting procedures. Some industries within the watersheds have already begun the permitting process and have been issued permits.

The WDNR will review applications, determine additional monitoring requirements, and issue permits which will specify mangement needs for each site. It is likely that many of the industrial activities targeted for permits will not be eligible for cost sharing through the nonpoint program.

It is the intent of this watershed plan to implement a Business Partners for Clean Water Program concurrent with the mailing of these permits. This program will guide industry through the permitting process, as well as educate and inform them about reducing stormwater runoff impacts. A pilot program begun in Waukesha County can easily be adapted for these two urban areas. This will be the model for the program within the watershed.

The Land Conservation Department along with UW Extension will conduct training sessions to help participants develop plans to eiminate polluted runoff (Water Walk, 1995). The Solid and Hazardous Waste Education Centers, Industrial Recycling Assessment Program should be

included in all these training sessions. They have expertise in reducing hazardous wastes disposal costs, substituting "cleaner" raw materials in the production process, or providing strategies for byproduct utilization.

Construction Site Permits

It is the intention of Brown County Land Conservation Department to seek contractual relationships to conduct construction site erosion control plan review and inspections. For example, towns or municipalities could hire LCD staff to do such inspections which are currently overlooked largely due to lack of construction site erosion control staff in municipalities. Outagamie County is relying upon Outagamie County Zoning Department staff and municipalities to do construction site erosion control enforcement.

Implementation Schedule

A phased approach to urban stormwater control is recommended for the watershed. This approach includes a program of "core" activities that communities and nations can begin work on in the first year, as well as a "segmented" approach which can take place over several years.

Core Urban Stormwater Program

The core elements of the urban nonpoint control program include measures that can be implemented easily and without study or significant expenditures. Adopting a core program is the first step in the implementation process. The basic elements of the core program are:

- Develop, adopt and enforce a construction erosion control ordinance consistent with the model developed jointly by the Wisconsin League of Municipalities and the DNR. Control practices should be consistent with the standards and specifications in the Wisconsin Construction Site Best Management Practice Handbook.
- Develop and implement a community specific program of urban housekeeping practices which reduce urban nonpoint source pollution. This may include a combination of information and education efforts, adoption of ordinances regulating pet wastes or changes in the timing and scheduling of leaf collection.
- Implement an information and education program containing the elements and achieving the goals of the urban information and education strategy.

Local Responsibilities and Timing for the Core Program

The following is a schedule for implementing the core elements of the urban nonpoint source control strategy for this project. To receive technical and financial assistance, communities must commit within the first three years of the project, to implementing the core program. This is a requirement that applies only to the receipt of funds used directly by the municipality

as a grantee; it does not apply in instances where the municipality acts as a grantor, i.e. passing cost-share funds through to private landowners. Individual landowners therefore could receive cost-share funds prior to a municipality's agreement to conduct core elements of the program.

To implement the core program each governing body should:

- Identify in writing an authorized representative for the local unit of government
- Adopt an adequate construction site ordinance, develop administrative procedures and determine staff needs to enforce a construction erosion control ordinance in cities, villages and other nations within 24 months of start of implementation.
- Identify roles and responsibilities of towns and counties for controlling construction erosion in unincorporated areas. Adopt adequate ordinances, develop administrative procedures and determine staff needs to enforce a construction erosion control ordinance in unincorporated areas within 24 months of the start of implementation. *Nonpoint source program funding to the Oneida Nation, Outagamie and Brown Counties for carrying out agricultural management recommendations is not contingent upon construction site erosion control coverage for the county.*
- Develop and implement a community specific program of urban housekeeping practices which reduce urban nonpoint pollution. The content of the community specific program and a schedule for implementation will be negotiated by the local unit of government and the DNR within 3 years of the start of implementation.
- Prepare and submit annual work plans for staff and activities.
- Apply for local assistance grants from DNR to support Core Activities.
- Implement an information and education strategy consistent with this plan.
- Prepare and submit to DNR tracking reports specified in Chapter 9.
- Participate in the annual watershed project review meeting.

Segmented Urban Stormwater Program

The segmented elements of the urban nonpoint source program include those that require site-specific investigations prior to implementation. It is anticipated that many of these segmented elements will be implemented individually as discrete nonpoint source control practices. An example would be construction of one or more detention ponds in a given subwatershed following completion of an engineering feasibility study.

Importantly, the higher costs of implementing this portion of the urban management program will require entities to budget expenditures over the course of several years. Best management practices implemented under this portion of the program likely will include detention ponds, infiltration devices, and other structural means for reducing pollution. These elements may also include changes in street sweeping schedules and equipment when used as a stepping stone to achieving the recommended level of urban structural practices. The detailed studies will include engineering feasibility studies and other site-specific assessments for existing and new

development. The results will determine the best as well as most economic means for reducing sources in a community.

The basic elements of the Segmented Program are:

Conduct detailed engineering studies to determine the best means to implement community specific nonpoint source control measures in existing developed areas. Detailed engineering studies shall set forth an equitable cost allocation when more than one municipality contributes runoff to an urban structural practice. Source reduction activities should also be considered when assessing the reduction goals for each community.

Design and installation of structural best management practices for existing urban areas with completed engineering studies.

Develop management plans for planned urban development.

Adopt and enforce a comprehensive stormwater management ordinance consistent with the state model stormwater ordinance under preparation.

Conduct (as needed) detailed financing and implementation studies which determine the means to pay for administering an urban nonpoint program in each community. These studies should be conducted concurrently with other elements in the segmented program.

Local Responsibilities and Timing for the Segmented Program

The following is a schedule for the segmented elements of the urban control strategy:

- Identify within 6 months of the start of implementation, the high priority segments the community wishes to pursue in the existing and planned urban areas.

- Enter into local assistance and nonpoint grants as appropriate to secure state funding support for segmented activities.

- Conduct engineering feasibility studies for control practices in existing urban development. The type and manner of practice installation will be guided by these studies. A community must agree to carry out recommendations of a completed feasibility study before funds for additional studies will be released.

- Prepare stormwater management studies in planned areas which identifies the type and location of practices.

- Adopt, administer and enforce a comprehensive stormwater management ordinance for planned urban development within 12 months of completion of an approved state model ordinance.

- Enter into cost-share agreements for eligible BMPs.

For practices installed and maintained by private individuals, the cost-share agreement is between the landowner and the local unit of government. The local units of government will be required to:

Design or contract for the design of best management practices and verify proper practice installation. Involve the DNR in pre-design and Pre-construction conferences as outlines in NR 120.

Request reimbursement from the DNR for practices installed by private landowners, and in turn reimburse those landowners for the eligible amount of cost sharing.
Monitor landowner compliance with provisions of the cost-share agreement.

For practices installed and maintained by the local unit of government, the cost share agreement is with the DNR. Where more than one community contributes runoff to a control practice, the DNR will enter into cost-share agreements consistent with an equitable allocation based on municipal contributions to the pollutant loadings and volumes.

Practice maintenance is the responsibility of the grant recipient.

Submit information needed for project evaluation to DNR. In some situations, private landowners will install BMPs on their property. As such, landowners can be important participants in the urban implementation strategy. Eligible land owners will participate in the project by signing cost-share agreements with local units of government.

Communities can implement the segmented elements of the urban management strategy any time following the development and initial implementation of the Core program. However, cost sharing will be limited to those elements of the segmented program completed within the eight year implementation period.

State Funding for Best Management Practices (BMPs)

BMPs Eligible for Cost-Sharing and their Rates

Best management practices are those practices identified in NR 120 determined in this watershed plan to be the most effective in reducing nonpoint sources of pollution. Eligible practices and cost-share rates are shown in Table 6-1. Short definitions for structural urban

practices and street sweeping are presented below. A more detailed discussion of these practices is presented in NR 120.14.

- Structural Urban Practices - Measures such as constructed infiltration areas, infiltration trenches, detention basins and filtration devices designed to control runoff rate or volume as a means to reduce the amount of pollutants carried in runoff or to reduce the water resource impacts of excessive flows.

- High Efficiency Street Sweeping - Use of a combination brush and vacuum style sweeper to remove leaf litter and accumulated pollutants from street surfaces on a frequent schedule.
  Street sweeping (several passes for each curb mile) is recommended as early in the spring as possible to collect the debris, sediment and associated pollutants generated during the winter months through until late into the fall to remove leaves. The effectiveness of sweeping in residential areas during the summer is not cost-effective, but the effectiveness for commercial and industrial areas of a 1-2 times/week schedule, spring through fall, is expected to provide continued reduction in pollutant loads.

Table 6-1. State Cost-share Rates for Urban Management Practices

BEST MANAGEMENT PRACTICE	STATE COST-SHARE RATE
Critical Area Stabilization	70%[1]
Grade Stabilization Structures	70%
Shoreline and Streambank Stabilization	70%
Shoreline Buffers	70%[1]
Wetland Restoration	70%[1]
Structural Urban Practices	70%[2,3]
Street Sweeping	50%[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 and streets. 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. Street sweeping, using high-efficiency sweepers is currently being piloted in the Osceola Creek Watershed Project. The results of that evaluation will determine the acceptable cost share rates for this and other watershed projects.

Design Criteria and Performance Standards for Urban Practices

Design and installation of the best management practices must meet the conditions listed in NR 120. Practice standards and specifications for critical area stabilization, grade stabilization structures, shoreline and streambank stabilization, shoreline buffers and wetland restoration can be found in NR 120 and the Natural Resources 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. The guidelines in this section are presented to facilitate the urban practices design, through the nonpoint source program.

The following preliminary standards should be used to guide the design of individual practices. These preliminary standards will be superseded by standards developed as part of the model ordinance for stormwater, which the DNR is preparing.

- Wet detention ponds in existing and planned urban areas should be designed to control 80 percent of the incoming suspended sediment load. This will be achieved by trapping the 5 micron particle size. This will provide approximately 60 percent control of the annual lead load from lands tributary to the pond. Where retrofitted, ponds should be located to control runoff primarily from the significant land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses.

  Wet detention ponds *in existing urban areas* should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.Wet detention ponds *in planned urban areas* should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

- Infiltration devices in existing and planned urban areas should infiltrate all runoff from the half-inch storm in an off-line system. Infiltration basins and grassed swales are most effective, since they reduce the volume of runoff from all impervious surfaces (roofs, streets, parking lots) in the contributing area. If infiltration trenches are used that control selected impervious surfaces, such as parking lots and rooftops only, overall land use control efficiency drops significantly since street runoff remains uncontrolled. Where retro-fitted, these devices should be located to control runoff primarily from the significant land uses. In locating practices, infiltration rates should be carefully considered as these are prime determinants of the pollution control efficiency and the long term operation of infiltration practices, particularly in non-residential areas.

  It is important to note the inclusion of pretreatment and groundwater monitoring 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 needing maintenance. Pretreatment could include a sediment trap, a wet detention pond, or a grass filter strip. Selected practices should be equipped with groundwater monitoring wells to assure that groundwater contamination remains within acceptable bounds.

Finally, all above-ground or visible urban structural practices should be equipped with signs that clearly identify that the site contains urban stormwater pollutants. Such signs should also carry warnings, where appropriate, against using stormwater practices in ways which could endanger public health. Wet detention ponds should not be used for consumptive fishing, swimming or wading. Infiltration basins might pose a hazard if used as open recreational space during dry periods due to possibility of suspending contaminated dust.

Infiltration devices in *existing urban areas* should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.Infiltration devices *in planned urban areas* should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

- Filtration devices should be designed off-line to control the half-inch storm from contributing areas. These should be located to control runoff primarily from the significant land uses for existing development.

- Stream corridor buffers and streambank stabilization are designed to reduce streambank erosion and provide filtering of overland flow to the stream.

Using Easements to Support Urban Pollution Control Practices

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 these practices as storm water runoff control measures, and the use of easements to support these 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 also apply to urban stream reaches.

Funding for Local Staff Assistance

Table 6-2 shows the types of local management activities that are supported by the state. The state funds these activities 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 70-100 percent, since local governments cover only certain staff support costs. However, support for local staff to administer and enforce local ordinances is only meant to augment funds collected through local permit fees. State support will only be made available to provide that portion of the staff costs remaining after the use of permit fees. In many cases, ordinance administration and enforcement will be self-supporting.

Table 6-2 Urban Implementation Strategy Measures Eligible for State Funding Under Local Assistance Grants

Activity	Support Rate
Development of Construction Erosion Control Ordinances	70-100 %
Development of Stormwater Management Ordinances	70-100 %
Engineering Studies for Existing Urban Areas; Stormwater Planning Studies for Planned Urban Areas[1]	70-100 %
Design and Engineering for Structural Best Management Practices to Control Existing Significant Land Uses	70-100 %
Staff for Enforcing Construction Erosion and Stormwater Management Ordinances[2,3]	70-100 %
Additional Staff Needed for Accelerated Street Sweeping[4]	50-100%
Development of Alternative Financing and Administration Strategies	70-100 %
Information and Education Activities	70-100 %

1 Funding not available for components dealing exclusively with drainage and flooding
2 Funding limited to five years. Level of staffing based on a work plan submitted by local units of goverment and approved by the DNR.
3 DNR covers only that portion of the local staff support that cannot be met through local permit fees.
4 State cost-share rates for street sweeping will be negotiated on a case-by-case basis. Grants for accelerated sweeping on significant land uses during the late spring to early fall period may be limited to demonstration and research projects.

Activities and Sources Not Eligible for Funding

Priority watershed cost-share funds can not be used to control sources of pollution and land management activities specifically excluded in NR120.10 and 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 (will be defined on a case-by-case basis).

Urban Budget

The budgets for various components of the urban management program are presented in Tables 6-3 through 6-7 and summarized in 6-8. It is assumed that most of the work associated with activities in these Table will be contracted out to private consulting engineers. The consulting fees are included as part of the budget estimate.

Local units of government will probably need to hire additional municipal staff for certain activities, however. These are anticipated to include local ordinance administration and enforcement, overall project management and information and education. The local staffing needs are not included in Tables 6-3 through 6-7 but are included in Tables 6-2 and 6-8. Additional information and education staffing and budget needs for urban areas are included in Tables 6-3 through 6-4 and Table 8-2 (Chapter 8).

Urban Staffing Needs

In the inventory process for this watershed, it was observed that several surface water degradation problems are occurring in the urban area. It should be noted that these problems are irrespective of the stormwater discharge problems. These problems include, but are not limited to: streambank erosion, mowing right up to the streambank edge, mis-application of pesticides and herbicides, and illegal dumping of lawn cuttings, tires and garbage into stream channels.

To adequately address these problems, a more thorough survey is needed to locate, identify and implement solutions. Within the urban study area of Brown County, there are approximately 75 miles of stream identified from USGS quad maps. Within the Outagamie portion, there are 11 miles of urban streams. It should noted that streams which cross lands of the Oneida Nation are included in these numbers. Urban demonstration sites, landowner contact, data input and analysis, and conducting the Business Partners Program are additional activites that will be done in the urban portion.

Table 6-3 Ten-Year Implementation Costs for Brown and Outagamie County Urban Areas in the Duck, Apple and Ashwaubenon Creeks Watershed

Activity	Unit	Hours
Streambank Inventory ▸ Includes travel time from Brown Co. to Outagamie Co. ▸ Locate and map all vegetated conveyance areas	2 hrs/mile	172
Streambank Erosion Control, Survey and Design	35 sites @ 60 hrs/site over life of the project	2,100
Urban Demonstration Sites (contact, survey, post-implementation follow-up)	6 @ 120 hrs/site	720
Business Partners Program ▸ Work with DNR to identify NR 216 permits ▸ Contact/correspondence for training in NR 216 provisions ▸ Include Waste Recycling & Reduction Unit in training ▸ Visit sites where possible; make recommendations	200 businesses at 6 hrs/site	1,200
Erosion Control Inspection (over the life of the project)	370 sites at 4 hrs/site	1,480
Conduct Training Seminars, Public Meetings & Presentations	16 @ 40 hrs/presentation	640
Data Input and Analysis	120 hrs/yr for 10 years	1,200
Administrative	250 hrs/yr for 10 years	2,500
Total		**10,012**

note: Brown County LCD will provide all staffing needs to implment this part of the plan.

Table 6-4 Urban Staffing Needs for Municipalities[1]

Activity	Unit	Hours
Urban Demonstration Projects	160hrs./site (3 sites)	480
Erosion Control Inspection	1040 hrs/yr for larger or high growth communities; 100 hrs/year for smaller communities.	4,760 hrs/yr for 5 years
Conduct Training, Seminars, Public Meetings & Presentations	40 hrs/yr for larger communities	160 hrs/yr
Administration	80 hrs/year for larger communities	320 hrs/yr
Total		29,000 hrs

[1] These estimates were based on information provided by the city of Appleton.

Activities forExisting Urban Areas

Table 6-5 shows (next page) costs for detailed engineering feasbility studies for existing urban portions of Brown and Outagamie counties, which are projected at $353,000, and $134,000, respectively.

Table 6-6 shows (next page) the cost of constructing wet detention ponds on 100% of the significant land uses or 50% of the significant land uses, or sweeping with a high efficiency sweeper on the parking lots and streets of the significant land uses.

The total cost for installing these ponds in densely urbanized areas such as the city of Green Bay, ranges from $400,000 to $800,000 per surface acre of pond, depending on the need to condemn and relocate existing structures such as homes or businesses. The lower cost assumes open land is available for purchase, but that extensive rerouting of the storm sewer system is required. The upper end of the cost range assumes that land is completely developed, and condemnation of businesses or home would be required. Both figures assume the cost of pond excavation and development, such as pond inlet and outlet structures and pond landscaping, at about $70,000 per acre. In the DAA Watershed, an average figure of $400,000 per surface acre of pond is used. In cases where open land is available and storm sewer re-routing is not needed, the cost per acre would drop significantly.

Table 6-5 Estimated costs for detailed engineering feasibility studies for existing urban areas, DAA Watershed [1]

Subwatershed	Planning Needs (ac)[2]	Estimated Cost[3]
Beaver Dam Creek	1,101	$110,100
Direct Drainage	51	$5,100
Dutchman's Creek	1,330	$133,000
Fish Creek	0	$0
Hemlock Creek	580	$58,000
Lancaster Brook	148	$14,8000
Slough Creek	319	$31,900
Trout Creek	0	$0
Brown Cty Subtotal	*3,529*	*$352,900*
Appleton	774	$77,400
Freedom	561	$56,100
Burma Swamp	0	$0
Outagamie Cty Subtotal	*1,335*	*$133,500*
WATERSHED	*4,864*	*$486,400*

[1] Most of the cost for preparing feasibility studies will be borne by the state.
[2] This figure includes all significant urban land uses.
[3] Estimated cost of feasibility studies is $100/acre.
Note: This table assumes 100% participation.

Under all scenarios, the state share of the cost includes 70 percent of the cost for pond excavation and development and 70-100 percent of the design costs. In addition, the DNR covers up to 50 percent of the costs for land purchase, storm sewer re-routing and building removal. Annual operation and maintenance costs are not eligible for cost sharing under the existing rules governing the state nonpoint source program.

Table 6-6 Comparison of Size and Cost of Wet Detention Ponds vs High Efficiency Street Sweeping, DAA PWS Project

Subwtrshd	Munic.	Com.+Ind. Acres	Acres of Pond[1]	Cost- 100% Detention[2] (millions of $)	Cost - 50% Detention[2] (millions of $)	Cost - O&M/year[3]	Acres of Com./ Ind. Parking/Sts.[4]	Cost- High Effic. Sweeper[5] (millions of $)	Cost - O&M/yr[6]
Beaver Dam Cr.	v. Ashwaub.	66	1	$0.4	$0.2	$3,500	26	$0.04	$57,000
	c. Green Bay	522	10	$4.0	$2.0	$35,000	209	$0.36	$460,000
	v. Howard	333	7	$2.8	$1.4	$24,500	133	$0.23	$293,000
Direct Drain	c. Green Bay	25	.5	$0.2	$0.1	$1,750	10	$0.02	$22,000
	t. Hobart	0	0	0	0	0	0	0	0
	v. Howard	26	.5	$0.2	$0.1	$1,750	10	$0.02	$22,000
Dutchman's Cr.	v. Ashwaub.	941	19	$7.6	$3.8	$66,500	376	$0.64	$827,000
	c. Green Bay	0	0	0	0	0	0	0	0
	t. Hobart	389	8	$3.2	$1.6	$28,000	156	$0.27	$343,000
Fish Creek	c. Green Bay	0	0	0	0	0	0	0	0
	t. Hobart	0	0	0	0	0	0	0	0
Hemlock Cr.	v. Ashwaub.	305	6	$2.4	$1.2	$21,000	122	$0.2	$268,000
	c. DePere	175	4	$1.6	$0.8	$14,000	70	$0.12	$154,000
Lancaster Brook	t. Hobart	0	0	0	0	0	0	0	0
	v. Howard	148	3	$1.2	$0.6	$10,500	59	$0.1	$130,000
Slough Cr.	v. Howard	319	6	$2.4	$1.2	$21,000	128	$0.22	$282,000
Trout Cr.	t. Hobart	0	0	0	0	0	0	0	0
Burma Swamp	----------	0	0	0	0	0	0	0	0

Subwtrshd-	Munic.	Com.+Ind. Acres	Acres of Pond[1]	Cost- 100% Detention[2] (millions of $)	Cost - 50% Detention[2] (millions of $)	Cost - O&M/year[3]	Acres of Com./ Ind. Parking/Sts.[4]	Cost- High Effic. Sweeper[5] (millions of $)	Cost - O&M/yr[6]
Appleton	c. Appleton	353	7	$2.8	$1.4	$24,500	141	$.24	$310,000
	v. Little Chute	28	.6	$.24	$.14	$2,100	11	$.02	$24,000
	t. Grand Chute	130	2.6	$1.04	$.52	$9,100	52	$.09	$114,000
	t. Freedom	56	1	$0.4	$0.2	$3,500	22	$.04	$48,000
	t. Vandenbroek	207	4	$1.6	$0.8	$14,000	83	$.14	$183,000
Freedom	v. Little Chute	166	3.3	$1.3	$.65	$11,550	66	$.11	$145,000
	v. Kaukauna	292	5.8	$2.3	$1.15	$20,300	117	$.20	$257,000
	t. Vandenbroek	53	1.1	$.44	$.22	$3,850	21	$.04	$46,000
	t. Kaukauna	50	1	$0.4	$0.2	$3,500	20	$.03	$44,000
Watershed Total		**4584**	**92**	**$37**	**$18.5**	**$320,000**	**1834**	**$3.1**	**$4,000,000**

[1] The size of the pond is estimated at 2.0% of the drainage area for commercial and industrial land uses.
[2] The cost of a pond in a retrofit situation is estimated at $400,000/acre of pond. This includes capital expenses of pond excavation and development, cost of storm sewer re-routing, cost of land purchase, and engineering. The cost could rise to $700,000-800,000/acre if relocating existing structures such as businesses or homesis required. Where inexpensive open space is available that requires no re-routing of storm sewers, cost per acre of pond could be as low as $100,000. These ponds are estimated to be 80% efficient in removing sediment.
[3] O&M costs for ponds are estimated at $2,000-5,000/acre of pond/yr. An average of $3,500 was used in this analysis. The analysis was done for 100% detention.
[4] The acres of parking and streets is estimated at 40% of the total area for these land uses.
[5] The cost of a high-efficiency sweeper is estimated at $170,000/100acres. These sweepers are estimated at 50% efficient in removing sediment.
[6] The O&M cost of a sweeper is estimated at $2,200/acre swept/year. Sweeping occurs twice a week for 8 months.

Source: "Costs of Urban Nonpoint Source Water Pollution Control Measures", SEWRPC Tech. Rept. #31.

Activities for Planned Urban Areas

Table 6-7 presents the cost of implementing the recommendations for planned urban areas. These costs are presented by subwatershed and reflect projections of urban growth.Stormwater planning costs are anticipated to be $470,000 for the Brown County Study Area and $370,000 for the Outagamie County Study Area. This cost would be borne primarily by DNR.

The cost of installing urban structural practices, such as wet detention, in areas of new development, should be greatly reduced since proper planning can assure that land is set aside and stormwater practices are located in harmony with the conveyance systems. An estimated $4 million will be required to install wet detention in the planned urban areas for the Brown County Study Area; $3.1 million would be required for the Outagamie County Study Area. Land costs are additional. The entire cost of practice design and installation would be borne locally, as nonpoint source program funds are not used for practices in areas of new development. However, lands designated for industrial land development, may be controlled through the Federal Stormwater Permit Program, while costs associated with low intensity (low density residential, parks, institutional) land uses can probably be sized down or eliminated through the use of grassed swales.

The cost of controlling construction site erosion is not included in these tables but would probably cost about $250 per acre for practice design and installation. This amounts to $2 million for the Brown County Study Area and $1.5 million for the Outagamie County Study Area. This cost would be paid locally by developers.

Table 6-7 Cost of Stormwater Management Planning and Implementing Urban Practices in Planned Urban Areas in the Watershed

Subwatershed	Planning Needs (ac)[1]	Estimated Cost[2]	Pond Acres[3]	Estimated Cost[4]
Beaver Dam Creek	80	$800	0.8	$40,000
Direct Drainage	190	$1,900	2.0	$100,000
Dutchman's Creek	2,740	$27,400	27	$1,350,000
Fish Creek	490	$4,900	5.0	$250,000
Hemlock Creek	600	$6,000	6.0	$300,000
Lancaster Brook	2,560	$25,600	26	$1,300,000
Slough Creek	800	$8,000	8.0	$400,000
Trout Creek	350	$3,500	4.0	$200,000
Brown County Subtotal	7,810	$78,000	79	$4,000,000
Appleton	3,377	$33,767	34	$1,700,000
Freedom	2,333	$23,330	23	$1,150,000

Burma Swamp	405	$4,050	4.0	$200,000
Outagamie County Subtotal	6,115	$61,115	61	$3,100,000
WATERSHED	13,925	$139,250	140	$7,100,000

[1] Represents planned urban acres for the year 2020.
[2] Planning costs are estimated to be $10/acre planned. State covers 100% of planning cost.
[3] Acres needed are assumed to be 1% of the drainage area
[4] Cost of a pond in new development is estimated at $50,000/acre

Alternative Funding Sources

This plan recognizes that additional funding through new initiatives must be provided to improve full program implementation. A substantial portion of the estimated costs of implementing this plan's urban management recommendations is for the construction of stormwater management practices in existing urban areas to control pollutants generated by a wide variety of activities.

The nonpoint program will not be able to fund all the work needed to meet the goal in the project's time frame. This analysis is conducted to determine where the nonpoint dollars would best be spent. The program's priorities are to encourage adoption of construction site erosion control ordinances and continued enforcement; to develop stormwater plans and stormwater management ordinances to reduce pollutant contributions from new development; to conduct information and education work to prevent pollution and control sources of pollution; and to look for low cost/low technology solutions. Funding structural practices will be limited to demonstration projects and control of significant land use. Consideration should be given to disconnection of downspouts in industrial areas and operation of high-efficiency sweepers in commercial areas. A pilot of these practices would be appropriate.

This plan endorses continued investigation into source control alternatives as well as development of alternatives for internalizing local pollution control costs. Municipalities should investigate options such as creation of local utility districts to finance the local share of these estimated costs. DNR will help finance studies through the priority watershed program.

Summary of Project Urban Costs

It is very expensive to implement urban BMPs. To do all the work needed to meet project goals, costs would likely exceed $50 million. Staff assumed such costs would not be borne by the NPS program, and therefore assume that 50% of the water quality goals would be met, costing $25 million, of which $8.6 would be paid by the state. Table 6-8 summarizes the total cost of implementing the Duck, Apple, Ashwaubenon Creeks Project.

In urban areas, the local share of the project costs will be provided in part by individual landowners and in part by municipal governments. The overall state support rate for existing urban areas is about 34 percent. The overall state support rate for planned and developing urban areas is about 1 percent. The local share of the project cost in these areas is expected to be paid for primarily by individual landowners and developers.

Table 6-8 Estimated Total Costs for Urban Implementation[1]

	PROJECT ELEMENT	TOTAL COST	STATE SHARE	LOCAL SHARE
DEVELOPING URBAN AREAS				
1.	Construction Site BMPs	$3.5 Million	$0	$3.5 Million
2.	CSEC Ordinance Administration	included in urban staffing	--	--
PLANNED URBAN AREAS				
3.	Stormwater Management Plans	$0.14 Million	$0.14 Million	$0
4.	Stormwater Management BMPs	$7.1 Million	$0	$7.1 Million
EXISTING URBAN AREAS				
5.	Feasibility Studies	$0.12 Million	$0.12 Million	$0
6.	Structural BMPs[2]	$9.0 Million	$6.3 Million	$2.7 Million
7.	OR Street Sweeping[3],[4] (capital cost only)	$3.1 Million	$1.56 Million	$1.56 Million
INFORMATION & EDUCATION				
8.	Urban Staffing	$2.1 Million	$0.5 Million	$1.64 Million
WATERSHED TOTAL COST		**$25 Million**	**$8.6 Million**	**$16.5 Million**

[1] It is very expensive to implement urban BMPs. To do all the work needed to meet project goals, costs would likely exceed $50 million. Staff assumed such costs would not be borne by the NPS program, and therefore assume that 50% of the water quality goal would be met, costing $25 million, of which $8.6 would be paid by the state.

CHAPTER SEVEN
Integrated Resource Management

Introduction

This chapter identifies existing state, federal and local resource management programs that provide benefits for water quality and/or fish and wildlife resources in the Duck, Apple and Ashwaubenon Creeks Watershed. Project staff will work to coordinate the efforts of these programs to provide the best possible management of land and water resources. This comprehensive approach will facilitate consideration of the various goals and objectives of all the programs in which a landowner participates. These activities are described below.

Fisheries and Wildlife Management

Watershed BMPs such as streambank protection, shoreline buffer strips and easements, should be implemented in a manner that preserves and enhances the management goal of providing a quality fishery in the Duck, Apple and Ashwaubenon Creeks Watershed. Specifically, all streambank protection BMPs should be installed using large diameter-sized rock below the water line. Bioengineering should be considered as an alternative to riprap whenever and wherever feasible. When rock riprap is deemed necessary, it should be installed and sized so that the placement of rock will benefit fish habitat. Vegetative shoreline erosion control using emergent aquatic vegetation for habitat enhancement should be used where applicable. Wildlife habitat components should also be incorporated into vegetative filter strips along streams or in upland areas.

Shoreline erosion control measures will be installed in a manner beneficial to fisheries and wildlife habitat. DNR Fisheries and Habitat and Wildlife Management personnel will be consulted for input in the design of streambank and shoreline protection BMPs to maximize benefits to fish and wildlife communities. In cooperation with counties, DNR staff will also review placement of agricultural sediment basins, provide technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat, and assist in resolving questions concerning effects of agricultural nonpoint source BMPs on wetlands.

Wetland Restoration

No significant restorable wetland tracks have been identified in the Duck, Apple and Ashwaubenon Creeks Watershed. The general guidelines for wetland restoration, easement

acquisition and shoreline buffers to protect existing wetlands should be followed, however. Wetlands that are important wildlife habitat will be identified in consultation with DNR Wildlife, Fisheries and Habitat and Watershed Management personnel. Shoreline buffer easements may be acquired adjacent to these wetlands to offer better protection from sedimentation and other nonpoint source pollution.

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 groundwater. If not properly sealed, abandoned wells can directly channel contaminated surface water or shallow groundwater into deeper aquifers, bypassing the normal purifying action that takes place as surface water slowly percolates downward. Abandoned wells are a significant threat to groundwater quality in the watershed.

Outagamie County, Brown County and the Oneida Nation will encourage all landowners to properly seal abandoned wells. Information on proper abandonment procedures will be provided to landowners when abandoned wells are located.

Well Abandonment

The Environmental Quality Incentives Program (EQIP), administered by the Farm Services Agency (FSA), provides cost-share assistance to farm operators to properly seal abandoned wells to protect groundwater resources. Well abandonment is also an eligible cost-share practice under NR 120.

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 water supply personnel should be consulted for more information concerning income limits and other eligibility requirements. *Eligible landowners will be encouraged to apply for well replacement funds through the Wisconsin Well Compensation Grant Program.*

Private Sewage System Maintenance and Rehabilitation

Poorly sited or improperly functioning private sewage systems have the potential to contaminate groundwater and surface waters in the Duck, Apple and Ashwaubenon Creeks Watershed. Pollutants from sewage system discharge includes bacteria, viruses, household

chemicals, nitrates and phosphorus. Many sewage systems located in riparian areas are outdated and installed in soils with poor filtering ability and/or a high water table. Failing sewage systems in riparian areas are a special concern since pollutants can enter surface waters with minimal filtering. Sewage system failure is often due to poor maintenance -- primarily failure to pump the septic tanks regularly. Outagamie County, Brown County and Oneida Nation staff will promote educational materials to encourage proper maintenance of private sewage systems, including household tips for reducing groundwater contamination.

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 money to update private sewage systems that were installed before 1978. To be eligible the septic system must have been inspected by the Outagamie or Brown County Sanitarian and determined to be failing from discharging waste to groundwater or surface water. Only permanent Wisconsin residences qualify and income restrictions apply. Applications for Wisconsin Fund assistance must be made through Outagamie County, Brown County, or the Oneida Nation Zoning and Solid Waste Department. Project staff will inform watershed residents about the benefits of the Wisconsin Fund grant program and encourage eligible landowners to apply.

Riparian Zones

Cattle access to streams has not been identified as a serious problem in the watershed, although some sites must be addressed. Any sites affected by cattle access identified during project implementation should be protected with BMPs. Sensitive riparian areas can be acquired through easements to receive lasting protection. Duck, Apple and Ashwaubenon Creeks Watershed project staff will promote protection of riparian areas.

Stewardship Fund

The Stewardship Fund enables the purchase of land or easements to protect fragile areas. The Streambank Protection Program under the fund allows DNR to obtain easements or fencing on both sides of a stream (generally 66 feet wide on each side) to protect its streambanks from livestock access and other disturbances.

Forestry Programs

Private forest lands contribute to the quality of water, 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. Information on these programs is

located in Wisconsin Forestry Best Management Practices For Water Quality, (DNR FR-093-95) developed by the Bureau of Forestry.

Stewardship Incentive Program

The Stewardship Incentive Program (SIP) was developed to enhance management of forest lands by cost-sharing approved management practices. SIP provides cost-share funding of up to 75 percent for practices that provide soil and water protection. The SIP program applies to nonindustrial 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 hedgerow 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 provides tax incentives for industrial and nonindustrial private woodland owners who manage their woodlands for forest products and for water quality protection, wildlife habitat and public recreation. In return for following an approved management plan, the landowner's property tax rates are lowered. At a later time when the landowner receives an income from a timber harvest, a portion of the deferred tax is collected in the form of a yield tax. The management plans are based on the landowner's objectives and may address harvesting, planting, thinning, release and soil erosion as well as wildlife and aesthetic activities.

Other Forestry Programs

Some other forest programs available to watershed landowners include the Forest Improvement Program (FIP) and the Agricultural Conservation Program (ACP). These programs provide funding for establishing timber stands. Project staff and DNR Foresters should encourage eligible landowners in the Duck, Apple and Ashwaubenon Creeks Watershed to participate in Forest Stewardship Programs to benefit water resources and forest habitat. Protection of soil and water resources should be addressed in all SIP and MFL plans.

Floodplain, Shoreland and Shoreland-Wetland Zoning

County shoreland zoning ordinances protect riparian areas along navigable waterways by limiting development within 300 feet of rivers and streams or the landwatrd side of floodplains and within 1000 feet of lakes, ponds and flowages. The goals of the program are to protect water quality, protect natural scenic beauty and prevent the destruction of near shore habitat. These ordinances use minimum structural setbacks, minimum lot sizes, land division review

and limiting uses of wetlands as tools to reach these goals. Other tools that are used include protection of vegetative buffers, restrictions on grading and filling in riparian area, and enforcement of sanitary and well codes.

City and village shoreland-wetland zoning ordinances protect wetlands within shoreland zones by restricting structural development and limiting filling and grading of wetlands.

The main purpose for adopting county, city and village floodplain zoning ordinances is to protect life and property. However, proper floodplain management can have secondary benefits to water quality by recognizing the natural functions and values of flood-lain areas and protecting these resources. Limiting development in floodplain area reduces the amount of nonporous areas thereby reducing the amount of runoff to surface water.

Local governments must work with the DNR to ensure proper enforcement o these ordinances and the protection of riparian and floodplain areas. Local governments are encouraged to adopt more restrictive regulations if resource protection warrants it. For more information concerning floodplain, shoreland or shoreland-wetland zoning restrictions contact your local zoning administrator or building inspector. For assistance on valuating ordinance language contact your local DNR Regional Headquarters.

Coordinating Regulations, Permits and Zoning

BMPs that address shoreline erosion such as riprap or vegetative shoreline stabilization will require permits from the DNR. Any BMP that affects wetland form or function may require a permit or approval from the DNR, the Outagamie and/or Brown County Zoning office, the Oneida Nation Environmental Department and the U.S. Army Corps of Engineers. Project staff will work closely with these agencies to assure that necessary permits are received prior to the installation of shoreline stabilization practices.

To protect the use, enjoyment and water quality of our lakes and streams, state, federal and local governments regulate 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 lakefront property owners, particularly those who purchasing waterfront property for the first time, are unaware of these regulations or the need for them.

Project staff will work with the Property Listing Department, zoning departments and the DNR to provide information to new waterfront property owners throughout Brown and Outagamie counties to educate residents about zoning regulations and the proper contacts to make within each agency.

State & Federal Conservation Compliance Programs

The Duck, Apple and Ashwaubenon Creeks Watershed Project will be coordinated with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP) administered by DATCP, and the Federal Food Security Act (FSA) administered by the Natural Resource Conservation Service (NRCS). DATCP will assist the LCD and the NRCS offices to identify landowners within the watershed that are subject to the compliance provisions of FPP and FSA. Conservation Farm Plans were completed for all landowners in FSA by December 31, 1989. There are 224 FPP plans and 285 FSA plans within the watershed project. Implementation and amendment of these conservation plans will be necessary during implementation of the project. Watershed project staff will inform FPP and NRCS staff of changes in plans resulting from management decisions and installation of needed BMPs for nonpoint source pollution abatement.

Archaeological Sites: 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. This watershed project is a joint, cooperative effort between federal, state, and local agencies as well as private landowners who volunteer to participate. 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 with preserving cultural sites and implementing this project.

Many sites of archaeological and cultural significance lie within the Duck, Apple and Ashwaubenon Creeks Watershed. Ancestors of the Menominee and Ho-Chunk people have lived in the watershed since the last ice age (*at least* 10,000 years ago). The Oneida Reservation, established by Treaty in 1838, also exists within the project area. Prehistoric, historic and archaic Native American villages and settlements constitute the bulk of the known sites; these are primarily located within the Duck Creek and Trout Creek corridors.

In addition to abundant examples of Native American history and culture evident throughout the area, there exists remnants of the first European settlers inhabiting Northeastern Wisconsin. These include sawmills, grain mills and remains of Fort Howard within the present-day location of Pamperin Park, Brown County.

Archaeological sites in the watershed will need special consideration when structural best management practices are evaluated. Settling basins, manure storage structures and streambank or shoreline shaping and riprapping will likely impact archaeological sites if not designed carefully. State and federal laws require preservation of archaeological resources during design, implementation and evaluation of this nonpoint source project. Instructions and Cultural Resource Site Review Documentation forms are available in the Implementation

Manual. Before finalizing cost-share agreement with landowners, project staff should review maps showing known archaeological and historic sites. If a known site occurs in the vicinity of a proposed BMP, a formal Archaeological or Historic Site Review of the area may be required. Yet this type of finding does not necessarily mean the BMP should be moved or altered.

First, project staff conduct a "pre-review" to ensure that the *specific* location of the proposed BMP will not disturb the known archaeologic or historic site. If this is too difficult to determine or if it appears that the known site would be disturbed, a formal Archaeological or Historic Site Review should be set up. Costs incurred as part of a site review *will not be passed on to the landowner*. The state's Nonpoint Source Program will fund the professional site reviews.

Practices of concern for Archaeological Sites

Field Diversions
Terraces
Grade Stabilization Structures
Agricultural Sediment Basins
Streambank and Shoreline Stabilization
Sediment Retention, Erosion or Water Control Structures
Structural Urban Practices
Wetland Restoration

Practices of concern for Buildings

Barnyard Runoff Management Systems
Animal Lot Relocation
Manure Storage Facilities
Roofs for Barnyard/Manure Storage Facilities

Practices - Concern Probably Not Needed for Cultural Sites

Contour Farming
Contour Strip-cropping
Field Strip-cropping
Reduced Tillage
No-till Systems
Permanent Vegetative Cover
Cropland Protective Cover
Critical Area Stabilization
Nutrient Management
Pesticide Management
Shoreline Buffers
Livestock Exclusion from Woodlots
Grass Waterways

Endangered and Threatened Resources

Information on threatened and endangered resources was obtained from the DNR's Bureau of Endangered Resources. Endangered resources include rare species and natural communities. Although the DNR's Natural Heritage Inventory provides information about occurences of threatened or endangered species or communities, comprehensive resource surveys have not been completed for the Duck, Apple and Ashwaubenon Creeks Watershed. The lack of occurrence records for a species does not preclude the possibility it may be present in the watershed. In addition, the Bureau's endangered resource files are continuously updated from ongoing field work. Other rare species and natural communities may be in the process of being added to the database and so were unavailable for inclusion in this document.

Rare Species

Rare species are tracked by documenting known or reported occurrences in Wisconsin's Natural Heritage Inventory of which the Bureau of Endangered Resources is steward. Species tracked by the inventory include federal and state listed species (U.S. Fish and Wildlife Service; State of Wisconsin).

Wisconsin Endangered Species

An endangered species is one whose continued existence as a viable component of the state's wild animals or wild plants is determined by the DNR to be in jeopardy on the basis of scientific evidence. In addition to the two endangered animal species listed in Table 7-1 below, it is likely that numerous state-endangered or threatened plant species exist within the project boundaries.

Wisconsin Threatened Species

A threatened species is one which, if not protected, has a strong probability of becoming endangered. Wisconsin threatened species within the watershed are listed in Table 7-1.

Wisconsin Special Concern Species

A special concern species is one for which problems of abundance or distribution are suspected but not yet proven. This category's purpose is to focus attention on certain species *before* they become endangered or threatened. Special concern species in the watershed are listed in Table 7-1.

Table 7-1 Rare Species in the Duck, Apple and Ashwaubenon Creeks Watershed

Common Name	Latin Name	Threatened, Endangered or Special Concern
barn owl	*Tyto alba*	Endangered
bluntnose darter	*Etheostoma chlorosomum*	Endangered
red-shouldered hawk	*Buteo lineatus*	Threatened
bald eagle	*Haliaeetus leucocephalus*	Threatened
wood turtle	*Clemmys insculpta*	Threatened
Blanding's turtle	*Emydiodea blandingi*	Threatened
redfin shiner	*Notropis umbratillis*	Threatened
redside dace	*Clinostomus elongatus*	Special Concern

Natural Areas

Natural areas are sites that contain high quality examples of natural communities. The following areas are located in the Duck, Apple and Ashwaubenon Creeks Watershed:

Brown County Park
* Diverse upland hardwood forest
* Riparian floodplain forest
* Diverse flora and fawna associated with communities listed above

Oneida Village Wildlife Area
* Marshland and lowland forest
* 6 large wildlife ponds
* Diverse flora and fawna associated with communities listed above

Burma Swamp
* Largest contiguous wetland area in the watershed
* Diverse lowland and coniferous hardwood forest
* Diverse flora and fawna associated with communities listed above

Norbert Hill Woods
* Diverse upland hardwood forest
* Diverse flora and fawna associated with community listed above

Duck Creek Valley
* Diverse forest and wetland types
* Northern third of valley is forested
* Southern two thirds of valley is mostly wetlands

Trout Creek Headwaters
* Large 700+ acres of cedar forest and swamps

Numerous small scattered natural areas throughout headwaters
* Diverse forest, grassland and wetland areas

If specific locational 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 **should not** be released or reproduced in any publicly disseminated documents.

CHAPTER EIGHT
Information and Education Activities

This chapter outlines an information and education strategy designed to support implementation of water quality recommendations made in this plan. The strategy is based on survey data collected via a random phone questionnaire (Knupp and Watson, Inc., May 1995) from urban residents regarding their perceptions, attitudes and behaviors concerning water pollution. A focus group research study was conducted with rural landowners in Outagamie and Brown counties (Matousek & Associates, September 1995) to find out how much they knew about nonpoint source (runoff) pollution -- sources and solutions. This I & E plan draws on elements from other local water quality plans, including the East River Priority Watershed Plan and the Green Bay Remedial Action Plan (RAP) to complement rather than duplicate existing strategies and materials. This strategy identifies goals and target audiences, recommends activities to reach these audiences, and estimates funding needs.

Perspectives and Purpose

The primary purpose of the information and education strategy for the watershed project is to enhance implementation of watershed plan objectives. To achieve the most impact with available funds, education program planning was viewed from several perspectives:

- Key audiences capable of having the greatest impact on the resource because they own, manage, or help govern critical lands.
- Key messages from the watershed project that need to be conveyed.
- Potential uses of activities such as providing information, promoting participation and instruction on specific practices.
- Opportunities for combining efforts of public and private agencies.
- Critical timelines associated with phases in the watershed project.
- Educational approaches that are most effective for the purpose.

The resulting education plan for the Duck, Apple and Ashwaubenon Creeks Watershed Project area includes recommendations for general and audience specific activities. It recognizes that

certain targeted audiences hold the key to actions that will produce improvements in water resources. At the same time, the plan acknowledges that educational activities designed for general audiences are important, as they can influence both short and long-term management decisions. Even so, targeting audiences and refining messages will maximize cost efficiency and program impact.

Background

Each watershed has distinctive characteristics that must be considered when developing an information and education strategy. Land uses, water quality problems and population characteristics dictate the type and content of educational programs and informational materials that are needed. The Duck, Apple and Ashwaubenon Creeks Watershed has characteristics that distinguish it from its neighbors and yet it also has similarities. Therefore, this strategy relies on some programs shared with neighboring watersheds and on some geared toward the watershed's unique needs.

Watershed Characteristics

The Duck, Apple and Ashwaubenon Creeks Watershed is mostly undeveloped with 71 percent of the land remaining in rural land uses. However, the watershed lies within the rapidly growing Highway 41 corridor between Green Bay and Appleton.

Agriculture on the Urban Fringe

While cropland erosion is still the leading source of sediment in this watershed, reducing this source of pollution may be difficult due to the pressures of urbanization. Rising land prices and property taxes are influencing many landowners to anticipate selling their land for development. These landowners need high profits to pay their taxes and are usually unwilling to make long-term investments in purchasing new equipment. Many see only short-term farming opportunities but feel that protecting the soil and water for future generations is important. Others feel that the only way they can stay competitive is to increase the size of their operation. This suggests that information materials for these owners should emphasize low-cost practices and encourage protection of water resources even after development occurs.

Neighboring Water Quality Projects

The Duck, Apple and Ashwaubenon Creeks Watershed adjoins two other water quality projects -- the East River Priority Watershed Project in Brown County and the Green Bay Remedial Action Plan (RAP), active in both Brown and Outagamie counties. Because the all three project areas are part of the Fox-Wolf Basin, opportunities for combining education activities exist and should be explored. Coordinating programs with adjacent watersheds will use staff and limited funds more efficiently. Careful coordination is especially important for the public awareness and media campaigns designed to reach urban audiences.

Limited Use of the Streams

Due to poor water quality and low baseflow conditions, most of the streams in the watershed have little remaining habitat for fish and wildlife and few recreational opportunities for local residents.

In the short term, educational programs must emphasize benefits of cleanup efforts to downstream water resources such as Beaver Dam Creek, Lancaster Creek, Trout Creek and eventually the bay of Green Bay and the Fox River. Over the long run, the programs must also work on restoring a vision of the river and its tributaries as shared natural resources. School programs, stream cleanups, water quality monitoring and restoration of natural corridors along the streams would further promote a positive image of the watershed.

Culturally Diverse Population

This watershed includes nearly all land within the Oneida Nation tribal boundaries. To reach this audience materials and strategies must incorporate Native American cultural heritage.

Audience Characteristics

Key audiences have been grouped into five categories for this educational plan (see below). Important characteristics of each group and information about the best ways to reach them are also summarized below.

1. Local governments and community leaders
2. Urban residents/Rural non-farm
3. Rural landowners and operators
4. Business and industry
5. Youth

Local Governments and Community Leaders

Elected and appointed officials of local governments comprise an important audience because they apply for grants; adopt and enforce ordinances; and appropriate funds to address runoff problems. There are 20 local governments in this watershed (towns of Hobart, Lawrence, Wrightstown, Oneida, Grand Chute, Vanden Broek, Suamico, Pittsfield and Freedom; cities of Green Bay, De Pere and Appleton; villages of Ashwaubenon, Howard, Little Chute, Oneida, Wrightstown and Kaukauna; and Brown and Outagamie counties) and a sovereign nation (Oneida Indian Nation).

Special characteristics of the local government and community leader audience which have become apparent through discussions with the Urban Citizens Advisory Committee include:

Concern about protecting the quality of life for residents.
Individuals and communities can work together.
The economic and social benefits of a healthy environment.

The most effective ways to reach these audiences are:

- Presentations at local government and community group meetings.
- Articles in local newspapers.
- Workshops for local governments.
- Demonstration projects and tours.

Potential urban demonstration projects could include:

- AMS parking lot.
- Employers Health parking lot conveyance for erosion control and grass swale drainage best management practice designs.
- Promotion of the inventory and continuance of all existing grass swale conveyance within both counties and the reservation.
- Site control of an auto dealership ot and a Wood Building Products distribution center, specifically on Beaver Dam Creek.
- Post Office on Packerland Drive, control of parking lot runoff.
- St. Mary's Hospital in Green Bay for on-site source control (sand filtration, bioretention).
- Apple Creek Corridor Project, Appleton. Develop an environmental corridor that will provide additional water quality imrovements by linking two detention ponds/wetland facilities into a complete stormwater management system.

Considerable time and effort must be devoted to this audience due to the number of local governments and their importance in controlling construction erosion, storm water runoff and eroding streambanks.

Urban Residents/Rural Non-Farm

The Green Bay and Appleton/Fox Valley area is the largest urbanized region in northeastern Wisconsin. According to the East River focus group results (February 1993) watershed residents received information in the workplace, school and media. When broken down by age, residents 20 to 29 years old received most of their information from the radio during "drive time"; residents 30 to 44 years olds' primary information source was television and newspaper; and residents' 45 to 65 years old got their information from the newspapers. Despite the age or information source, most individuals are supportive of water quality improvement programs and are willing to take action at home to protect the environment by recycling oil, cleaning up pet waste, separating household hazardous waste for collection, limiting use of yard chemicals, directing downspouts onto lawns, and composting leaves and

grass clippings (Knupp and Watson, Inc., May 1995). Characteristics of the urban audience include:

Correcting the misconception that industry is the leading cause of water quality problems.
This group's reliance on television, radio and newspapers for current information.
Reluctance to attend meetings or workshops unless highly motivated by personal interests.

To reach the broad spectrum of urban residents, this information and education program will revolve around a marketing campaign based on recommendations from Knupp and Watson, Inc., with supporting educational activities for interested citizens. The recommended methods for this audience include:

- Public awareness or marketing campaign based on recommendations from professionals in public relations.
- Newspaper coverage including news, feature articles, and targeted advertising.
- Television and radio coverage including news, talk shows and targeted advertising.
- Watershed newsletters sent to citizens and groups expressing specific interest.
- Printed materials distributed at key times and locations.
- Watershed speakers for local groups.
- Exhibits at local events, especially water-related ones.
- Storm drain stenciling of sewered neighborhoods.

The educational approach for the urban public relies heavily on the mass media and mailings or handouts for targeted groups of residents such as pet owners, purchasers of vehicle oil and yard chemicals and boat owners. Workshops, speakers, demonstrations and leader training are reserved for interested citizens and organizations.

Rural Landowners and Operators

Rural land uses still account for 58 percent of the area in the Duck, Apple and Ashwaubenon Creeks Watershed and eroding cropland is still the leading source of sediment to the streams. Rural landowners and operators are an important audience because control of erosion is essential for meeting water quality objectives. As discussed previously, the agricultural sector is both in a state of transition and a significant cause of water quality degradation. Thus, convincing this audience to take action will be a difficult but vital task. Most landowners in the watershed believe that the quality of the water must be protected. However, many landowners are not aware of how and to what extent they affect water quality through their farming practices. Participants in the focus group research (Matousek and Associates, September 1995) felt that to have a successful watershed project, urban issues should not be neglected. Most importantly, rural landowners would be more willing to participate in the program if impartial sediment and phosphorus reduction goals are set for both rural and urban areas. General characteristics of rural audiences in this watershed are listed below:

Short planning horizon for many farms due to landowner age and pressures of urbanization. Economic pressure from escalating land values and taxes, lack of control over milk prices, high costs of equipment and increased regulations.

The best ways to reach this audience, based on the data from Matousek & Associates focus group results, include:

- One-on-one contacts - with a folder of materials tailored to each.
- Demonstration project and good practice mini-tours.
- Town meetings.
- Direct mailings.
- Peers.

Reaching rural audiences in this watershed and securing their participation will require flexibility. To be successful, the content of the message must change to reflect the pressures of urbanization. Diverse and innovative practices must be promoted and flexibility must be exercised in implementing program policies and rules.

Business and Industry

The primary business and industry audiences who must take action to implement recommendations in this plan are developers, contractors and builders. Others who will be affected include owners of property with eroding streambanks or property identified as critical areas for storm water management practices. Characteristics of this audience which should be considered when selecting educational methods and developing materials include:

Concern about economic costs and benefits.
Sense of civic responsibility and pride in their work.
Seasonal variations in time availability for those in the construction industry.

Effective methods for use with this audience include:

- Locally available workshops, videos, fact sheets, handbooks, and technical assistance for developers, contractors and builders.
- Watershed speakers for business and industry associations, including builders associations and chambers of commerce.
- Exhibits at appropriate industry shows and meetings (e.g. Home Show).

Youth

Youth are addressed by this plan because they are the ones who must support action to reduce nonpoint source pollution in the future. They also influence today's decision makers and are a

focus of media attention. The statewide requirement to integrate environmental education in school curricula makes water quality education initiatives for Youth especially appropriate.

Characteristics of the youth audience in this watershed include:

Interest and participation in water-based recreation.
Local access to streams, wetlands and wildlife habitat.
Some access to water resource education and teachers having appropriate training and adequate funding for field trips.

Educational activities recommended for this audience include:

- Use of adaptation of existing water resources curricula.
- Speakers for schools, teacher in-services and youth leader workshops.
- Promotion of the "Water Quality Monitoring" program to middle and high schools.
- Youth group projects, including storm drain stenciling, litter clean-ups, etc.

Major Water Quality Problems

Based on the preceding chapters of this plan, the major water quality problems that must be addressed by the information and education strategy are:

- Sediment and nutrients from eroding cropland.
- Sediment from eroding construction sites.
- Sediment from eroding stream banks.
- Sediment, nutrients and potentially toxic pollutants in runoff from existing urban areas.
- Extreme changes in stream flows and increases in water pollution due to runoff from new urban development.
- Nutrients, bacteria and decaying organic matter from barnyards.
- Low baseflow conditions.

Information and Education Priorities

To address these water quality problems, the information and education strategy must support this plan's recommended implementation program. Specifically, the strategy must help build:

- Public appreciation of water resources, awareness of the watershed program and support for water quality improvement efforts.
- Participation in the watershed BMPs:
    - Agricultural cropland practices

- Nutrient and pesticide management planning from problem barnyards
- Remediation of eroding streambanks in both the urban and rural areas
- Retrofitting storm water controls from critical land uses in existing urban areas

- Compliance with construction erosion control regulations.
- Development and implementation of stormwater ordinances and plans.

Due to limited staff and funding, information and education programs cannot address all of these needs at once. Therefore, budgets and schedules for information and education programs will be based in large part on this priority list.

Goals, Audiences and Activities

This section, sets goals, identifies target audiences and recommends specific activities to reach these audiences, is the heart of the information and education strategy for the Duck, Apple and Ashwaubenon Creeks Watershed.

Goal 1: Increase public awareness and understanding of the watershed program, runoff pollution, and the water resources in the project area.

Objective

Watershed residents will understand the value of surface water resources and how to preserve them.

Messages

- Good water quality is important to everyone.
- Good neighbors protect water quality.
- Maintain water quality for recreational uses.
- Storm drains run directly into nearby rivers, streams and wetlands.
- Water resources are an asset to local communities.

Activities

- Watershed newsletter (3 per year)
- News releases
- Demonstration sites
- Presentations (i.e. Rotary Club, FFA, government officials)

- Develop exhibits for use at libraries, government offices and local events (Turf and Garden Show, Home and Garden Show, County Fairs, farm shows)
- Breakfast/Brunch on the Farm
- Signage
- Informational meetings
- Demonstration tours
- Fact sheet development and distribution
- Informational folders
- Distribution of informational materials (i.e. placemats, pencils, magnets)
- Direct mailings to riparian and rural landowners.
- Public service announcements on local radio, TV stations, and the Internet.

Goal 2: Increase public involvement and implementation of watershed plan recommendations.

Objectives

1. Watershed residents will actively participate in activities that build awareness and understanding of the local water resources.

2. Landowners will participate in the watershed project through the installation of best management practices.

Messages

- Good water quality is important to everyone.
- Good neighbors protect water quality.
- Maintain water quality for recreational uses.
- Storm drains run directly into nearby rivers, streams and wetlands.
- Water resources are an asset to local communities.

Activities

- Participate/expand the annual River Bay Clean Up Day event to watershed residents.
- Watershed tour for elected officials
- Support the Clean Bay Backer awards program
- Expand the participation of teachers in the water quality monitoring program
- One-on-one contacts with landowners.
- Promote storm drain stencilling in the urban areas of the watershed.
- Field days highlighting demonstration projects.

- Develop business partnerships.
- Volunteer/school group activities (storm drain stencilling, water testing)

Goal 3: Reduce sediment loading from agricultural lands by providing rural landowners information about watershed cost-sharing and other agricultural programs.

Objectives

1. Agricultural producers will minimize nutrient, sediment and other polluting inputs from farming activities by adopting best management practices.

2. Landowners will protect and restore wetlands in the watershed to increase stream baseflow.

Messages

- BMPs can keep soil and nutrients on your farm.
- BMPs help preserve surface water quality.
- Cost sharing is available to implement BMPs.
- List and describe BMPs and cost share eligibility.
- Preserving stream corridors and wetlands is important.
- Buffers of vegetation to protect water quality.
- Wetlands provide wildlife habitat and protect water quality by trapping nutrients from runoff.
- BMPs are economically viable practices on the farm.

Activities

- One-on-one contacts with rural landowners.
- Develop fact sheets (i.e., buffers, conservation tillage, etc.) to support rural BMPs.
- Workshops promoting best management practices (i.e. wetland restoration, buffer establishment and maintenance, rotational grazing)
- Promotion of the Greenstripe Program in watershed high school FFA programs.

Goal 4: **Reduce pollutant loads from new and existing urban areas by raising awareness and helping local governments, residents and the construction industry develop values, knowledge and skills needed for better compliance with construction erosion control regulations.**

Objectives

1. Local governments will make decisions that protect water quality through the use of storm water management and construction erosion control measures.

2. Urban residents will reduce the amount of phosphorus, sediment and other pollutants through urban housekeeping practices.

3. Promote hiring inspectors through local municipalities for enforcement of erosion control and storm water management ordinances.

Messages

- Storm drains run directly into nearby streams, rivers and wetlands.
- Fertilizer, detergents, leaves and grass in storm drains cause water quality problems.
- Excessive amounts of runoff cause problems.
- Erosion from construction sites should be controlled.
- Yard/pet waste should be managed properly.
- Lawn fertilizer should be properly applied - don't over applicate.
- Infiltration areas minimize runoff.

Activities

- Promote erosion control workshops.
- Distribute "Erosion Control for Home Builders" fact sheets with permits.
- Promote the adoption and encourage the enforcement of erosion control and storm water management ordinances.
- Presentations at local planning meetings.
- Provide information on grant fund availability for training and additional enforcement staff.
- Provide information on lawn establishment and maintenance to new home owners.
- Distribute information on urban housekeeping practices at local events (i.e. Home Show).

Goal 5: Reduce nutrients and bacteria from animal waste by providing livestock owners with information about watershed cost-sharing.

Objectives

1. Livestock producers will minimize nutrient and other polluting inputs from farming activities by adopting best management practices.

Messages

- Nutrient management planning can help you manage your farm efficiently.
- BMPs help keep nutrients on your farm.
- BMPs require regular maintenance.

Activities

- One-on-one contacts.
- Distribute information packets containing information on BMPs.

Goal 6: Reduce sediment loadings from eroding streambanks by providing information about stabilization techniques and watershed cost-sharing.

Objectives

Riparian landowners will protect and stabilize streambanks through the use of BMPs.

Messages

- Streambank stabilization practices help water quality.
- Buffers of vegetation helps protect water quality.

Activities

- One-on-one contacts with landowners that have significant streambank erosion occurring.
- Direct mailings of buffer fact sheet to riparian landowners.

- Promote/sponsor workshops that demonstrate innovative stabilization techniques.
- Involve local sportsmen and community groups in stabilization projects.

Coordination with Other Agencies and Programs

Staff from UW-Extension, DNR, DATCP, County Land Conservation Departments, and the Oneida Nation of Indians will meet regularly to coordinate activities, including information and education efforts. The Information and Education Committee should continue functioning to enhance the process, generate new ideas, and help carry out the program's objectives.

Information and education activities for this watershed will be coordinated with the Green Bay RAP, the East River Priority Watershed, and other related programs. Many of the educational materials and programs needed for this watershed have already been initiated through the East River Priority Watershed. What is needed now is an effort to distribute materials and expand the program to reach audiences in the Duck, Apple and Ashwaubenon Creeks Watershed project area. In some cases, the materials and programs need adaptations to reach Native American audiences.

Evaluation

An evaluation report of information and education activities will be prepared annually. Program evaluation will be built into program activities where feasible. Activities may be evaluated through recording the number of attendees at a function, the number of target audience members reached, event surveys or other methods.

Baseline information regarding knowledge, attitudes and behaviors of watershed residents was obtained through a random telephone survey (Knupp and Watson, Inc., May 1995). The information received became the foundation of the information and education strategy for the urban portions of the watershed. To properly evaluate the effectiveness of the I & E strategy, a follow-up phone survey should be conducted 5 years into the project to determine if urban residents have changed their behavior, attitude, knowledge and priorities regarding water quality.

The educational strategy will be updated regularly on an annual basis to identify activities to be conducted during that year. The first update will rank among the most important due to the insights gained during year one of project sign-up.

Table 8-1 Rural I&E Budget and Staff Hours

ACTIVITY	DIRECT COST	YEARS 1-3	YEARS 4-10
Newsletters	$10,000	540	600
News Releases		50	40
Public Meetings	2,000	80	360
Project Videos	1,000	50	
Fact Sheets	3,000	180	
Project Display/Exhibits	500	60	
Demo Tours, Field Days	4,000	400	400
School Programs	1,500	180	160
FFA, 4H, Scout Programs		300	600
Business Partners Program	15,000	400	400
Watershed Signs	5,000	90	180
Presentations		120	120
Informational Packets	500	150	
Water Quality Monitoring	1,000	80	120
Partnerships with Groups		40	40
Watershed Picnic	3,600	100	100
River Walk/Ride		90	180
Direct Mail	16,000	100	100
Rural Focus Group	15,000		80
Urban Phone Survey	15,000		120
Oneida Nation Canoe Landing	5,000	120	
PSA's (TV, Radio)	10,000	160	300
Storm Drain Stencilling	1,000	240	400
River/Bay Clean Up Event	5,000	120	210
Promotional Materials	2,500	360	
TOTAL	$116,600	4010	4510

Table 8-2 Urban I & E Budget and Staff Hours

ACTIVITY	DIRECT COST	YEARS 1-3	YEARS 4-10
Newsletters	$10,000	270	300
News Releases		50	40
Public Meetings	2,000	80	360
Press Kit Development	1,000	60	
Fact Sheets	3,000	180	
Project Display/Exhibits	500	100	150
Develop Business Sponsorships	500	160	
School Programs	1,500	300	500
FFA, 4H, Scout Programs		300	500
Business Partners Program	15,000	750	500
Image Planning	5,000	800	
Presentations		120	120
Informational Packets	500	150	
Water Quality Monitoring	1,000	80	120
Partnerships with Groups		40	40
Speakers Bureau	1,000	60	120
Urban River Walk/Ride		90	180
Direct Mail	16,000	100	100
Urban Phone Survey	15,000		250
PSA's (TV, Radio newspaper)	10,000	360	400
Storm Drain Stencilling	1,000	240	300
River/Bay Clean Up Event	5,000	120	210
Promotional Materials	2,500	360	
TOTAL	$90,500	4770	4190

CHAPTER NINE
Project Evaluation

This chapter briefly summarizes the plan for monitoring the progress and evaluating the effectiveness of the Duck, Apple and Ashwaubenon Creeks Priority Watershed Project. The evaluation strategy includes these components:

- Administrative review
- Pollution reduction evaluation
- Watershed Resource Evaluation Monitoring

Information on the first two components will be collected by the Outagamie County LCD, the Brown County LCD and the Oneida Nation Planning Department and will be reported on a regular basis to DNR and DATCP. The project team will meet early each 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 Assistance. The Watershed Resource Evaluation Monitoring follows guidance established by DNR's Bureau of Watershed Management to select and monitor specific sites in the watershed to monitor resource quality changes.

A final report will be prepared for the Duck, Apple and Ashwaubenon Creeks Priority Watershed Project 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. The report will be developed to evaluate progress, provide documentation on attainment of water quality and pollutant load reduction objectives, evaluate BMP effectiveness, and provide recommendations on which target key areas needing improvement in the NPS program. Outagamie County, Brown County and the Oneida Nation Planning Department will prepare the final report.

Rural Administrative Review

The first component, the Administrative Review, will focus on the progress of Outagamie County, Brown County, the Oneida Nation and other units of government in implementing the project. The project will be evaluated for accomplishments, financial expenditures and staff time.

Accomplishment Reporting

The Outagamie County, Brown County and the Oneida Nation will provide the following data to the DNR and the DATCP annually:

- Planned and completed BMPs
- Planned and completed conservation systems
- Major information and education activities undertaken

Accomplishment data are summarized in the annual Accomplishment Report prepared by DATCP and DNR, and are also discussed at annual watershed review meetings, which focus on projects in implementation. Additional evaluation data provided by Outagamie County, Brown County and the Oneida Nation for the annual watershed review include:

- Pollutant load reductions (described below)
- Status of grants and related financial activities
- Evaluation of landowner participation
- Status of project administration including data management, staff training and BMP monitoring
- Status of nutrient management planning, and easement acquisition and development
- Effectiveness of construction site erosion control activities
- Status of stormwater management activities for new development undertaken by local units of government

Participating local units of government implementing the urban nonpoint source management program meet periodically with DNR staff to review progress. The DNR and local units of government will jointly evaluate the urban implementation program. Annual reports of governmental units will include:

- Information and education activities
- Construction site erosion control ordinance amendments adopted
- Number of permits monitored for ordinance compliance
- Implementation of urban "housekeeping" program activities
- Acres of existing (* avail. survey year) urban development, by land use, covered by storm water management plans and/or practices for controlling water quality
- Acres of new (post-* avail. survey year) urban development, by land use, covered by storm water management plans and/or practices for controlling water quality
- Storm water management ordinance provisions adopted
- Evaluation of demonstration sites, including any monitoring or I & E efforts

Details of the reporting requirements are contained in DNR Publication WR-223-94, 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 NRCS. The NRCS, the DNR and the DATCP use FOCS to meet accomplishment reporting requirements of all three agencies. The Outagamie County LCD will use FOCS to collect data for administrative accomplishments and will provide the information to the DNR and the DATCP for program evaluation. Brown County and the Oneida Nation will use a county parcel-based Geographical Information System (GIS) to complete all watershed accomplishment reporting and will also provide the information to the DNR and the DATCP for program evaluation.

Financial Expenditures

Outagamie County LCD, Brown County LCD, the Oneida Nation Planning Department, and other participating units of government will provide the following financial data to the DNR and the DATCP on an annual basis:

- Number of landowner cost-share agreements signed
- Amount of money encumbered in cost-share agreements
- Number of landowner reimbursement payments made for the installation of best management practices (BMPs), and the amount of money paid
- Staff travel expenditures
- Information and education expenditures
- Expenditures for equipment, materials and supplies
- Expenditures for professional services and staff support costs
- Total project expenditures for the Outagamie County LCD, the Brown County LCD and the Oneida Nation Planning Department staff
- Amount of money paid for installation of BMPs and money encumbered in cost-share agreements

The Outagamie County LCD, Brown County LCD, the Onieda Nation Planning Department and other participating units of government will also provide the DNR with the following financial data on an annual basis:

- Staff training expenditures
- Interest money earned and expended
- Total budget and expenditures on the project

Urban Administrative Review

Accomplishment Reporting

The DNR and local units of government will jointly conduct an evaluation of the urban program components. Local units of government will report annually to the DNR on progress for core program activities. Reports will cover:

- Scheduled information and education activities.
- Completion of construction site erosion control ordinance modification or adoption.
- Acres of construction activities with adequate erosion control plans.
- Acres of construction activities monitored for compliance with provisions of ordinance and erosion control plans.
- Identification of needed changes in housekeeping.
- Implementation of housekeeping program changes.

Local units of government will report annually on progress of 'segmented' program activities. Reports will cover:

- 1995 urban acres by landuse, covered by engineering feasibility studies.
- Acres of post-1995 urban development, by land use, covered by plans for controlling urban pollutant loads and stormwater flows.
- Acres of post-1995 urban development, by land use, not covered by plans for controlling urban pollutant loads and stormwater flows.
- Stormwater ordinance adoption or modification.

In addition, represenatives of governments addressing urban pollution issues will meet wtih DNR staff annually to review progress and identify workplan objectives for the coming year.

Financial Expenditures, Time Spent on Project Activities

Reporting on these items will parallel reporting specified in this plan for the rural areas.

Urban Pollutant Load Changes

This plan endorses continuing 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 respective municipalities. The DNR will help finance these studies through the priority watershed program.

Local units of government will provide the following information annually to the DNR so that the DNR staff can evaluate changes in urban pollutant loading:

- 1995 urban acres, by land use, which urban stormwater practices serve, and information requested by DNR concerning practice characteristics.
- Acres of post-1995 urban development, by land use, served by stormwater practices, and information requested by the DNR concerning practice characteristics.
- Acres of post-1995 urban development by land use not served by stormwater practices.
- Acres of construction site activity served by adequate erosion control practices.
- Acres of construction site activity not served by adequate erosion control practices
- Changes in streambank erosion, in tons and feet of erosion, due to installation of erosion control and flow reduction practices.

Nonpoint Source Pollutant Load Reduction

The purpose of the second evaluation component, pollutant load reduction, is to estimate reductions in nonpoint source pollutants from installation of BMPs. Key sources were identified for estimating changes in pollutant loads that reach surface waters in the Duck, Apple and Ashwaubenon Creeks Watershed. Data collected for evaluation include: sediment load reduction from uplands; streambanks and gullies; reduced winter spreading of manure; and streambank (habitat) protection. Chapter Two of this plan describes target pollutant reductions for the watersheds.

Cropland Sources

Outagamie County LCD will use the WINHUSLE (Wisconsin Nonpoint Source) model to estimate sediment reductions due to changes in cropping practices. Brown County LCD and the Oneida Nation Planning Department will use a county parcel-based GIS to estimate sediment reductions due to change in cropping practices. The Outagamie County LCD will use FOCS to provide data for the WINHUSLE model on an annual basis, as described above. Brown County LCD and the Oneida Nation Planning Department will use GIS to provide data for sediment and phosphorus modeling on an annual basis, as described above.

Streambank Sources

Outagamie County LCD, Brown County LCD and the Oneida Nation Planning Department staff will estimate changes in streambank sediment erosion. A tally will be kept of landowners contacted, the amount of streambank sediment (in tons) generated at the time of contact, and changes in erosion levels estimated after installing BMPs.

Barnyard Runoff

County LCDs will use the BARNY model to estimate phosphorus reductions due to the installation of barnyard control practices. Outagamie County will report the information to the DNR through FOCS. Brown County LCD and the Oneida Nation Planning Department will report the information to the DNR through GIS. In the event that FOCS is replaced, the replacement system will be used for all project tracking in Outagamie County.

Construction Sites

Local units of government participating in the urban implementation program will 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.

Urban Areas

Local units of government will report annually to the DNR on any activities that may result in changes in urban pollutant loadings. Such activities include acres of existing (1996) and new (post-1997) urban land, by land use, served by new storm water BMPs; new urban lands, by land use, not served by storm water BMPs; and other information requested by the DNR concerning BMP characteristics.

Water Resource Evaluation Monitoring

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 evaluation monitoring activities is to determine the progress the Nonpoint Source Program is making towards improving the quality of Wisconsin's water resources. Evaluation monitoring activates were developed to answer five questions about the water resource objectives and the pollution reduction goals:

1) Do the levels and types of best management practices recommended in the watershed plans achieve the water resource objectives?

2) Do the types and levels of best management practices recommended in the watershed plans achieve the pollutant reduction goals?

3) Does any level of practice installation below 100 percent achieve the water resource objectives or the pollutant reduction goals?

4) Do we need to adjust the pollutant load reduction goals to achieve the water resource objectives?

5) Can we use simple environmental indicators in many of the watershed projects to provide some early evidence that the practices might achieve the water resource objectives and pollutant reduction goals?

A team of experts from state and federal agencies and the University of Wisconsin was formed to develop and direct evaluation monitoring activities at Whole Stream Monitoring and Signs of Success sites.

Whole Stream Monitoring Sites

Criteria were developed to select and monitor 12 streams around the state. The stream sites represent the 5 major types of fisheries found in the agricultural and urban poritons of priority watersheds, as well as 3 of the 5 ecoregions 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 stormsewer outfall is also being monitored. The ecoregion types represented are the Southeastern Wisconsin Till Plain, the Driftless Area, and the North Central Hardwood Forest.

All but one of the stream sites drains a small area (about 10 square miles or less). The schedule involves 2 years of monitoring before any BMPs are installed; 5 years of monitoring during the practice installation phase; 2 years of monitoring during the response period, and 2 years of monitoring during the post-practice installation phase, for a total of 11 years of monitoring.

State-of-the-art chemical and physical monitoring is conducted at all stream sites. State-of-the-art biological monitoring will be done at 8 of the 12 streams. Results of the monitoring will be used to determine how well the best management practices achieve pollution reduction goals and objectives. Improving the fish community is the highest priority water resource objective for all the streams.

A total of about $8,360,000 would be needed for the stream monitoring, if the work is carried out over a period of 11 years. The success of the evaluation monitoring activities depends on the installation of all the BMPs at the Whole Stream Monitoring Sites.

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APPENDIX A

The Wisconsin DNR, in conjunction with the USGS, has been sampling stormwater dischrges throughout Wisconsin and some neighboring states to characterize event mean concentrations of stormwater pollutants. One method of interpreting these conentrations is to compare them to discharge standards established for industrual and municipal point sources. This comparison is only meant to provide some perspective on the degree of stormwater contamnation that is being observed. Whether or not these discharges will actually exert a toxicity response amongst organisms living in or using the receiving waters is a case by case phenomenon dependent upon a number of other factors taht are complexely intertwined. It is well documented, however, that:

- Urban streams are often degraded, showing poor substrate; unstale stream flows;eroding and unstable streambanks; elevated levels of stormwater pollutantsi n water, sediment and animal tissue; poor diversity and abundance of aquatic life; loss of aesthetic value.
- Concentrations of urban pollutants are relatively high in stormwater idscharges and occasionally exert acute toxicity in text organisms exposed tostormwater effluents.
- The urban stream environmental can be very toxic, with complete mortality observed in test organisms exposed to stream water.
- We have a long way to go in understanding exactly what the cauea dn patheways of toxicity are, or what the thresholds are for inducing toxicity.

Appendix G shows the probability that event mean concentrations measured in stormsewers will exceed point source discharge criteria and the probabiliuty that steam concentrations will violate Wisocnsin water quality criteria. These data were collected between 1989 and 1994.

Storm sewers were located in:

Muncipality	Residential	Commercial	Industrial	Open space
Madison	√	√	√	
Milwaukee	√			
West Allis	√	√	√	
Marquette, MI	√	√	√	√
Superior		√		

Urban streams that were sampled included:

Stream	Residential	Commercial	Industrial	Open Space	Institutional	Freeway	Rural
Noyes Creek, Michigan	√	√	√	√	√	√	
Underwood Ck, West Allis, WI	√	√	√	√	√		√
Lincoln Creek, Milwaukee, WI	√	√	√	√			
Menomonee R., Wisconsin	√	√	√	√	√	√	√

Data was pooled within both analyses. Cooper and zinc most often exceeded acute toxicity criteria for storm sewers and streams. Nine PAHs and DDT frequently exceeded human cancer criteria for storm sewer discharges, and industrial wastewater discharge permits were frequently exceeded. Fecal coliform counts frequently exceeded standards for discharges and receiving waters. Pthalate esters and PCB most fequently exceeded the groundwater enforcement standards.

From: *Quality of Wiconsin Stormwater,* 1989-1994. Roger Bannerman, Andrew D. Legg and Seven R. Greb, 1996. Open File Report, 96-458. Prepared in cooperation with the WDNR.

APPENDIX B
Leaking Underground Storage Tanks (LUSTs)

The following LUST list is dynamic and frequently updated. Please contact the DNR for a current list of sites. At the time this plan was written in 1996, there were roughly 300 known LUST sites in the watershed. Of these, 228 were located in Outagamie County (112 in Appleton) and 164 in Brown County (134 in Green Bay).

Lust Sites in the Duckand Ashwaubenon Creeks and Duck Creek Priority Watersheds

Site Name	Address	City	County	Q
K-C AVIATION INC	301 DISCOVERY DR	APPLETON	Outagamie	
K-C AVIATION INC	301 DISCOVERY DR	APPLETON	Outagamie	
AUGUST WINTER AND SONS INC	2323 N ROEMER RD	APPLETON	Outagamie	
APPLETON AREA SCHOOL DISTRICT	531 N MORRISON ST	APPLETON	Outagamie	
ARK GARD CONTROLS INC	600 MOASIS DR	LITTLE CHUTE	Outagamie	
TECHNI-FLEX INC	801A W BLUEMOUND DR	APPLETON	Outagamie	
ALLIS MINERAL SYSTEMS	2600 ROEMER RD	APPLETON	Outagamie	
AMERITECH BALLARD GARAGE PO108	1601 N BALLARD RD	APPLETON	Outagamie	
EMRO STATION 2056	2501 W WISCONSIN AVE	APPLETON	Outagamie	
ST ELIZABETH HOSPITAL INC	1506 SO ONEIDA ST	APPLETON	Outagamie	
RANDALLS	3815 W WISCONSIN AVE	APPLETON	Outagamie	
FORE WAY EXPRESS INC	2240 W SPENCER RD	APPLETON	Outagamie	
FORE WAY EXPRESS INC	2240 W SPENCER RD	APPLETON	Outagamie	
PENSKE TRUCK LEASING CO LP	3111 W WISCONSIN AVE	APPLETON	Outagamie	
BUSY BEE CAR WASH	1714 E WISCONSIN AVE	APPLETON	Outagamie	
VALLEY PACKAGING INDUSTRIES IN	1325 S PERKINS ST	APPLETON	Outagamie	
APPLETON CITY OF MUNICIPAL SERVICE BLDG	2625 E GLENDALE AVE	APPLETON	Outagamie	
SULPACO WEST	600 E HANCOCK ST	APPLETON	Outagamie	
GAS STOP	1717 W COLLEGE AVE	APPLETON	Outagamie	
GAS STOP	1717 W COLLEGE AVE	APPLETON	Outagamie	
FOX VALLEY CAB	437 W FRANKLIN	APPLETON	Outagamie	
FOX VALLEY TECHNICAL COLLEGE	1825 N BLUEMOUND DR	APPLETON	Outagamie	
K MART	2400 W COLLEGE AVE	APPLETON	Outagamie	
SUPERIOR ELECTRIC CO	1825 W HIGHLAND AVE	APPLETON	Outagamie	
OUTAGAMIE CNTY HWY DEPT	3302 W BREWSTER ST	APPLETON	Outagamie	
ASTEN FORMING FABRICS INC	6840 W COLLEGE AVE	APPLETON	Outagamie	
LANGSTADT ELECTRIC SUPPLY CO	1524 W CIVIC ST	APPLETON	Outagamie	
CLOUD BUICK CO INC	2445 W COLLEGE AVE	APPLETON	Outagamie	
OUTAGAMIE CNTY HEALTH CTR	3400 W BREWSTER	APPLETON	Outagamie	
STOKELY USA INC	1820 W 8TH ST	APPLETON	Outagamie	
PIERCE MFG INC	315 S PIERCE ST	APPLETON	Outagamie	
CHASKA GOLF COURSE	HWYS 45/10	APPLETON	Outagamie	
KWIK TRIP 2733	1342 PROSPECT AVE	APPLETON	Outagamie	
RIVERSIDE PAPER CO	110 N KENSINGTON DR	APPLETON	Outagamie	

38	ATHENA CORP	200 W WISCONSIN AVE	APPLETON	Outagamie
39	ENTERPRISE MOTORCARS INC	1990 VAN DYKE RD	APPLETON	Outagamie
40	EXPRESS CONVENIENCE CTR	2811 E NEWBERRY ST	APPLETON	Outagamie
41	SHELF & DINING FURNITURE LTD	4790 W WISCONSIN AVE	APPLETON	Outagamie
42	APPLETON PAPERS INC	115 N KENSINGTON	APPLETON	Outagamie
43	FOXLAND HARVESTORE	1400 ROSEHILL RD	LITTLE CHUTE	Outagamie
44	DAVES AUTO SALES SERV	500 S MADISON AVE	LITTLE CHUTE	Outagamie
45	WARA ENTERPRISES DBA RICHMOND SVC	1601 N RICHMOND ST	APPLETON	Outagamie
46	SUNRISE DONUTS BAKERY & RESTAURANT	2025 N RICHMOND ST	APPLETON	Outagamie
47	BUTTE DES MORTES GOLF COURSE	1411 S BLUEMOUND ST	APPLETON	Outagamie
48	WI ELECTRIC POWER CO	800 S LYNNDALE DR	APPLETON	Outagamie
49	A C COMPRESSOR CORP	401 E SOUTH ISLAND ST	APPLETON	Outagamie
50	CENTER VALLEY COOP	1900 BOHM DR	LITTLE CHUTE	Outagamie
51	GRIESBACH EQUIPMENT INC	1334 W WISCONSIN AVE	APPLETON	Outagamie
52	ARATEX SERVICES INC	1610 W WASHINGTON ST	APPLETON	Outagamie
53	PIERCE MFG INC	3100 N MCCARTHY RD	APPLETON	Outagamie
54	HUDSON ENERGY	3641 W COLLEGE AVE	APPLETON	Outagamie
55	NORTHGATE 76	105 W NORTHLAND AVE	APPLETON	Outagamie
56	TRI CNTY DISTRIBUTORS PART L T	1341 W SPENCER ST	APPLETON	Outagamie
57	TRUCK COUNTRY OF WISCONSIN	700 RANDOLPH DR	APPLETON	Outagamie
58	MILLER ELECTRIC MFG CO	1635 W SPENCER ST	APPLETON	Outagamie
59	EXPRESS CONVENIENCE CTR	303 W MAIN ST	LITTLE CHUTE	Outagamie
60	EXPRESS CONVENIENCE CTR	303 W MAIN ST	LITTLE CHUTE	Outagamie
61	APPLETON WASTEWATER TREATMENT PLT	59 WEIMAR COURT	APPLETON	Outagamie
62	ATHENA CORP	200 W WISCONSIN AVE	APPLETON	Outagamie
63	CROWN AUTO INC	2600 W COLLEGE AVE	APPLETON	Outagamie
64	CLARK OIL STATION #1621	409 E WISCONSIN AVE	APPLETON	Outagamie
65	U S POSTAL SERVICE	410 W FRANKLIN ST	APPLETON	Outagamie
66	BUTCHS AUTO BODY	1337 E NORTHLAND AVE	APPLETON	Outagamie
67	APPLETON AREA SCHOOL DISTRICT	2121 EMMERS DR	APPLETON	Outagamie
68	JACK & DICKS SERVICE STATION	1818 LOCUST ST	APPLETON	Outagamie
69	APPLETON OIL	1200 W WISCONSIN AVE	APPLETON	Outagamie
70	APPLETON OIL	1200 W WISCONSIN AVE	APPLETON	Outagamie
71	HOFFMASTER APPLETON	1200 S PERKINS ST	APPLETON	Outagamie
72	BARTELT INSULATION SUPPLY INC	1330 N BALLARD RD	APPLETON	Outagamie
73	MENARDS	4350 GREENVILLE DR	APPLETON	Outagamie
74	VOITH SULZER PAPER TECHNOLOGY INC	2200 N ROEMER RD	APPLETON	Outagamie
75	BAUR TRUCK & EQUIPMENT	2520 W WISCONSIN AVE	APPLETON	Outagamie
76	MEYER SERV INC	4520 GREENVILLE DR	APPLETON	Outagamie
77	VAN ZEELAND TIRE & AUTO	SE CORNER OF CTH OO & CTH N	LITTLE CHUTE	Outagamie
78	U PUMP	1306 ONEIDA ST	APPLETON	Outagamie

79	SUPERIOR ELECTRIC CO	1825 W HIGHLAND AVE	APPLETON	Outagamie
80	VALLEY CAST INC	908 N LAWE ST	APPLETON	Outagamie
81	PENSKE TRUCK LEASING CO LP	3111 W WISCONSIN AVE	APPLETON	Outagamie
82	VAN ZEELAND PROPERTY	1754 FREEDOM RD	LITTLE CHUTE VIL	Outagamie
83	KRAY'S SERVICE	1235 W WISCONSIN AVE	APPLETON	Outagamie
84	KRAY'S SERVICE	1235 W WISCONSIN AVE	APPLETON	Outagamie
85	FOX VALLEY TRUCK SERVICE INC	3103 W WISCONSIN	APPLETON	Outagamie
86	FOX VALLEY TRUCK SERVICE INC	3103 W WISCONSIN	APPLETON	Outagamie
87	FOX VALLEY TRUCK SERVICE INC	3103 W WISCONSIN	APPLETON	Outagamie
88	SCHULTZ ROBERT RESIDENCE	525 N DURKEE ST	APPLETON	Outagamie
89	APPLETON MEDICAL CTR	1818 N MEADE ST	APPLETON	Outagamie
90	TREASURE ISLAND	3305 W COLLEGE AVE	APPLETON	Outagamie
91	ZAUG'S INC	4100 W WISCONSIN AVE	APPLETON	Outagamie
92	GLENDALE WAREHOUSE CO.	2430 E GLENDALE	APPLETON	Outagamie
93	ROBERTS DOROTHY ESTATE	427 W PROSPECT AVE	APPLETON	Outagamie
94	BANK ONE PROP	405 N APPLETON ST	APPLETON	Outagamie
95	EXPRESS CONVENIENCE CTR	1201 N BADGER AVE	APPLETON	Outagamie
96	OPEN PANTRY	111 W WISCONSIN AVE	APPLETON	Outagamie
97	CONTINENTAL GRAIN	1915 W EDGEWOOD DR	APPLETON	Outagamie
98	HAHNS LANES	618 W WISCONSIN AVE	APPLETON	Outagamie
99	APPLETON PARKS & REC DP	1819 NORTHFIELD BLVD	APPLETON	Outagamie
100	NORTHLAND OIL CO	2722 N RICHMOND AVE	APPLETON	Outagamie
101	VALLEY TRANSIT	801 WHITMAN AVE	APPLETON	Outagamie
102	CHICAGO CORNER STORE	N6099 CTH H	DEPERE	Outagamie
103	FULTON AUTO HAAS TRANS	540 N ONEIDA ST	APPLETON	Outagamie
104	ZENTNERS AMOCO	3640 W COLLEGE AVE	APPLETON	Outagamie
105	FOX VALLEY TECHNICAL COLLEGE	1825 N BLUEMOUND DR	APPLETON	Outagamie
106	APPLETON POLICE DEPT	222 S WALNUT ST	APPLETON	Outagamie
107	GLASLITE INDUSTRIES INC	1861 W COMMERCIAL ST	APPLETON	Outagamie
108	ONEIDA ONE STOP CONVENIENCE STOR	INT HWY 54 & SEMINARY RD	ONEIDA	Outagamie
109	ONEIDA ONE STOP CONVENIENCE STOR	INT HWY 54 & SEMINARY RD	ONEIDA	Outagamie
110	GRISHABER SERVICE STATION	1404 E SOUTH RIVER ST	APPLETON	Outagamie
111	CLARK OIL STATION #1503	2220 NEWBERRY ST	APPLETON	Outagamie
112	HAHNS LANES	618 W WISCONSIN AVE	APPLETON	Outagamie
113	SUPERAMERICA #4168	415 S MEMORIAL DR	APPLETON	Outagamie
114	GRAFFS AUTO TRANSMISSION	1109 E WISCONSIN AVE	APPLETON	Outagamie
115	CUSTOM MEAT INDUSTRIES	3220 E NORTHLAND AVE	APPLETON	Outagamie
116	FREIMUTH MASONRY INC	951 N PERKINS	APPLETON	Outagamie
117	SCHAETZEL EDMUND FARM	W7045 W SPENCER RD	APPLETON	Outagamie
118	WI ELECTRIC POWER CO	800 S LYNNDALE DR	APPLETON	Outagamie
119	KURZ & ROOT CO	232 E N ISLAND ST	APPLETON	Outagamie

120	APPLETON CITY OF MUNICIPAL SERVICE BLDG	2625 E GLENDALE AVE	APPLETON	Outagamie
121	OUTAGAMIE CNTY HEALTH CTR	3400 W BREWSTER	APPLETON	Outagamie
122	EXPRESS CONVENIENCE CTR	800 E WISCONSIN AVE	APPLETON	Outagamie
123	HERB KETTER TRUCKING	1719 E EDGEWOOD DR	APPLETON	Outagamie
124	MOBIL STATION	2221 N FREEDOM RD	LITTLE CHUTE	Outagamie
125	FOX VALLEY TRUCK SERVICE INC	3103 W WISCONSIN	APPLETON	Outagamie
126	MACHINERY AND SUPPLIES	114 N OUTAGAMIE ST	APPLETON	Outagamie
127	BEHM MOTORS INC	3939 W COLLEGE AVE	APPLETON	Outagamie
128	CONSOLIDATED CONSTRUCTION CO	4300 N RICHMOND ST	GRAND CHUTE TN	Outagamie
129	ALL AMERICAN	2138-40 W WISCONSIN AVE	GRAND CHUTE TN	Outagamie
130	STOKELY USA INC	1820 W 8TH ST	APPLETON	Outagamie
131	ZAUG'S INC	4100 W WISCONSIN AVE	APPLETON	Outagamie
132	APPLETON CTY PROPERTY	4810 N BALLARD RD	APPLETON	Outagamie
133	TOTAL RENTAL INC	1900 E MAIN ST	LITTLE CHUTE VIL	Outagamie
134	ONEIDA TRIBE OF INDIANS OF WISCONSIN	W1131 RANCH RD	ONEIDA TN	Outagamie
135	ONEIDA TRIBE OF INDIANS OF WISCONSIN	N5772 CTH H	DEPERE TN	Outagamie
136	DODGE, MARY	N7345 CTH U	ONEIDA TN	Outagamie
137	DINO STOP	1828 ASHLAND AVE	GREEN BAY	Brown
138	BROWN CNTY HWY DEPT	2198 GLENDALE AVE	GREEN BAY	Brown
139	SCHNEIDER TRANSPORT INC	2661 S BROADWAY	GREEN BAY	Brown
140	WI DOC GREEN BAY	HWY 172 & RIVERSIDE DR	GREEN BAY	Brown
141	RECYCLED FIBERS DIV GREEN BAY PLANT	940 PRAIRIE AVE	GREEN BAY	Brown
142	GREEN BAY CTY WATER UTILITY	631 S ADAMS ST	GREEN BAY	Brown
143	WIS LIFT TRUCK CORP	3049 S RAMADA WAY	GREEN BAY	Brown
144	STADIUM SHELL	1221 LOMBARDI AVE	GREEN BAY	Brown
145	LEICHT TRANSFER & STORAGE CO	1401-55 STATE ST	GREEN BAY	Brown
146	JAEGER BAKING CO	977 N MILITARY AVE	GREEN BAY	Brown
147	BROWN WILBERT INC	1155 SCHEURING RD	DEPERE	Brown
148	BARK RIVER CULVERT & EQUIPMENT	600 LIBERTY ST	GREEN BAY	Brown
149	CITY WIDE INSULATION OF GREEN BAY INC	827 MARQUIS WAY	GREEN BAY	Brown
150	DE PERE FOUNDRY INC	805 S SIXTH ST	DEPERE	Brown
151	AMOCO OIL SS15812	1151 W MASON ST	GREEN BAY	Brown
152	CORROSION TECHNOLOGY INC	2141 WOODALE AVE	GREEN BAY	Brown
153	BUSY BEE CONVENIENCE MART	1754 MEMORIAL DR	GREEN BAY	Brown
154	BUSY BEE CONVENIENCE MART	1754 MEMORIAL DR	GREEN BAY	Brown
155	LITTLE STORE THE	2590 UNIVERSITY AVE	GREEN BAY	Brown
156	LCL TRANSIT CO	949 ADVANCE	GREEN BAY	Brown
157	NORTHWEST ENGINEERING CO INC	201 W WALNUT ST	GREEN BAY	Brown
158	SCHNEIDER TRANSPORT INC	817 MCDONALD ST	GREEN BAY	Brown
159	ST VINCENT HOSPITAL	835 S VAN BUREN ST	GREEN BAY	Brown
160	JAMES RIVER PAPER CO INC	500 DAY ST	GREEN BAY	Brown

161	ADVANCE BUSINESS DEV CTR	835 POTTS AVE	GREEN BAY	Brown
162	TNT CRUST	1438 CEDAR ST	GREEN BAY	Brown
163	BROWN CNTY HWY COMM	HWY 54	NEW FRANKEN	Brown
164	STANG WIS CORP	972 VELP AVE	GREEN BAY	Brown
165	GEO M HOUGARD & SONS INC	1045 LAKE ST	GREEN BAY	Brown
166	ROADWAY EXPRESS	3185 MARKET ST	GREEN BAY	Brown
167	BUDS SPUR FAST FOOD MART	1872 SHAWANO AVE.	GREEN BAY	Brown
168	AVIS RENT-A-CAR	2077 AIRPORT DR	GREEN BAY	Brown
169	GREEN BAY FOOD CO	857 SCHOOL PL	GREEN BAY	Brown
170	CITGO MINI MART	1530 MAIN ST	GREEN BAY	Brown
171	LOOMIS ARMOURED	603 S ONEIDA ST	GREEN BAY	Brown
172	TRI-STAR SERVICE CTR	1869 SHAWANO AVE	GREEN BAY	Brown
173	WIS CENTRAL RR	901 5TH ST	GREEN BAY	Brown
174	JEFFS MARATHON	1372 E MASON	GREEN BAY	Brown
175	GREEN & GOLD CONCRETE INC	2100 LARSEN RD	GREEN BAY	Brown
176	VELP AUTO & RV SALES INC	1629 VELP AVE	GREEN BAY	Brown
177	VELP AUTO & RV SALES INC	1629 VELP AVE	GREEN BAY	Brown
178	VAN BOXTEL FORD JEEP EAGLE	1010 S MILITARY AVE	GREEN BAY	Brown
179	U W GREEN BAY	2420 NICOLET DR	GREEN BAY	Brown
180	ST VINCENT DEPAUL SOCIETY	1529 WEBSTER CT	GREEN BAY	Brown
181	ST VINCENT DEPAUL SOCIETY	1529 WEBSTER CT	GREEN BAY	Brown
182	CHICO'S SUPER SERVICE	404 MATHER ST	GREEN BAY	Brown
183	CHICO'S SUPER SERVICE	404 MATHER ST	GREEN BAY	Brown
184	VAN ESS CONCRETE BLOCK INC	1156 VELP AVE	GREEN BAY	Brown
185	HOWARD VIL	2456 GLENDALE AVE	GREEN BAY	Brown
186	MASS ADVERTISING INC	112 S PEARL ST	GREEN BAY	Brown
187	AMPI MORNING GLORY DAIRY	3399 S RIDGE RD	DEPERE	Brown
188	DE PERE MINI MART	821 GEORGE ST	DEPERE	Brown
189	DEPERE MOBIL SERVICE CTR	746 MAIN AVE	DEPERE	Brown
190	PORT PLAZA AUTO	615 MATHER	GREEN BAY	Brown
191	PORT PLAZA AUTO	615 MATHER	GREEN BAY	Brown
192	BUERGI & MADDEN SCALE CO.	1322 RUSSETT COURT	HOWARD VIL	Brown
193	EXPRESS CONVENIENCE CTR	2031 S ONEIDA ST	GREEN BAY	Brown
194	POLK DIESEL & MACHINE INC	2851 ALLIED DR	GREEN BAY	Brown
195	POLK DIESEL & MACHINE INC	2851 ALLIED DR	GREEN BAY	Brown
196	MEDIX	969 WAUBE LN	GREEN BAY	Brown
197	COCA-COLA BOTTLING CO.	2523 S ONEIDA	ASHWAUBENON	Brown
198	PHILLIPS EDWIN RESIDENCE	762 S VANDENBERG RD	GREEN BAY	Brown
199	CONDON OIL	1031 LOMBARDI AVE	GREEN BAY	Brown
200	C & D MOBIL	2429 UNIVERSITY AVE	GREEN BAY	Brown
201	WI DOT	HWY 41, 10 MI S OF DEPERE	DEPERE	Brown

202	UNITED PARCEL SERVICE	2412 HUTSON	GREEN BAY	Brown
203	EMERY WORLDWIDE	3080 MARKET ST	GREEN BAY	Brown
204	E-Z GO FOOD MART	401 MATHER ST	GREEN BAY	Brown
205	BROWN CNTY HWY DEPT	2198 GLENDALE AVE	GREEN BAY	Brown
206	WIESE BROTHERS FARM	7043 BUNKER HILL RD	GREENLEAF	Brown
207	WIS KENWORTH & GMC	580 POTTS AVE	GREEN BAY	Brown
208	CLIFF WALL MOTOR SALES INC	1988 E MASON ST	GREEN BAY	Brown
209	GREEN BAY CTY OF	130 N HENRY ST	GREEN BAY	Brown
210	GREEN BAY FIRE STATION NO 3	885 SHAWANO AVE	GREEN BAY	Brown
211	SCHOTT MILK TRANSIT GERALD L	3777 SHIRLEY RD	DE PERE	Brown
212	BROWN CNTY HWY DEPT	2198 GLENDALE AVE	GREEN BAY	Brown
213	PROCTER & GAMBLE PAPER PRODUCTS CO	501 EASTMAN AVE	GREEN BAY	Brown
214	FORT HOWARD CORP	1919 S BROADWAY	GREEN BAY	Brown
215	BROWN CNTY HWY DEPT	2198 GLENDALE AVE	GREEN BAY	Brown
216	C A LAWTON	233 N BROADWAY	DEPERE	Brown
217	ROMO INC SCREEN PRINTERS	139 S WASHINGTON ST	GREEN BAY	Brown
218	BELLEVUE FOOD MARKET	3222 MANITOWOC RD	GREEN BAY	Brown
219	GREEN BAY CTY PARKS DEPT SHOP	919 CROCKER ST	GREEN BAY	Brown
220	ST NORBERT ABBEY	1016 N BROADWAY	DEPERE	Brown
221	BROADWAY CHEVROLET OLDS INC	2700 S ASHLAND	GREEN BAY	Brown
222	RYDER TRUCK RENTAL	711 HANSON RD	GREEN BAY	Brown
223	SUPERAMERICA #4218	1300 S MILITARY AVE	GREEN BAY	Brown
224	SUPER STOP QWIK MART	871 HANSEN RD	GREEN BAY	Brown
225	CONDON COMPANIES	3907 S WEBSTER ST	GREEN BAY	Brown
226	PACKERLAND PACKING	1330 LIME KILN RD	GREEN BAY	Brown
227	GAS STOP	601 N MILITARY AVE	GREEN BAY	Brown
228	JOHN RYAN INC	2300 AUTO PLAZA WAY	GREEN BAY	Brown
229	STOCK LUMBER CO INC	1990 LARSEN RD	GREEN BAY	Brown
230	MENARDS	905 WAUBE LN	GREEN BAY	Brown
231	WRIGHTSTOWN VIL	420 WASHINGTON ST	WRIGHTSTOWN	Brown
232	NORTHEAST WISCONSIN TECHNICAL COLLEGE	2740 W MASON ST	GREEN BAY	Brown
233	CONWAY CENTRAL EXPRESS	2666 GROSS AVE	GREEN BAY	Brown
234	ALL SEASONS POOLS & SPAS	2651 S ONEIDA ST	GREEN BAY	Brown
235	BADGER SHEET METAL WORKS	420 S BROADWAY	GREEN BAY	Brown
236	D & G EXCAVATING	805 CORMIER RD	GREEN BAY	Brown
237	QUIK MART 30490	1165 W MASON ST	GREEN BAY	Brown
238	BROWN CNTY REFORESTATION CAMP	4418 REFORESTATION RD	GREEN BAY	Brown
239	HALRON OIL CO INC	1618 STATE ST	GREEN BAY	Brown
240	FORE WAY EXPRESS INC	1009 ADVANCE ST	GREEN BAY	Brown
241	AUTOMATIC MOTORS	626 N BROADWAY ST	GREEN BAY	Brown
242	BAY WEST PROFESSIONAL ARTS BLD	1061 W MASON	GREEN BAY	Brown

243	GENES DEEP ROCK	1792 MAIN ST	GREEN BAY	Brown
244	QUIK MART 30491, SOUTHLAND CORP	1180 E MASON ST	GREEN BAY	Brown
245	NORTHEAST WISCONSIN TECHNICAL COLLEGE	2740 W MASON ST	GREEN BAY	Brown
246	AUSTIN STRAUBEL INTERNATIONAL AIRPORT	2077 AIRPORT DR	HOBART/ASHWAUBENON	Brown
247	SUPERAMERICA #4101	952 W MASON ST	GREEN BAY	Brown
248	UNITED PARCEL SERVICE	2412 HUTSON	GREEN BAY	Brown
249	BROWN COUNTY GOLF COURSE	897 RIVERDALE DR	ONEIDA	Brown
250	WI DOT GREEN BAY HWY GARAGE	944 VANDERPERREN WAY	GREEN BAY	Brown
251	GREEN BAY CTY MUNICIPAL GARAGE EAST	1820 MILLS ST	GREEN BAY	Brown
252	JAYMAR SCREEN PRINTERS INC	1014 PARKVIEW RD	GREEN BAY	Brown
253	U S POSTAL SERVICE	300 PACKERLAND DR	GREEN BAY	Brown
254	WEST CENTRAL AUTO SERVICES	605 DOUSMAN ST	GREEN BAY	Brown
255	WHITEFIELD AUTO BODY	750 HANSEN RD	GREEN BAY	Brown
256	U S OIL CO INC	1910 N QUINCY AVE	GREEN BAY	Brown
257	U S POSTAL SERVICE	300 PACKERLAND DR	GREEN BAY	Brown
258	VAN BOXTEL FORD JEEP EAGLE	1010 S MILITARY AVE	GREEN BAY	Brown
259	WI DOC GREEN BAY	HWY 172 & RIVERSIDE DR	GREEN BAY	Brown
260	DOWNTOWN AUTO SERVICE	434 E WALNUT ST	GREEN BAY	Brown
261	SHINE SHOP, THE	714 S FISK ST	GREEN BAY	Brown
262	SCHREIBER FOODS INC	1607 MAIN ST	GREEN BAY	Brown
263	NORTHEAST WISCONSIN TECHNICAL COLLEGE	2740 W MASON ST	GREEN BAY	Brown
264	WI PUBLIC SERVICE CORP	600 N ADAMS ST	GREEN BAY	Brown
265	SEARS ROEBUCK AND CO #2112	1555 GREEN BAY PLAZA	GREEN BAY	Brown
266	U S NAVAL MARINE CORPS RES TRN CTR	2949 RAMADA WAY	GREEN BAY	Brown
267	GAUTHIER TRUCKING INC	344 HENRY ST	GREEN BAY	Brown
268	HARRISON ENGINE & MACHINE INC	1140 S BROADWAY	GREEN BAY	Brown
269	PBBS EQUIPMENT CORP	1901 VELP AVE	HOWARD VIL	Brown
270	PACKERLAND PACKING	1330 LIME KILN RD	GREEN BAY	Brown
271	PACKERLAND PACKING	1330 LIME KILN RD	GREEN BAY	Brown
272	PENSKE TRUCK LEASING CO LP	2590 GROSS AVE	GREEN BAY	Brown
273	DALES SPUR SERVICE	500 W WALNUT	GREEN BAY	Brown
274	ZELTEN SMALL ENGINE REPAIR	1934 DICKINSON AVE	LEDGEVIEW TN	Brown
275	SUPERAMERICA #4094	610 E WALNUT ST	GREEN BAY	Brown
276	CLARKLIFT OF NORTHERN WI	2770 ASHLAND AVE	GREEN BAY	Brown
277	GUSTMAN PONTIAC MAZDA	811 PILGRIM WAY	GREEN BAY	Brown
278	LAMERS BUS LINES	2407 SOUTH POINT RD	ASHWAUBENON VIL	Brown
279	LAIDLAW JELCO WISC	1840 LIME KILN RD	GREEN BAY	Brown
280	WI DOC GREEN BAY	HWY 172 & RIVERSIDE DR	GREEN BAY	Brown
281	JAVCO INC	1116 TERRY LN	DEPERE	Brown
282	EXPRESS CONVENIENCE CTR	606 W DOUSMAN	GREEN BAY	Brown
283	EXPRESS CONVENIENCE CTR	1618 VELP AVE	GREEN BAY	Brown

284	MURPHY CONSTRUCTION CO	1205 LAWRENCE DR	DEPERE	Brown
285	PROGRESSIVE FARMERS COOP	548 BUTLER ST	DEPERE	Brown
286	DEPERE MOBIL SERVICE CTR	746 MAIN AVE	DEPERE	Brown
287	EXPRESS CONVENIENCE CTR	1356 BELLEVUE ST	GREEN BAY	Brown
288	COUNTRY EXPRESS	2601 MONROE RD	DEPERE	Brown
289	HOWARD OIL CO	2002 VELP AVE	HOWARD VIL	Brown
290	DOUCAS CYCLE INC	2640 S ASHLAND AVE	GREEN BAY	Brown
291	BROOKS OIL	531 MAN-CAL RD	HOLLAND TN	Brown
292	BROOKS OIL	531 MAN-CAL RD	HOLLAND TN	Brown
293	WESTERFIELD MOBIL STATION	113 WISCONSIN ST	PULASKI VIL	Brown
294	PULASKI-CHASE COOP	428 THIRD	PULASKI VIL	Brown
295	DEBAUCHE CLARENCE PROPERTY	809 N TAYLOR	GREEN BAY	Brown
296	CIRCLE T PLAZA	3720 DUTCHMAN RD	LEDGEVIEW TN	Brown
297	AMOCO SERVICE STATION #18734	1465 UNIVERSITY AVE	GREEN BAY	Brown
298	HENDRICKS CONST CO	2701 CALAWAY DR	ASHWAUBENON VIL	Brown
299	SEILTZ PROPERTY	4364 LANGES CORNER RD	GLENMORE TN	Brown
300	SHIPYARD MARINE	1212 MARINE ST	GREEN BAY	Brown
301	SHIPYARD MARINE	1212 MARINE ST	GREEN BAY	Brown

APPENDIX C
Spill Sites

There have been roughly 250 reported spills in the watershed between 1978 and 1995. Of these, 166 occurred in Brown County and 83 occurred in Outagamie County. Generally, reported spills per year have increased over time in Brown County, to reach 20 reported spills in 1995, compared to 2 reported spills in 1978. This discrepancy may have occurred for a variety of reasons, including greater public awareness.

Spill Sites in the Apple and Ashwaubenon Creeks and Duck Creek Priority Watersheds

Date	County	Destination	City	Cause
04/23/78	BROWN	SOIL	GREEN BAY	LEAK IN PIPELINE
12/26/78	BROWN	SOIL	GREEN BAY	TRUCK ACCIDENT
03/01/79	BROWN	SOIL	GREEN BAY	RUPTURED TRANSFORMER
04/11/79	BROWN	SOIL	GREEN BAY	SPILLED WHILE FILLING HEATING UNIT
06/05/79	BROWN	SOIL	HOWARD	TRUCK ACCIDENT
06/07/79	BROWN	SOIL		ACCIDENT, RUPTURED SADDLE TANKS
01/22/80	BROWN	SOIL	GREEN BAY	DYE THROWN INTO GUTTER
02/19/80	BROWN	SOIL	GREEN BAY	LEAK IN TANK
05/05/80	BROWN	SOIL	GREENLEAF	ACCIDENT
06/20/80	BROWN	SOIL	GREEN BAY	RR ENGINE RUPTURED FUEL TANK
06/24/80	BROWN	SOIL	GREEN BAY	LEAK AT A FLANGE COUPLING
07/07/80	BROWN	SOIL	GREEN BAY	FAULTY TANK ON TRUCK
07/29/80	BROWN	SOIL	GREEN BAY	FLANGE GASKET WORE OUT
01/02/81	BROWN	SOIL	GREEN BAY	RUPTURED LINE ON TRAILER
01/29/81	BROWN	SOIL	GREEN BAY	ACCIDENT, SADDLE TANK RUPTURED
04/20/81	BROWN	SOIL	DEPERE	PROBABLY OVERFILL OF STORAGE TANK
05/15/81	BROWN	SOIL	DE PERE	TANK TIPPED OVER
06/12/81	BROWN	SOIL	GREEN BAY	FUEL EXPANDED IN FULL TANK
06/23/81	BROWN	SOIL	GREEN BAY	OVERTURNED SEMI
02/18/82	BROWN	SOIL	GREEN BAY	NOZZLE BROKE WHILE UNLOADING FUEL
02/20/82	BROWN	SOIL	GREEN BAY	TANK OVERFLOWED
03/12/82	BROWN	SOIL	GREEN BAY	BREAK IN PIPE
05/25/82	BROWN	SOIL	HOWARD	TANK TRAILER TIPPED- LINE BROKE
06/30/82	BROWN	SOIL	GREEN BAY	OVERFILLED TANK

07/17/82	BROWN	SOIL	ASHWAUBENON	
08/08/82	BROWN	SOIL	GREEN BAY	
08/19/82	BROWN	SOIL	GREEN BAY	LEAKING AUTOMOBILE TANK
08/24/82	BROWN	SOIL	ASHWAUBENON	TRUCK ACCIDENT
10/08/82	BROWN	SOIL	GREEN BAY	AUTOMATIC SHUT-OFF VALVE FAILED
11/02/82	BROWN	SOIL	GREEN BAY	OVERFILLED SEMI-TRUCK
03/20/83	BROWN	SOIL	GREEN BAY	CAR GAS TANK LEAK
04/21/83	BROWN	SOIL	DE PERE	LEAKY HOSE
08/01/83	BROWN	SOIL	GREEN BAY	TRUCK GAS TANK LEAK
08/20/83	BROWN	SOIL	GREEN BAY	VANDALISM TO SEMI
08/26/83	BROWN	SOIL	GREEN BAY	LOAD SHIFTED
10/26/83	BROWN	SOIL	GREEN BAY	TRUCK-TRAIN ACCID. AT FACILITY
03/27/84	BROWN	GROUNDWATER	GREEN BAY	POSSIBLE L U S T
07/24/84	BROWN	SOIL	GREEN BAY	IMPROPER STORAGE
09/08/84	BROWN	SOIL		TRUCK TIPPED OVER
10/04/84	BROWN	SOIL	GREEN BAY	THEFT/VANDALISM
02/15/85	BROWN	SOIL	ASHWAUBENON	LEAKING FUEL FILTER
03/30/85	BROWN	SOIL	GREEN BAY	OVERFLOW ON HOLDING TANK
03/30/85	BROWN	SOIL	ASHWABANON	TORN BAG
08/30/85	BROWN	SOIL		VANDALISM
02/20/86	BROWN	SOIL	DE PERE	ABONDONED CONTAINERS - OPENED
03/21/86	BROWN	SOIL		
04/22/86	BROWN	SOIL	GREEN BAY	PIPE BROKE ON TRUCK
05/08/86	BROWN	SOIL	GREEN BAY	TRAFFIC ACCIDENT
05/09/86	BROWN	SOIL		HOSE BROKE
05/29/86	BROWN	SOIL	ASHWAUBENON	LOAD IN TRUCK TIPPED OVER

06/26/86	BROWN	SOIL	DE PERE	TRUCK LOADING, LINE BROKE
06/27/86	BROWN	SOIL	DEPERE	VANDALISM
06/28/86	BROWN	SOIL	DEPERE	LEAKING VALVE
07/09/86	BROWN	SOIL	GREEN BAY	LEAKING PUMP
07/11/86	BROWN	SOIL	ASHWAUBENON	LEAKING BARREL
08/18/86	BROWN	SOIL	DEPERE	TREAT TANK SLOPPED OVER
09/25/86	BROWN	SOIL	GREEN BAY	
09/29/86	BROWN	SOIL	HOWARD	HIGH WATER
10/08/86	BROWN	SOIL	GREEN BAY	VEHICLE ROLLOVER
10/30/86	BROWN	SOIL	GREEN BAY	BLOWN GASKET
11/22/86	BROWN	SOIL	GREEN BAY	OVERFILL OF STORAGE TANK
12/22/86	BROWN	SOIL	DEPERE	SPILL DURING GASOLINE DELIVERY
01/27/87	BROWN	SOIL		CATERPILLAR TURNED OVER
02/13/87	BROWN	SOIL	GREEN BAY	GAS PUMP LEFT ON AT ISLAND
04/07/87	BROWN	SOIL	ASHWAUBENON	HYDRAULIC HOSE BROKE
04/10/87	BROWN	SOIL	GREEN BAY	OVERFILL OF TANK
04/13/87	BROWN	SOIL	DEPERE	HYDRAULIC LINE BREAK
04/27/87	BROWN	SOIL	GREEN BAY	BROKEN PIPE BETWEEN DIKE & TREAT PL
05/20/87	BROWN	SOIL		VALVE ON AG SPRAYER LEFT OPEN
08/01/87	BROWN	SOIL		VEHICLE ACCIDENT
09/16/87	BROWN	SOIL		BRIDGE BROKE, TRACTOR OVERTURNED
11/11/87	BROWN	SOIL	GREEN BAY	MECHANICAL FAILURE
02/01/88	BROWN	SOIL	GREEN BAY	TRAFFIC ACCIDENT
02/23/88	BROWN	GROUNDWATER	GREEN BAY	LEAKING TANKS ON LOCOMOTIVES
04/20/88	BROWN	GROUNDWATER		TRAFFIC ACCIDENT
04/22/88	BROWN	GROUNDWATER	GREEN BAY	UNKNOWN, SMELL OF GAS IN BASEMENT

05/05/88	BROWN	SOIL	ASHWAUBENON	REAR AXLE FELL OFF TRAILER
05/17/88	BROWN	SOIL		BROKEN FUEL LINE
05/24/88	BROWN	SOIL		TRACTOR ROLLOVER
05/31/88	BROWN	SOIL		BROKEN FUEL LINE
12/29/88	BROWN	SOIL	GREEN BAY	AT GAS PUMP
12/30/88	BROWN	SOIL	GREEN BAY	ACCIDENT
01/24/89	BROWN	GROUNDWATER	GREEN BAY	LEAK IN FUEL LINE
02/10/89	BROWN	SOIL	DEPERE	SEMI UNLOADING
03/30/89	BROWN	SOIL	GREEN BAY	VALVE WAS NOT COMPLETELY CLOSED
04/13/89	BROWN	SOIL	GREEN BAY	LEAKING CONTAINER
05/19/89	BROWN	SOIL	DE PERE	OVERFLOW OF FUEL TANK
06/15/89	BROWN	SOIL	GREEN BAY	OVERFLOW OF TANK WHILE REFUELING
07/21/89	BROWN	SOIL	GREEN BAY	EQUIPMENT MALFUNCTION ON TRUCK
08/30/89	BROWN	SOIL	GREEN BAY	TANK RUPTURED
09/06/89	BROWN	SOIL	GREEN BAY	BACK UP IN SYSTEM
10/06/89	BROWN	SOIL	GREEN BAY	DELIVERY AND DROPPED TANK
01/04/90	BROWN	SOIL	GREEN BAY	RUPTURED FUEL SYSTEM ON LOCATION
09/20/90	BROWN	SOIL	GREEN BAY	BROKEN HOSE
12/12/90	BROWN	SOIL	GREEN BAY	DAMAGED PIPE
01/14/91	BROWN	SOIL		LEAKING RAILROAD CAR
02/27/91	BROWN	SOIL	GREEN BAY	TRAFFIC ACCIDENT
03/05/91	BROWN	SOIL.	DEPERE	TRANSPORTATION SPILL
04/01/91	BROWN	SOIL	GREEN BAY	OVERFILLING STORAGE TANK
04/05/91	BROWN	SOIL	DEPERE	PUNCTURED SADDLE TANK
04/17/91	BROWN	SOIL	GREEN BAY	PUNCTURED SADDLE TANK
05/13/91	BROWN	SOIL	GREEN BAY	BAD FITTING IN THREADED FITTING

06/04/91	BROWN	SOIL	GREEN BAY	FAILURE OF HYDRAULIC SYSTEM IN ELEV
06/28/91	BROWN	SOIL	GREEN BAY	TRUCK VS TRAIN
11/04/91	BROWN	SOIL	GREEN BAY	UNDERGROUND PIPE LEAK
11/05/91	BROWN	SOIL		TRAFFIC ACCIDENT
11/08/91	BROWN	SOIL	GREEN BAY	RUPTURED FUEL TANK
12/18/91	BROWN	SOIL	GREEN BAY	OVERFILL OF HEATING TANK
01/02/92	BROWN	SOIL	GREEN BAY	ACCIDENTLY LEFT ON PUMP
03/06/92	BROWN	SOIL	GREEN BAY	DUMPING OF FUEL OIL TANK
03/22/92	BROWN	SOIL	GREEN BAY	TRAFFIC ACCIDENT
05/07/92	BROWN	SOIL	DEPERE	OVERFILL
05/14/92	BROWN	SOIL	GREEN BAY	
06/20/92	BROWN	SOIL	GREEN BAY	LEAK
07/10/92	BROWN	SOIL	GREEN BAY	FUEL TANK RUPTURE
08/20/92	BROWN	SOIL	GREEN BAY	LEAK FORM TRAIN ENGINE
08/28/92	BROWN	SOIL	DEPERE	ILLEGAL DISPOSAL
09/04/92	BROWN	SOIL	GREEN BAY	ABOVE GROUND TANK COLLAPSED
12/03/92	BROWN	SOIL	GREEN BAY	LEAK FROM VENT PIPE ON TRUCK
12/21/92	BROWN	SOIL	GREEN BAY	TRUCK ROLLED INTO PUMP
02/26/93	BROWN	SOIL	GREEN BAY	TANK OVERFILL
04/01/93	BROWN	SOIL		TRAFFIC ACCIDENT
06/21/93	BROWN	SOIL	GREEN BAY	PIPE BREAK
06/22/93	BROWN	SOIL	GREEN BAY	
06/24/93	BROWN	SOIL	GREEN BAY	LEAKING HYDRAULIC LINE
06/25/93	BROWN	SOIL	GREEN BAY	LEAK IN TRANSFORMER
06/29/93	BROWN	SOIL	GREEN BAY	LEAKING 55 GALLON DRUM
07/05/93	BROWN	SOIL	GREEN BAY	TRAFFIC ACCIDENT

07/08/93	BROWN	SOIL		TANK COLLAPSE
09/01/93	BROWN	SOIL	ASWAUBENON	TRAFFIC ACCIDENT
10/22/93	BROWN	SOIL	GREEN BAY	LEAKING SADDLE TANK
11/06/93	BROWN	SOIL	GREEN BAY	CAR TORE OFF HOSE
11/11/93	BROWN	SOIL	GREEN BAY	FAULTY CHECK VALVE
01/01/94	BROWN	GROUNDWATER	GREEN BAY	LEAKING GAS TANK OF CAR
01/04/94	BROWN	SOIL	GREEN BAY	PUNCTURED CONATINER
01/22/94	BROWN	SOIL		NOZZLE NOT RETURNED TO PUMP
03/06/94	BROWN	SOIL	GREEN BAY	ENGIN REMOVEL
03/07/94	BROWN	SOIL	GREEN BAY	HOSE BROKE ON HYDRAULIC SYSTEM
05/09/94	BROWN	SOIL	GREEN BAY	BROKEN PUMP SEAL
05/23/94	BROWN	SOIL	GREEN BAY	DRUM FELL OFF FORK LIFT
05/30/94	BROWN	SOIL	GREEN BAY	VEHICLE DRIVE OFF BROKEN HOSE
06/27/94	BROWN	SOIL	GREEN BAY	OVER FILL TANK #7301
07/18/94	BROWN	SOIL	GREEN BAY	BROKEN LINE
12/14/94	BROWN	SOIL	GREEN BAY	HOSE RUPTURE
12/14/94	BROWN	SOIL		PAST SPILLAGE
12/17/94	BROWN	SOIL	GREEN BAY	BARREL TIPPED OVER
01/24/95	BROWN	SOIL	GREEN BAY	TRAIN WRECK
02/06/95	BROWN	SOIL	GREEN BAY	TANK OVERFILL
02/14/95	BROWN	SOIL	DE PERE	FIRE
02/17/95	BROWN	SOIL	GREEN BAY	SPILL OF COLLECT WASTE
04/11/95	BROWN	SOIL	GREEN BAY	DISCHARGE IN SUMP PUMP
04/26/95	BROWN	SOIL	GREEN BAY	SPILL FROM AN AST
05/08/95	BROWN	SOIL	GREEN BAY	BROKEN EQUIPMENT
05/11/95	BROWN	SOIL		RR DERAILMENT

05/31/95	BROWN	SOIL	GREEN BAY	OVER FILLED TANK
06/01/95	BROWN	SOIL	GREEN BAY	DRIPPING PUMP ON AST.
06/05/95	BROWN	SOIL	DE PERE	HISTORICAL SPILL FROM AST
06/15/95	BROWN	SOIL	GREEN BAY	TRAIN DERAILMENT
07/06/95	BROWN	SOIL	GREEN BAY	TRAFFIC ACCIDENT
08/11/95	BROWN	SOIL	GREEN BAY	BROKEN VALVE ON TRAILOR
08/25/95	BROWN	SOIL	GREEN BAY	LEAK
09/03/95	BROWN	SOIL	GREEN BAY	PLANE CRASH
09/22/95	BROWN	SOIL		
11/02/95	BROWN	SOIL	GREEN BAY	PIPE FAILURE
11/17/95	BROWN	SOIL	GREEN BAY	UNCAPED HOSE
12/29/95	BROWN	SOIL	GREEN BAY	NOSSEL FAILURE
01/13/78	OUTAGAMIE	SOIL	APPLETON	GAS TANK OVERFLOW
07/20/78	OUTAGAMIE	SOIL	APPLETON	BROKEN GASKET ON TRUCK
03/26/79	OUTAGAMIE	SOIL		TANKER OVERTURNED
09/10/79	OUTAGAMIE	SOIL		2 TRUCK ACCIDENT
04/14/80	OUTAGAMIE	SOIL		MATERIAL PUMPED INTO DITCH
05/08/80	OUTAGAMIE	SOIL	LITTLE CHUTE	TANK LEAKING
08/11/80	OUTAGAMIE	SOIL	APPLETON	TRUCK ACCIDENT
02/09/81	OUTAGAMIE	SOIL	APPLETON	BROKEN VALVE
03/23/81	OUTAGAMIE	SOIL	APPLETON	ACCIDENTAL DUMPING
07/08/81	OUTAGAMIE	SOIL	APPLETON	RELIEF VALVE OPEN
08/03/81	OUTAGAMIE	GROUNDWATER		VANDALISM
10/26/81	OUTAGAMIE	SOIL	APPLETON	RUPTURED FUEL TANK
10/28/81	OUTAGAMIE	SOIL	APPLETON	SPILLED WHEN REPAIRING TANK
10/29/81	OUTAGAMIE	SOIL	APPLETON	SIGN POST PUNCTURED VEHICLE'S TANK

11/03/81	OUTAGAMIE	SOIL	APPLETON	OVERFLOWED STORAGE TANK
11/18/81	OUTAGAMIE	SOIL	APPLETON	TRAIN DERAILMENT
01/07/82	OUTAGAMIE	SOIL	LITTLE CHUTE	LEAKING UNDERGROUND STORAGE TANK
01/19/82	OUTAGAMIE	SOIL	APPLETON	IMPROPER MAINTENCE PROCEDURE
04/11/82	OUTAGAMIE	SOIL	APPLETON	WORKER CUT 1 1/2" PIPE
04/12/82	OUTAGAMIE	SOIL	LITTLE CHUTE	TRANSPORTATION LEAKAGE
04/16/82	OUTAGAMIE	SOIL	APPLETON	EXPLOSION
02/05/83	OUTAGAMIE	SOIL		VANDALISM
03/10/83	OUTAGAMIE	SOIL		LOSS OF LOAD
03/12/83	OUTAGAMIE	SOIL		VALUE OPENED
06/28/83	OUTAGAMIE	SOIL	APPLETON	DRIVER EMPTIED FUEL TANK
10/27/83	OUTAGAMIE	SOIL	APPLETON	LEAKING TRANSFORMER
05/18/84	OUTAGAMIE	SOIL	APPLETON	SEVERAL LEAKY PUMP COUPLINGS
12/17/84	OUTAGAMIE	SOIL		TRAILER FRAME BROKE
05/06/85	OUTAGAMIE	SOIL		BROKEN HOSE ON TANK
05/14/85	OUTAGAMIE	SOIL	LITTLE CHUTE	BROKEN PIPE LINE
05/17/85	OUTAGAMIE	SOIL	APPLETON	LEAKING PIPE VALVES, PUMP
05/30/85	OUTAGAMIE	SOIL	APPLETON	DUMPING OF METAL CUTTINGS
07/08/85	OUTAGAMIE	SOIL		TRAFFIC ACCIDENT
07/10/85	OUTAGAMIE	SOIL		DELIBERATE ABANDONMENT
07/26/85	OUTAGAMIE	SOIL		COLLECTION TANK LEAK-TO GROUND
01/21/86	OUTAGAMIE	SOIL	APPLETON	OIL IN SOIL FROM CONSTRUCTION SITE
03/17/86	OUTAGAMIE	SOIL	APPLETON	LEAK IN PIPING
03/20/86	OUTAGAMIE	SOIL		LEAKING VALVE ON TANKER
05/17/86	OUTAGAMIE	SOIL	APPLETON	LEAKING PIPE VALVES PUMPS & FILLING
07/29/86	OUTAGAMIE	SOIL	APPLETON	

08/11/86	OUTAGAMIE	GROUNDWATER	APPLETON	RUPTURED HOME OIL TANK
09/24/86	OUTAGAMIE	SOIL	APPLETON	SPILLAGE FROM 55-GALLON DRUM
10/24/86	OUTAGAMIE	SOIL		
12/15/86	OUTAGAMIE	SOIL	APPLETON	STORAGE TANK RUPTURED
03/10/87	OUTAGAMIE	SOIL	APPLETON	LEAKY VALVE ON TANK CAR
05/12/87	OUTAGAMIE	SOIL		INTENTIONAL DUMPING
06/05/87	OUTAGAMIE	SOIL		TRANSFORMER FAILURE
07/10/87	OUTAGAMIE	SOIL	APPLETON	ILLEGAL STORAGE
07/29/87	OUTAGAMIE	GROUNDWATER		POSSIBLE EXISTING SPILL FROM TANKS
12/04/87	OUTAGAMIE	SOIL	APPLETON	FUEL TANK OVERFLOW OR LEAKING
01/09/88	OUTAGAMIE	SOIL		TRANSPORT MAKING DELIVERY SPILLED
03/02/88	OUTAGAMIE	SOIL		ACCIDENT
05/03/88	OUTAGAMIE	SOIL		TRUCK FIRE INCIDENT
10/13/88	OUTAGAMIE	SOIL	APPLETON	RUPTURED FUEL TANK
03/30/89	OUTAGAMIE	SOIL	APPLETON	INTENTIONAL DUMPING
04/10/89	OUTAGAMIE	SOIL	APPLETON	
05/24/89	OUTAGAMIE	SOIL		TRAFFIC ACCIDENT
06/02/89	OUTAGAMIE	SOIL	APPLETON	BIN TIPPED
06/06/89	OUTAGAMIE	SOIL	APPLETON	INTENTIONAL DUMPING
06/09/89	OUTAGAMIE	SOIL	APPLETON	TIRE BLOW OUT,GAS TANK BREAK
10/09/89	OUTAGAMIE	SOIL	APPLETON	
04/20/90	OUTAGAMIE	SOIL	APPLETON	SPILL FROM HOSE WHILE FILLING TANK
05/01/90	OUTAGAMIE	SOIL	APPLETON	SPILL-OVERFLOW OF TANK
05/07/90	OUTAGAMIE	SOIL	APPLETON	RR CARS DERAILED
09/20/90	OUTAGAMIE	SOIL	APPLETON	TRAFFIC ACCIDENT
08/20/91	OUTAGAMIE	SOIL	LITTLE CHUTE	CONTAM. DISCOVERY UPON TANK REMOVAL

10/09/92	OUTAGAMIE	SOIL	APPLETON	LEAK FROM ELEVATOR HYDRAULICS
01/12/93	OUTAGAMIE	SOIL	APPLETON	PUMP LEFT ON CAUSING VALVE LEAK
01/19/93	OUTAGAMIE	SOIL	LITTLE CHUTE	TRUCK TANK OVERFLOW
07/13/93	OUTAGAMIE	SOIL	APPLETON	FUEL LINE LEAK
08/12/93	OUTAGAMIE	SOIL	APPLETON	TRAFFIC ACCIDENT
08/17/93	OUTAGAMIE	SOIL	APPLETON	RUPTURED FUEL LINE
12/09/93	OUTAGAMIE	SOIL	APPLETON	DAILY USE
01/31/94	OUTAGAMIE	SOIL	APPLETON	HISTORIC DUMPING
06/13/94	OUTAGAMIE	SOIL		HEAT CAUSED FUEL TO OVER FLOW TANK
07/28/94	OUTAGAMIE	SOIL	APPLETON	TANK PULL
08/02/94	OUTAGAMIE	SOIL	LITTLE CHUTE	FORMER LOCATION OF AN AST SPILL
10/13/94	OUTAGAMIE	SOIL	APPLETON	DIGGING A DITCH HIT PIPES
10/21/94	OUTAGAMIE	SOIL	APPLETON	ACCINENTAL SPILL
01/04/94	OUTAGAMIE	SOIL	APPLETON	BLOWN GASKET
10/05/95	OUTAGAMIE	SOIL		HOSE FAILURE
10/10/95	OUTAGAMIE	SOIL	APPLETON	HISTORIC RELEASE NEAR TRASH
11/01/95	OUTAGAMIE	SOIL		DRUM TIPPED OVER
11/14/95	OUTAGAMIE	SOIL	APPLETON	FUEL DELIVERY TO INCORRECT RES.

APPENDIX D
Septage Speading Sites

There are roughly 34 permits for septage spreading sites in the watershed. There are additional permits for landspreading of municipal, industrial and hazardous wastes.

Septage Spreading Sites in the Apple and Ashwaubenon Creeks and Duck Creek Priority Watersheds

County	Section	Acres
Brown	34	30
Outagamie	6	3
Outagamie	11	40
Outagamie	19	3
Outagamie	5	5
Outagamie	16	40
Outagamie	16	40
Outagamie	13	80
Outagamie	13	112
Outagamie	26	60
Outagamie	35	100
Outagamie	4	55
Outagamie	9	45
Outagamie	17	100
Outagamie	20	20
Outagamie	20	25
Outagamie	32	90
Outagamie	34	50
Outagamie	8	55
Outagamie	16	40
Outagamie	18	32
Outagamie	35	50
Outagamie	22	100

County	Section	Acres
Outagamie	27	260
Outagamie	36	35
Outagamie	36	45
Outagamie	22	100
Outagamie	26	30
Outagamie	32	40
Outagamie	19	100
Outagamie	25	120
Outagamie	10	40
Outagamie	27	100
Outagamie	28	55

CORRESPONDE

APPENDIX E
Street Sweeping Policy Paper

State of Wisconsin

DATE: August 29, 1996 FILE REF: 3200

TO: Gordon Stevenson, WT/3
Dick Wedepohl, WT/3

FROM: John Pfender, WT/3
Mary Anne Lowndes, WT/3
Percy Mather, WT/3
Terry Kafka, WT/3

SUBJECT: Interim Street Sweeping BMP for Osceola Creek

The purpose of this letter is to request your approval of an interim street sweeping BMP for use in the Osceola Creek Priority Watershed Project. This interim BMP would allow up-front reimbursement from DNR for purchase of a street sweeper, which is a departure from approaches used in the past. Since this may have obvious repercussions for the program, we have also developed a broader set of program guidance for use in other projects that need to develop interim BMP's for street sweeping.

Background

Street sweeping has been eligible for cost sharing under several priority watershed projects. Due to the difficulty of getting significant water quality benefits from street sweeping, however, the eligibility criteria have been very restrictive. BMP requirements have been rigorous (frequent, tandem sweeping with brush & vacuum), the level of support has been relatively low (50% for a maximum of five years), cost share payments for equipment have been restricted to annual reimbursements of either contract sweeping, leasing, or amortization of equipment purchase, and the general philosophy has been that sweeping would eventually be supplanted by more effective practices like wet detention. Few, if any, municipalities have taken advantage of this cost share element.

Recent advances in street sweeping technology are resulting in machines that provide greater water quality protection. One such machine is the Enviro Whirl, a machine that combines dry sweeping and vacuum action into one unit. In the case of Osceola, the community can actually achieve its entire stated pollution reduction goal by using a combination of detention in its industrial park and sweeping with a high efficiency sweeper in its commercial areas. What has ensued is a request by the Village of Osceola for support in purchasing a sweeper as a cost-effective approach to meeting plan goals. Although these machines are quite expensive to either purchase or lease, they could represent a significant tool in our arsenal.

Four things are included in this approval request. These include:

1) Revised program guidance for support of street sweeping activities (*Attachment A*),
2) Technical information concerning the general effectiveness of the Enviro Whirl (*Attachment B*),
3) Specific analysis of the effectiveness and cost of sweeping in Osceola (*Attachment C*),
4) The interim BMP for the Osceola Creek Project (*Attachment D*).

Please review both the revised guidance and the interim BMP.

ATTACHMENT A: REVISED PROGRAM GUIDANCE

Purpose of Guidance

The purpose of this guidance is to establish general principles for use in developing street sweeping BMP's. The custom development of an interim street sweeping BMP will be done by priority watershed planning staff using these guidelines, and incorporated into the watershed plan.

General Approach to Supporting Street Sweeping Programs

This guidance is based on three levels of support for street sweeping programs. The levels of support are based on the importance of street sweeping as a BMP, and also on the level of commitment that the municipality is willing to make to implementing the urban program recommendations set forth in the watershed plan. The following decision tree provides a path to the three basic levels of support:

A1. Plan identifies street sweeping as a necessary and cost-effective component of the urban stormwater management recommendations.

1A1. Community commits to implementing all urban plan recommendations needed to meet urban pollutant reduction goals for the municipality as a whole, or for an entire subwatershed.

Support Levels I & III available to the community.

2A1. Community not ready to commit to implementing all urban plan recommendations needed to meet urban pollutant reduction goals for the municipality as a whole, or for an entire subwatershed.

Support Levels II & III available to the community.

A2. Plan does not identify street sweeping as a necessary component of the urban stormwater management recommendations

Support Level III available to the community.

General Eligibility, Cost Share Rates, and Conditions for Support Levels

Support Level I

Rationale for This Support Level

This is the highest support level, and is meant to include such items as purchase of street sweeping equipment or long-term support of equipment leases or sweeping contracts. It is restricted to those situations where the entire set of urban recommendations will be carried out in either the entire municipality or a designated subwatershed(s), and where the street sweeping component is a cost-effective and significant component of the strategy. As with other practices, the intent is to provide support for only the water quality related benefits of sweeping. Consequently, higher rates of support are available for communities that are already conducting a street sweeping program of some sort. Lower levels of support are available for communities that have no existing street sweeping program. Activities under Support Level III must also be conducted as a condition of receiving funds.

Cost Share Conditions

The plan must include an interim BMP for the street sweeping program that specifies type of equipment, frequency and seasonality of sweeping, as well as information on eligible items for cost sharing, cost share rates, and cost share conditions.

Funding can only be provided if it is accompanied by a program to maximize efficiency of the equipment, including such things as a citizen I&E program, operator training, and parking restrictions if necessary.

The community must agree, as a grant condition, to fully implement all urban nonpoint source controls needed to meet the plan's urban pollutant reduction goals for either the entire municipality or for identified subwatersheds where the street sweeping program will be applied.

Leasing and Contract Sweeping: Support for leasing or contract sweeping will be offered to a community for up to 5 years. If leasing agreements or sweeping contracts include built-in operation and maintenance charges, then these items are eligible for support.

If leasing or contract sweeping, the community is responsible for continuing to sweep according to the prescribed program for the remaining years of the implementation period of the watershed project. This period may be waived if other, equally effective practices, are implemented to serve the sweeping area.

The Department and municipality must consider equipment leasing and contract sweeping as alternatives to equipment purchase. If cost-effective and administratively

acceptable, leasing or contract sweeping options shall be considered preferable to equipment purchase.

Equipment Purchase: Program support can be used towards purchase of street sweeping equipment consistent with the plan recommendations. Where additional staff is needed to operate the equipment, it may be supported with local assistance funds. All other operation and maintenance items, however, are ineligible for program support. The community must continue to operate and maintain the equipment (if purchased) for the 10 year maintenance period in the watershed plan.

Cost Share Rates

For a community that has no street sweeping program at all, the Nonpoint Source Program can fund 50% of the cost of leasing a sweeper, contract sweeping or purchasing a new sweeper. The lower cost share rate reflects the fact that a community is responsible on its own for a minimum street sweeping program, such as that conducted for aesthetics and safety reasons.

For a community that is already sweeping , the Nonpoint Source Program can fund 70% of the cost to lease, contract sweep, or purchase additional or new equipment as needed to provide the frequency and type of sweeping specified in the plan.

The rates for additional staff needed to operate machinery, for I&E materials, and for other local assistance activities are as specified in NR 120.

Support Level II

Rationale for This Support Level

This is the intermediate level of support available for street sweeping programs. As in Support Level I, the watershed plan must identify street sweeping as a cost-effective and significant component of the urban pollutant reduction strategy. It is meant for communities that are uncertain about how to proceed with implementing the entire street sweeping program identified in the plan, and consequently wish to conduct a pilot program before making further commitments. Funding can only be provided for the water quality benefits of sweeping, as defined in the watershed plan. Activities under Support Level III must also be conducted as a condition of receiving funds.

After conducting the pilot, a community may opt to seek funding under Support Level I.

Cost Share Conditions

The plan must include an interim BMP for the street sweeping program that specifies type of equipment, frequency and seasonality of sweeping, as well as information on eligible items for cost sharing, cost share rates, and cost share conditions.

Funding can only be provided if it is accompanied by a program to maximize efficiency of the equipment, including such things as a citizen I&E program, operator training, and parking restrictions if necessary and feasible to put in place for the pilot period.

Leasing and Contract Sweeping: The Nonpoint Source Program will only support equipment leases or contract sweeping; there is no support available for purchase of street sweeping equipment to be used in demonstration or pilot projects. Support for leasing or contract sweeping will be offered to a community for up to 2 years of actual equipment operation. If leasing agreements or sweeping contracts include operation and maintenance charges, then these items are eligible for support. After the pilot is concluded, the community will have no further obligation to continue with the sweeping regimen being demonstrated.

Cost Share Rates

Support rates for equipment leasing or contract sweeping demonstrations are set at 70%, regardless of whether or not there is an existing street sweeping program in place.

The rates for additional staff needed to operate machinery, for I&E materials, and for other local assistance activities are as specified in NR 120.

Support Level III

Rationale for This Support Level

The lowest priority for funding, which is limited to making operational changes in an existing street sweeping program, is for situations where efficiency of existing street sweeping operations can be increased by such things as I&E, operator training, and possibly parking restrictions. This option should be incorporated into the I&E portion of the Priority Watershed Plan. Support for these activities should be available for every community with a street sweeping program.

Cost Share Rates

Funding will be provided at a cost share rate consistent with NR 120 for operator training, a general I&E effort as it pertains to street sweeping, and possibly the development and implementation of parking restrictions where determined in the plan to be cost-effective. Equipment maintenance is not eligible for support.

Financing Street Sweeping through the Nonpoint Program

Support of leases and contract sweeping is considered to be short-term (1-5 years) and will be handled through local assistance grants.

Support for equipment purchases (street sweeper) are considered long-term, and will be handled in one of two ways. A Nonpoint Source Grant between DNR and the local municipality is the preferred option. This arrangement is not prohibited by statute but it is unclear if it is allowed under NR 120.12. Another option is through a cost share agreement between the local municipality and the county. This is clearly not prohibited by statute or code but may be undesirable as it would place the county in the role of grantor, a position that may be better suited to the Department of Natural Resources.

ATTACHMENT B: EFFECTIVENESS OF ENVIRO WHIRL

Enviro Whirl Technologies, Inc. (Centralia, Illinois), has developed a sweeper that combines both brush and vacuum into a single unit that performs a dry sweeping/vacuuming operation. The efficiency of this machine at reducing street loads has been measured in western (Las Vegas, Washington) and midwestern (Illinois) states and reductions for sediment has been very high across a wide range of particle sizes, including those under 10 microns where a large amount of pollutants are attached (Satterfield & Associates, 1996). Figures 1-4 show the pick-up efficiency of the Enviro Whirl as compared to other types of street sweeping machines across a wide range of particle sizes. The PM-10 range of particles includes those particles that are equal to or less than 10 microns in diameter. The total pick-up efficiency ranged from 73% to 91% (median 80%) for machines driven 5 mph (one negative efficiency test is not included in these statistics).

For many reasons, reductions in street load may not translate directly into reductions in pollutant loadings to water resources. The primary reasons are that rains tend to selectively wash off small particles whereas many sweepers (especially mechanical types) tend to selectively pick up larger particles. Another factor is the timing of sweeping operations with respect to rainfall patterns: poorly timed sweeping leaves more material on the street available for washoff. Finally, proper machine maintenance and operation (road speed, curb access, etc) are critical. Assuming adequate operation and maintenance, the more frequent the sweeping pattern, and the greater the sweeper's ability to capture small particles, the more the water quality benefits will approach the ability of the machine to reduce street loads.

The water quality benefits of sweeping with the Enviro Whirl have been estimated using information about pick-up efficiency as input data for a water quality model (Sutherland & Jelen, 1996). Calibrated model simulations are presented in Figures 5 & 6 for a major arterial and a street in a single family residential area. Generally, for a sweeping program involving about 30 passes per year (a reasonable expectation for Wisconsin), the estimated reduction in washoff of total suspended solids was approximately 60%. Accumulation and rainfall patterns in Wisconsin will vary from those used in the modelling study, but the study shows that compared to mechanical sweepers the Enviro Whirl can be expected to produce superior water quality control.

NURP data was used in conjunction with information on pick-up efficiency of the Enviro Whirl to see if the general conclusions about the efficiency of this machine could be corroborated. This test does not incorporate accumulation and rainfall dynamics, and so it is simplistic. However, it is interesting to note the following:

1. Using measured Enviro Whirl pick-up efficiencies for each of 9 particle size classes, and the distribution of street dirt mass amongst those same particle size classes as measured in a Milwaukee residential area (Bannerman et al, 1983), the estimated overall pick-up efficiency is calculated to be about 70%. This

compares very favorably with the median measured efficiency of 80% based on EW field tests.

2. Using measured Enviro Whirl pick-up efficiencies for each of 9 particle size classes, and the all NURP particle size distribution for urban stormwater runoff (Donovan et al, 1995), the estimated reduction in washoff of suspended solids is calculated to be about 50%. This compares favorably with washoff reductions of about 60% as simulated by Sutherland. Note, however, that Sutherland's modelling probably assumes some interaction between sweeping schedules and rainfall whereas the simple calculation presented above does not do this.

3. Using measured Enviro Whirl pick-up efficiencies for each of 9 particle size classes, pollutant concentrations (mg/kg) for lead associated with different size classes from NURP, and the particle size distribution of street dirt in stormwater, the estimated reduction in lead washoff is about 60%.

Although these calculations are not exactly comparable with Sutherland's modeling results, they do seem to indicate that his modelling results are probably reasonable.

If we can then assume that the EW can reduce sediment and associated pollutants in stormwater runoff generated from streets and parking lots by 50-60%, and we have some knowledge about the importance of streets as a source area, then we should be able to estimate the impact that this type of machine could have on reducing stormwater pollutant loads. For example, an analysis of source area dominance in the Duck, Apple, & Ashwaubenon Creeks watersheds shows that in commercial areas streets account for 20% of the copper loading and parking areas account for 55%. Assuming a 55% reduction in washoff of pollutants from targeted source areas, then we should be able to reduce copper loads in stormwater discharges from commercial land uses about 10% by sweeping the streets and about 30% by sweeping parking areas, or about 40% by sweeping both. If sweeping is only done once per week, this efficiency will probably drop. If sweeping is done twice per week, these figures are probably a good ball-park estimate.

Attachment 2

DNR Nonpoint Source Pollution Abatement Program
Interim Best Management Practice

(The Nonpoint Source Pollution Abatement Program will no longer use alternative as the defining word for interim Best Management Practices (BMPs). Interim BMPs are created to meet the specific and individual needs identified during the planning process of a priority watershed project and will be used on a trial basis. The practice will be evaluated for its effectiveness before consideration as a standard BMP. A procedure defining the process for interim BMP approval will be detailed within the Implementation Handbook.)

A. Name of Interim Best Management Practice:

Accelerated Street Sweeping Management Program for the Village of Osceola.

B. Definition

Street Sweeping involves the removal of grit, debris, and trash from urban impervious areas such as streets, parking lots, and sidewalks.

C. Purpose

The implementation of an accelerated street sweeping management program will be an integral part of attaining the desired urban water quality objectives identified in the Osceola Creek Priority Watershed Nonpoint Source Control Plan.

A water quality appraisal of Osceola Creek was conducted in 1995; this appraisal documents a dramatic decrease in macroinvertebrate numbers downstream of the stormwater discharge area, including reduced instream oxygen levels. Because the Village of Osceola is situated along the escarpment of the St. Croix River, limited pollutant treatment options exist within the stormwater discharge area. The Osceola Creek Urban Water Quality Analysis, prepared by Barr Engineering, recommends street sweeping as the only feasible pollutant reduction practice in the commercial area.

The specific pollutants generally reduced by street sweeping include sediment, nutrients, and heavy metals. The Osceola Creek Water Quality Appraisal Workgroup has established a pollutant reduction objective of 25 percent for the urban area of the watershed. Implementation of an accelerated street sweeping management program identified within the watershed plan will be an important component to attaining this objective. (Street sweeping can achieve a 16% reduction of the urban lead load for Osceola, with the use an effective sweeper and an accelerated frequency of sweeping.

D. Eligibility Parameters

1) The Village of Osceola shall adopt an accelerated urban street sweeping program that incorporates the following activities:

a) Leaf and litter pick-up and proper disposal that is consistent with the water quality objectives of the program.

b) An alternate side parking policy to allow the street sweeper complete access to the full length of the curb, as with snow removal.

c) Pickup in the spring before spring rains wash the finer particles off the streets.

d) An accelerated street sweeping program in the commercial area shall be in effect from the period of spring thaw through fall leaf pickup, on a weekly schedule.

2) The Village adopted accelerated street sweeping program shall meet the following management objectives:

a) Significantly reduce the pollutant load in the existing storm sewer area with curb and gutter, through the use of a higher efficiency combination sweeper.

b) The accelerated street sweeping program shall occur from spring thaw through fall leaf pickup, on a weekly schedule.

c) That the Village maintain the accelerated level of sweeping for a minimum period of ten-years.

3) The Village of Osceola and/or the Polk County Land Conservation Department shall develop an Urban Information and Education Program that includes but not limited to:

a) Storm drain stenciling to promote water quality awareness.

b) Sign placement or policy development to promote alternate side parking to accommodate an accelerated street sweeping program.

c) Educating local urban residents on proper lawn and garden care that includes nutrient and pesticide applications as lawn watering recommendations.

d) Beneficial landscape practices to improve water quality.

e) Good Housekeeping practices such as composting of lawn, garden, and household biodegradable materials.

E. Cost-sharing is authorized:

1) At a rate of 70% for a five-year professional services contract or lease of the necessary equipment to meet the street sweeping management objectives identified in the watershed plan.

2) At a rate of 70% for the purchase of a Department approved high efficiency sweeper.

3) For activities which promote an aggressive information and education program that targets local residents and businesses, and increases awareness of the water quality aspects of the program.

4) At a rate consistent with Administrative Code NR120, for the training of a sweeper operator to optimize the efficiency of the street sweeping effort.

5) For the development of a policy to control parking on village streets to be swept if the existing program is determined to be inadequate.

F. Cost-sharing is not authorized for:

1) Adopting a minimal street sweeping program that provides no additional water quality benefits.

2) Operation and maintenance of a street sweeper purchased with Nonpoint Source Program funding.

3) Disposal of the material collected by the street sweeper, although it shall be disposed of in a manner approved by the Department.

G. Sediment and Phosphorus Crediting Parameters:

1) Sediment and nutrient reduction crediting shall be determined by the Department; the pollutant reduction percentage will be dependent upon the street sweeping management program being implemented, which may include other incorporated core elements.

APPROVED: _____ 8/30/96
Planning Unit — Date

APPROVED: _____ 8/30/96
Technical Unit — Date

APPROVED: _____ 8/30/96
Section Chief — Date
for Becky Wallace

References

Bannerman et al, 1983. Evaluation of Urban Nonpoint Source Pollution Management in Milwaukee County, Wisconsin: Volume I. Wisconsin DNR.

Donovan et al, 1995. The Wisconsin Stormwater Manual Part II: Technical Design Guidelines for BMP's. Draft, Wisconsin Department of Natural Resources.

Satterfield & Associates, 1996. Enviro Whirl I: PM-10 Efficiency Study Removing Re-entrained Road Dust. 13 pages. Unpublished Report.

Sutherland, R.C., and S.L. Jelen, 1996. Contrary to Conventional Wisdom: Street Sweeping Can Be An Effective BMP. 4 pages. Abstract for Stormwater and Water Quality Modelling Conference, February 22-23, 1996, Toronto, Canada.

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APPENDIX F
MUNICIPAL QUESTIONNAIRE AND SUMMARY
Duck/Apple/Ashwaubenon Creeks Priority Watershed
Municipal Stormwater Management Questionnaire

Name of Municipality: _____

Watershed: _____ *Subwatershed:* _____

SECTION 1. EXISTING STORMWATER PRACTICES

A. Extent of Grassed Swale Drainage

Please indicate in the table below the extent to which the various land use types **in this subwatershed portion of your municipality are drained by grassed swales, and the extent to which stormwater may be infiltrating in these swales. Also, please mark the roadside, grassed swale systems (or general areas served by grassed swales) on the map provided or on a municipal stormsewer map.*

Land Use	Portion of Land Use Drained by Grassed Swales *(%)*	Estimated Infiltration Rate of Swales if Known *(in/hr, or qualitative)*
Residential: fewer than 2 lots/ac	%	
Residential: 2-6 lots/ac	%	
Commercial Strip	%	
Commercial Shopping Center	%	
Commercial Office Park	%	
Industrial: assembly & warehouse	%	
Industrial: manufacturing	%	
Institutional: Schools, Hospitals	%	
Parks	%	
Open Space	%	
Other	%	

General Comments: _____

_____

_____

_____

_____

_____

B. Catch-Basin Sumps

*Please indicate in the table below the extent to which catch basin sumps are used for the various land use types **in this subwatershed portion of your municipality**. *Also indicate how often they are generally cleaned. If possible, please indicate on the map provided or on a stormsewer map the general areas served by catch basin sumps. In the comments section, please indicate where washwater from sump cleaning equipment is discharged, and where sump sediments are disposed of.*

Land Use	Portion of Land Use Draining to Sumps *(%)*	Estimated Cleaning Frequency of Sumps *(times cleaned/year)*
Residential: fewer than 2 lots/ac	%	
Residential: 2-6 lots/ac	%	
Residential: Over 6 lots/ac	%	
Commercial Strip	%	
Commercial Shopping Center	%	
Commercial Office Park	%	
Industrial: assembly & warehouse	%	
Industrial: Manufacturing	%	
Institutional: Schools, Hospitals	%	
Parks	%	
Open Space		
Other	%	

General Comments (include where equipment washwater is discharged & where sump materials are disposed of):

_____

_____

_____

_____

_____

_____

C. Street Sweeping Schedules and Equipment

Please indicate the sweeping frequency used **in this subwatershed portion of your municipality by marking the appropriate boxes in the table below. Three separate tables are provided in case your sweeping frequency changes by season.*

Also, please indicate in the comments sections what types of equipment you use for sweeping (such as brush, vacuum, re-generative air, single or tandem sweeping), whether or not your sweepers can generally get up against the curb or whether parked cars cause an access problem, and whether or not large municipal and private parking lots are swept.

Land Use	Street Sweeping Frequency: SPRING				
	once/week	twice/month	once/month	other	do not sweep
Residential: fewer than 2 lots/ac.					
Residential: 2-6 lots/ac					
Residential: over 6 lots/ac					
Commercial Strip					
Comm. Shopping Cntr.					
Comm. Office Park					
Industrial: assembly & warehouse					
Indust: Manufacturing					
Institutional: Schools, Hospitals					
Parks					
Open Space					
Other					

Land Use	Street Sweeping Frequency: SUMMER				
	once/week	twice/month	once/month	other	do not sweep
Residential: fewer than 2 lots/ac					
Residential: 2-6 lots/ac					
Residential: over 6 lots/ac					
Commercial Strip					
Comm. Shopping Cntr.					
Comm. Office Park					
Industrial- assembly & warehouse					
Indust.-Manufacturing					
Institutional: Schools, Hospitals					
Parks					
Open Space					
Other					

Land Use	Street Sweeping Frequency: FALL				
	once/week	twice/month	once/month	other	do not sweep
Residential: fewer than 2 lots/ac					
Residential: 2-6 lots/ac					
Residential: over 6 lots/ac					
Commercial Strip					
Comm. Shopping Cntr.					
Comm. Office Park					
Industrial assembly & warehouse					
Indust. Manufacturing					
Institutional: Schools, Hospitals					
Parks					
Open Space					
Other					

Comments (include equipment type, access to curb when sweeping, sweeping of large parking lots): ___

D. Location of Existing Structural Stormwater Management Practices

Please mark on the map provided or on a municipal stormsewer map the locations of any structural stormwater practices (such as detention, retention, or infiltration areas) contained* ***in this subwatershed portion of your municipality.*

Comments:

E. Existing and Potential Streambank Erosion Problem Areas

*If you are aware of streams where existing stormwater runoff causes streambank erosion, or where you are concerned that increased runoff will cause such problems in the future, please indicate on the enclosed map where these stream segments are located.

Comments: _____
_____
_____
_____

SECTION 2. GENERAL HOUSEKEEPING & EDUCATION PROGRAMS

**Please answer the following questions concerning activities in your community that can affect the general potential for generating contaminated stormwater.*

A. Leaf Collection

1. Do you have a municipal leaf collection program? Yes _____ No _____
2. If you have such a program, then:
   a. What is the frequency of leaf collection? _____
   b. Are homeowners advised to keep leaves out of the street prior to pick-up? _____
   _____.
   c. How are collected leaves disposed of? _____.
3. If you do not have a municipal leaf collection program, then:
   a. what do you advise residents to do with their leaves? _____
   _____.

Comments: _____
_____
_____.

B. Grass Clipping & Brush Collection

1. Do you have a municipal grass/brush collection program? Yes_____ No _____
2. If you have such a program, then:
   a. What is the frequency of collection? _____
   b. Are homeowners instructed to keep grass clippings out of the street? _____
   _____.
   c. How are collected materials disposed of?_____.
3. If you do not have a grass/brush collection program, then:
   a. What do you advise residents to do with these materials? _____
   _____.

Comments: _____
_____
_____.

C. **Snow Removal and Street Salting**

1. Does your community have a salting policy (such as reduced use, sand/salt mixes, or use of alternative de-icers) that can minimize stormwater pollution? Yes ____ No ____
2. If you do have such a policy, could you briefly describe it? Application Rate if known?

_____

_____

_____

_____

3. Are your snow disposal sites located in places where meltwater is well buffered from surface waters and stormwater conveyance systems? Yes _____ No _____

Describe the site, i.e. size, distance from conveyance systems:

_____

_____

_____

D. **Fertilizer and Pesticide (Herbicide, Insecticide, etc.) Use**

1. Does your municipality have policies/procedures that are meant to reduce and or eliminate use of these materials? Yes _____ No _____
2. If you do have such policies/procedures, could you briefly describe them? _____

_____

_____

_____

_____

E. **Public Works Facilities (Yard Areas, Storage Areas, Maintenance Shops)**

1. Do you have any of these facilities within the watershed? Yes _____ No _____
2. If yes, are there pollution prevention activities (such as covering or berming the fueling, maintenance, storage, vehicle washing, or recycling areas) to minimize the discharge of contaminated stormwater? Yes _____ No _____

Comments: _____

_____

_____

F. **General Information Education**

1. Does your community take efforts to educate people concerning stormwater pollution and what they can do to help reduce it? Yes ___ No _____
2. If yes, do your efforts include any of the following?
   a. educating internal department heads, municipal staff, or elected officials? Yes ___ No ___
   b. educating the business community? Yes ____ No ____
   c. educating the general public? Yes ____ No _____
3. Do you have a pet waste control ordinance? Yes ___ No ____

Comments: _____

_____

_____

_____

SECTION 3. STORMWATER MANAGEMENT AND CONSTRUCTION EROSION POLICIES FOR NEW DEVELOPMENT

A. Stormwater Management

1. Does your municipality require that runoff from new development (after the construction phase is over) be controlled in some manner? Yes _____ No _____
2. If your community requires that long-term stormwater runoff controls be put in place, please indicate briefly what level of control is required for each of the following factors:
   Peak Flow Discharge Rate: _____
   Total Runoff Volume: _____
   Quality of Stormwater discharges: _____
3. Do you require certain development practices (such as requiring curb and gutter drainage, or requiring that rooftop leaders be directed either onto pavement or onto grassy areas) that affect the volume and quality of stormwater discharged ? Yes __ No __
4. If yes, please list the general nature of these requirements: _____

_____

_____

_____.

Other Comments:_____

_____

_____

_____.

5. Do you require that stormwater management plans (such as single site plans, sub-division plans, or regional plans) be prepared as part of development approval process?
   Yes ____ No ____
6. Do you include stormwater management needs in your annual operating budgets?
7. How are stormwater projects typically funded in your community?

B. Construction Erosion Control

1. What authority enforces the UDC for erosion control on one and two family dwellings in your community? _____.
2. What authority enforces erosion controls on commercial sites in your community? _____

   _____.
3. Do you have local ordinances that cover erosion control on sites not regulated by DNR or DILHR (such as jobs under 5 acres that do not involve a building)? Yes ___ No ___
4. If yes, what type of construction does the local ordinance cover? _____

   _____

   _____.
4. Are you satisfied with compliance of erosion control provisions in state (DILHR, DNR) and local laws? Yes ____ No ____
5. If no, which of the following would help?
   More enforcement staff: Yes ____ No ____
   Different administrative policies and procedures: Yes ___ No _____
   More training: Yes ____ No ____
   Other: _____

_____

_____

_____

_____.

MUNICIPAL QUESTIONNAIRE SUMMARY

THE FOLLOWING TABLES ARE A SUMMARY OF SELECTED QUESTIONS FROM A MUNICIPAL SURVEY SENT OUT TO VARIOUS MUNICIPALITIES WITHIN THE DUCK, APPLE AND ASHWAUBENON CREEK WATERSHED(S). THIS INFORMATION WAS COLLECTED IN JANUARY OF 1996. IT IS NOT AN ALL INCLUSIVE SINCE OTHER LOCALES AND TOWNSHIPS ENGAGE IN SOME OF THESE MANAGEMENT PRACTICES. VARIOUS MANAGEMENT STYLES ARE EVIDENT IN THIS SUMMARY. THE FOLLOWING ABBREVIATIONS ARE USED: APP = APPLETON; ASH = ASHWAUBENON; DeP = DePERE; GB = GREEN BAY; HW = HOWARD; KK = KAUKAUNA; LC = LITTLE CHUTE.

STREET SWEEPING FREQUENCY IN SPRING,SUMMER & FALL

	1/wk	2/mo	OTHER	COMMENTS
APP	X	X		COMMERCIAL STRIP IS 1/wk., ALL OTHER LAND USES IS 2/mo
ASH	X			
DeP			1/5wks	
GB	X	X	1/10 day	SPRING (2/mo),SUMMER (1/wk), FALL (1/EVERY 10 DAYS)
HW			2/yr	ONCE IN SPRING AND FALL
KK	X	X		USE A BRUSH MACH., LARGE PARKING LOTS ARE PRIVATELY DONE. OFFSTREET PARKING ONLY
LC	X			PELICAN SWEEPER WITH ACCESS TO CURB

EXISTING STORMWATER CONTROLS

	WHAT'S IN PLACE
APP	DETENTION PONDS, VEGETATED DRAINAGE
ASH	NONE PRESENTLY
DeP	DETENTION PONDS IN BUSINESS PARK, VEGETATED DRAINAGE
GB	NO PUBLICLY OWNED, UNKNOWN PRIVATE
HW	DETENTION PONDS
KK	PUMP STATION ACTS AS A RETENTION AREA AND SUMP — prob. out of low area
LC	DETENTION POND PLANNED FOR 1996

CATCH-BASIN SUMP CLEANING

	YES	NO	COMMENTS
APP		X	NONE IN PLACE
ASH		X	IN 1996 WILL USE SEWER VAC FOR INLETS
DeP		X	NONE IN PLACE
GB	X		EVERY OTHER YEAR
HW		X	CURRENT NUMBER UNKNOWN, NO CLEANING DONE
KK	X		ENTIRE BASIN DRAINAGE IS THROUGH PUMP STATION, CLEANED 1/yr, SUMP MATERIAL IS LANDFILLED
LC		X	NONE IN PLACE

GENERAL HOUSEKEEPING & EDUCATION PROGRAMS

LEAF COLLECTION

	YES	NO	FREQ	DISPOSAL METHOD
APP	X		1/10da	FARM FIELDS, AFTER THREE MONTHS STORAGE
ASH	X		1/wk	COMPOSTING, RESIDENTS DIRECTED TO KEEP LEAVES OFF OF STREET
DeP	X		1/6wks	COMPOST SITE
GB	X		1/8day	SPRING & FALL COLLECTION, PAYING RESIDENTS WEEKLY, CITY OWNED COMPOST SITE, LEAVES KEPT OUT OF STREET
HW	X		2/yr.	COMPOSTING, RESIDENTS KEEP LEAVES OFF OF STREET
KK	X		1/wk	RESIDENTS KEEP LEAVES OFF OF STREET, TAKEN TO FARM LAND FOR DISPOSAL
LC	X		1/wk	COMPOSTED AT BUSINESS, PLACING IN CURB REDUCES LABOR INVOLVED WITH COLLECTION

GRASS CLIPPING & BRUSH COLLECTION

	YES	NO	FREQ	DISPOSAL METHOD
APP	X		2/yr	ONCE IN SPRING & FALL, COMPOSTED, $1/BAG FEE FOR GRASS
ASH		X		DROPPED AT MUNICIPAL GARAGE AND COMPOSTED
DeP	X			COMPOST, COLLECTION ALL YEAR LONG
GB	X			BRUSH COLLECTED YEAR ROUND (WEEKLY),GRASS WEEKLY FROM PAYING RESIDENTS, OPTION TO LEAVE CLIPPINGS ON LAWN OR TAKE TO COMPOST DROP-OFF SITE.
HW	X		1/wk	COMPOSTED, RESIDENTS KEEP GRASS OFF OF STREET
KK	X		2/yr, 12/yr	GRASS 2/yr (COMPOSTED), BRUSH 12/yr (CHIPPED FOR PARK TRAILS), CITY LOOKING TO START COMPOSTING IN 1996, NO POLICY TO KEEP CLIPPINGS OUT OFF OF STREET
LC	X		1/wk	COMPOSTED AT BUSINESS, MUST KEEP OUT OF STREET, ESTABLISHED COLLECTION RULES, $2 BAG FOR GRASS

SNOW REMOVAL & SALTING POLICY

	YES	NO	RATE	DESCRIBE, BUFFERS IN PLACE FOR SITES IN WATERSHED?
APP	X		<300 lbs/mile	200' BUFFER GRAVEL SURFACE, SPREADERS CALIBRATED ANNUALLY
ASH	X		unk	APPLIED ONLY ON HILLS INTERSECTIONS AND CURVES. THE SNOW DISPOSAL SITE IS BUFFERED FROM SURFACE WATER
DeP		X		NO SNOW DISPOSAL SITE IN WATERSHED
GB	X		<300 lbs/mile	FOLLOW SALT INSTITUTE GUIDELINES [illegible] SPREADERS CALIBRATED EVERY OCT., 5% SAND/SALT MIX
HW		X	unk	NO DISPOSAL SITES
KK		X		SNOW DISPOSAL SITES ARE NOT BUFFERED
LC	X			SALT WITH CHIPS WHEN BELOW 15 DEGREES

FERTILIZER & PESTICIDE USE

	YES	NO	COMMENTS
APP	X		FERTILIZE ATHLETIC FIELDS ONLY, PESTICIDES VERY LIMITED USE BY STATE CERTIFIED APPLICATORS
ASH	X		FOLLOW AREA METRO GUIDELINES, ADOPTED 1/23/96
DeP	X		FOLLOW AREA METRO GUIDELINES, ADOPTED 1/23/96
GB	X		FOLLOW AREA METRO GUIDELINES, ADOPTED 1/23/96, PESTICIDES USED ONLY IF IDENTIFIED
HW	X		FOLLOW AREA METRO GUIDELINES, ADOPTED 1/23/96
KK		X	N/A
LC		X	VERY LIMITED USE

PUBLIC WORKS FACILITIES IN WATERSHED & SURFACE WATER PROTECTION

	COMMENTS
APP	NONE IN WATERSHED
ASH	YES THERE ARE YARDS BUT NO PREVENTION ACTIVITIES
DeP	NONE IN WATERSHED
GB	YES, COMPOST SITE AND STORAGE AREA
HW	YES, COVERED SALT STORAGE, INDOOR MAINTENANCE/ VEHICLE WASHING
KK	N/A
LC	YES THERE ARE YARDS

GENERAL INFORMATION & EDUCATION ACTIVITIES ABOUT STORMWATER
CHECK ALL THE TARGETED GROUPS

	YES	NO	STAFF	PUBLIC	BUSINESS	PET WASTE ORDINANCE?
[illegible]	X		X	[illegible]	X	[illegible]
[illegible]	X		X	[illegible]	X	[illegible]
[illegible]	X		X	[illegible]		[illegible]
[illegible]		X				[illegible]
[illegible]		X				[illegible]
[illegible]		X				[illegible]
[illegible]	X		X	[illegible]	X	[illegible]

STORMWATER MANAGEMENT

POST CONSTRUCTION RUNOFF CONTROL — IF YES, TYPE OF CONTROL

	YES	NO	PEAK FLOW	RUNOFF VOLUME	COMMENTS
APP	X		YES		
ASH	X			= TO GRASSED AREA	
DeP		X			CITY HAS TAKEN AN ACTIVE ROLE ,FLOW CONTROL ON A BASIN BASIS
GB		X			
HW		X			
KK	X				
LC	X		DEVEL RUNOFF CANNOT EXCEED PRESENT FLOW		

ARE THERE DEVELOPMENT REQUIREMENTS WHICH AFFECT THE VOLUME & QUALITY OF STORMWATER?

	YES	NO	EXPLAIN
APP	X		CURB & GUTTER, STORM LATERALS TO ALL COMMERCIAL AND RESIDENTIAL SITES. A RESULT OF WATER FLOWING OVER SMALL GRASSED AREAS ICING UP SIDEWALKS
ASH	X		WHERE A STORMSEWER IS AVAILABLE A CONNECTION IS REQUIRED. SHEET DRAINING ADJACENT PROPERTY IS NOT PERMITTED
DeP	X		CURB AND GUTTER
GB	X		NUISANCE FLOW MUST BE ROUTED TO STORMSEWER
HW	X		CURB & GUTTER IN SELECT AREAS, NO REQUIREMENTS FOR ROOFTOP DRAINS
KK	X		FLOWING INTO STORM SEWER SYSTEM OR YARD SWALES
LC	X		ROOF TOP LEADERS TO GRASS OR TO STORM SEWER DIRECTLY, SUMP PUMPS DIRECTLY TO STORMSEWER

DOES YOUR COMMUNITY REQUIRE STORMWATER MANAGEMENT PLANS AS PART OF THE DEVELOPMENT APPROVAL PROCESS?

	YES	NO	IN OPERATING BUDGET	ARE THERE FUNDING MECHANISMS IN PLACE? EXPLAIN. OTHER COMMENTS
APP	X		YES	ASSESSMENTS & STORMWATER UTILITY FEES
ASH		X		INCLUDED IN STORMWATER AREA WIDE ASSESSMENT BASED ON BASIN
DeP		X	YES	THE CITY HAS TAKEN AN ACTIVE ROLE IN DEVELOPING CONTROL ON A BASIN BASIS, ASSESSMENT FEES
GB		X		ASSESSMENTS & PROPERTY TAXES
HW		X	NO	BY DEVELOPER OR THROUGH VILLAGE IF REGIONAL
KK	X		NO	N/A
LC	X		YES	FROM PRIVATE DEVELOPMENT

CONSTRUCTION EROSION CONTROL

WHO ENFORCES THE UDC, AND COMMERCIAL SITES CODES

	1 & 2 FAMILY DWELLINGS	COMMERCIAL BUILDINGS
APP	BUILDING INSPECTOR	STATE
ASH	BUILDING INSPECTOR	BUILDING INSPECTOR
DeP	BUILDING INSPECTOR/ PUBLIC WORKS	BUILDING INSPECTOR/ PUBLIC WORKS
GB	BUILDING INSPECTOR	BUILDING INSPECTOR
HW	BUILDING INSPECTOR	BUILDING INSPECTOR/VILLAGE ENG.
KK	INSPECTION DEPARTMENT	INSPECTION DEPARTMENT
LC	BUILDING INSPECTOR/VILLAGE ENG.	BUILDING INSPECTOR/VILLAGE ENG.

ARE THERE LOCAL ORDINANCES THAT COVER EROSION CONTROL ON SITES NOT REGULATED BY DILHR OR DNR ,PLEASE EXPLAIN.

	ORDINANCE		IF YES PLEASE ELABORATE
	YES	NO	
APP		X	
ASH	X		DNR, DILHR GUIDELINES
DeP	X		ALL GROUND DISTURBING ACTIVITIES
GB	X		ALL GROUND DISTURBING ACTIVITIES
HW	X		ALL GROUND DISTURBING ACTIVITIES
KK		X	
LC	X		LAND DISTURBANCE >4000 FT, FILLING > 400 yd^3, ALL BRIDGE, ROAD AND UNDERGROUND PIPING REPAIR OR REPLACEMENT

2-3 pages

ARE YOU SATISFIED WITH THE COMPLIANCE OF THE EROSION CONTROL PROVISIONS IN STATE AND LOCAL ORDINANCES. IF NOT CHECK THOSE THAT WOULD ASSIST YOUR COMMUNITY.

	YES	NO	ADD STAFF	DIFFERENT POLICIES AND PROCEDURES	MORE TRAINING	OTHER SUGGESTIONS OR COMMENTS
APP		X	X	X	X	REGULATIONS ARE SUBJECT TO INTERPRETATION ENFORCEMENT NEEDED EDUCATE BUILDERS
ASH		X	X	X	X	
DeP		X	X			
GB		X			X	CONTRACTOR TRAINING
HW		X	X	X		LAWS ARE ADEQUATE BUT ENFORCEMENT IS IMPOSSIBLE WITH BUILDER CONSTRAINTS, TIME FOR CORRECTIVE ACTION IS TOO LONG TO ACHIEVE EFFECTIVE CONTROL AND LOCAL POLICY THROUGH IS NECESSARY
KK	X					
LC	X					

Appendix G
Probability of Event Mean Concentrations Exceeding Wisconsin Suface Water and Groundwater Quality Criteria

Constituent	Probability of Exceedence, Percent (%)	
	Stormsewers	Streams
Acute Toxicity Criteria for Cold Water Fish (Chapter NR 105)		
Cadmium	11	0
Copper	87	9
Lead	18	0
Silver	20	?
Zinc	91	7
Human Cancer Criteria for Public Water Supply/Coldwater Fish (Chapter NR 105)		
Benzo(a)anthracene	98	100
Benzo(a)pyrene	99	100
Benzo(a)fluoranthene	100	100
Benzo(ghi)perylene	99	100
Benzo(k)fluoranthene	99	99
Chrysene	100	100
Indenopyrene	100	99
Phenanthrene	100	99
Pyrene	100	100
DDT	98	100
Effluent Limitations (Chapter NR210)		
Total Phosphorus (Great Lakes)	9	0
Suspended Solids - 7 day average	97	100
BOD_5 (7 day average)	5	100
Water Quality Standards (Chapter NR 102)		
Fecal Coliform (400 counts/100 ml)	96	99

Groundwater Quality Standards: Enforcement Standards (Chapter NR 140)		
Bis(2-ethylhexy)phthalate	60	44
Atrazine	2	0
Alachlor	2	0
2,4-D	2	0
PCB	42	0
Chloride	4	9

From: *Quality of Wiconsin Stormwater,* 1989-1994. Roger Bannerman, Andrew D. Legg and Seven R. Greb, 1996. Open File Report, 96-458. Prepared in cooperation with the WDNR.

APPENDIX H

Field Inventory Sheet for Land Use Characteristics

FIELI rICS:

*Date:*_____ *Time:*_____ *Preparer:*_____
*Municipality:*_____ *Sheet No:* _____ *Site No:*____
*Photo No:*_____ *Roll No:*_____ *Age of Buildings:*_____

Land-use

Residential:	Single family (density: Low Medium High) Multiple family (density: Med/High) Mobile Home Parks (denstity: Med/High) Alleys: Yes No		
Institutional:	School	Hospital	Other
Commercial:	Strip	Shopping Center	Downtown
Industrial:	Light	Medium	Heavy
Open Space:	Park	Undeveloped	Cemetery
Other:	Freeway	Utility	Railroad

Source area characteristics

Roofs *Type:* Flat Pitched
Drains to: Underground Gutter
Gutter drains to: Impervious _____% Pervious _____%

Topo *Street Slope:* Flat(<2%) Medium (2-5%) Steep (>5%)
Land Slope: Flat (<2%) Medium (2-5%) Steep (>5%)

Streets *Texture:* Smooth Intermediate Rough
Roadside: Curb and gutter Undeveloped
Condition of curb and gutter: Poor Fair Good
Road coveyance: GrassSwale Ditch Curb and Gutter
Parking density: None Light Moderate Heavy
Curb-miles(street length X two): _____ mi.

Drivewy *Surface type:* Paved Unpaved
Drains to: Impervious _____% Pervious _____%

Parking/ Storage *Surface type:* Paved Unpaved
Drains to: Impervious _____% Pervious _____%

Sidewlk *Drains to:* Impervious ___% Pervious ___% (Default 50/50)

Other paved *Drains to:* Impervious _____% Pervious _____%

NOTES

APPENDIX I

Land Development Categories and Descriptions for Urban Areas

Land use	Code	Description
RESIDENTIAL:		
High Density with Alleys	HRWA	Urban single and two-family housing at a density of greater than 6 units per acre, including the house, driveway, yard, alley, and streets.
High Density with No Alleys	HRNA	Urban single and two-family housing at a density of greater than 6 units per acre, including the house, driveway, yard, and streets.
Medium Density with Alleys	MRWA	Urban single and two-family housing at a density between two and six units per acres, including the house, driveway, yard, alley, and streets.
Medium Density with No Alleys	MRNA	Urban single and two-family housing at a density between two and 6.5 units per acres, including the house, driveway, yard, and streets.
Low Density	LR	Urban single and two-family housing at a density of between 0.7 and two units per acre, including the house, driveway, yard alley and streets.
Multiple Family	MF	Housing for three or more family units from one to three stories in height. Units may be adjoined up and down, side by side, or front and rear. Includes building, yard, parking lot, and driveway.
High Rise Apartments	HIR	Housing four or more stories in height. Units may be adjoined up and down, side by side, or front and rear. Includes building, yard, parking lot, and driveways.

High Rise Apartments	HIR	Housing four or more stories in height. Units may be adjoined up and down, sid by side, or front and rear. Includes building, yard, parking lot, and driveway.
Trailer Parks	MOBR	For a mobile home or trailer park, includes all vehicle homes, the yard, driveway, and office area.
Suburban	SUBR	Urban single family housing at a density of between 0.2 and 0.6 units per acre, including the house driveway, yard, alley and streets.
COMMERCIAL:		
Strip Commercial	CST	Commercial areas for which the primary function involves the sale of goods and/or services. This land includes the buildings, parking lots, and streets. This category does not include buildings used for the manufacture of goods or warehouses; nor does it include nurseries, tree farms, or lumber yards.
Shopping Centers	SC	Commercial areas the related parking lc at least 2.5 times the size of the building roof area. The buildings in this land use are usually surrounded by the parking lot, and the streets.
Office Park	OP	Land use where non-retail business takes place. The buildings are usually multi-storied surrounded by larger areas of lawn and landscaping. This land use includes the buildings, lawn, and road areas.
Downtown Commercial	CDT	Highly impervious downtown areas of commercial land uses.
INDUSTRIAL:		
Manufacturing	MI	Those buildings and premises which are devoted to the manufacture of products. This category also includes utility power plants.

Non-Manufacturing	LI	Those buildings which are used for the storage and/or distribution of goods awaiting further processing or sale to retailers. This category includes warehouses and wholesalers. This category also includes businesses such as lumber yards, auto salvage yards, junk yards, oil tank farms, coal and salt storage areas, grain elevators, agricultural coops, and areas for bulk storage of fertilizers and pesticides.
INSTITUTIONAL:		
Hospitals	HOSP	Medical facilities that provide inpatient overnight care. Includes nursing homes, state, county, or private facilities. Includes the buildings, grounds, parking lots, and drives.
Education	SCH	Includes any public or private primary, secondary, or college educational institutional grounds. Includes buildings, playgrounds, athletic fields, roads, parking lots, and lawn care.
Miscellaneous/Institutional	MISC	Churches and large areas of institutional property. This includes government buildings, parking lots, lawns, and road areas.
OPEN SPACES:		
Cemeteries	CEM	Includes cemetery grounds, roads, and buildings located on the grounds.
Parks	PARK	Outdoor recreational areas including municipal playgrounds, botanical gardens, arboretums, golf courses, and natural areas.
Undeveloped	OSUD	Lands that are private and publicly owned with no structures and have a complete vegetative cover. This includes vacant lots.

Priority Watershed Projects in Wisconsin: 1996 - 1997

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

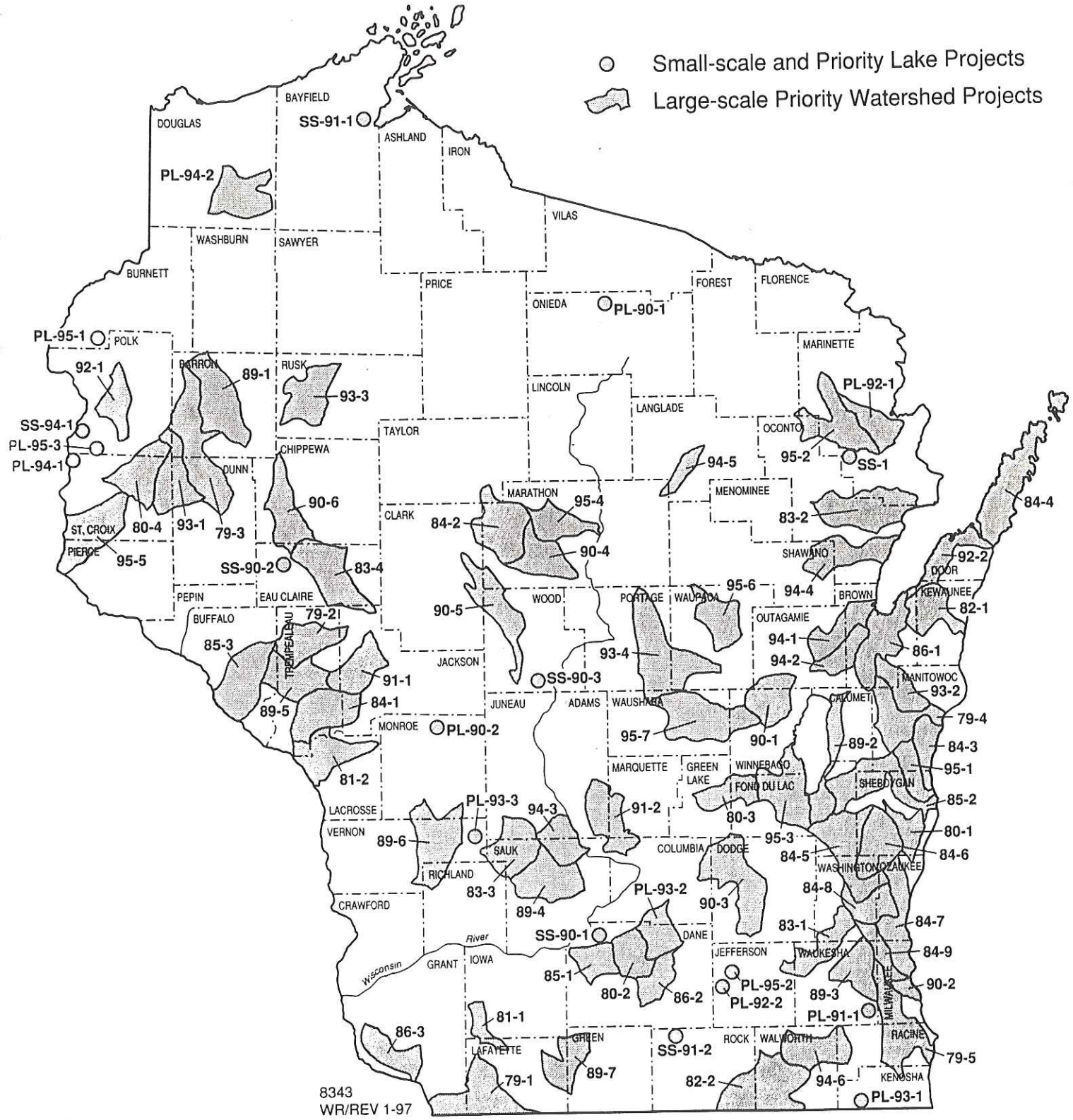
Year Selected-Map Number	Priority Lake Project	County(ies)
PL-90-1	Minocqua Lake	Oneida
PL-90-2	Lake Tomah	Monroe
PL-91-1	Little Muskego, Big Muskego, Wind Lakes	Waukesha, Racine, Milwaukee
PL-92-1	Lake Noquebay	Marinette
PL-92-2	Lake Ripley	Jefferson
PL-93-1	Camp/Center Lakes	Kenosha
PL-93-2	Lake Mendota	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).*

Land under development	CNST	Lands not yet fully developed at the time of the survey and bare soil is present.
FREEWAY:		
Freeways	FREE	Limited access highways and the interchange areas.

Priority Watershed Projects in Wisconsin
1996-1997



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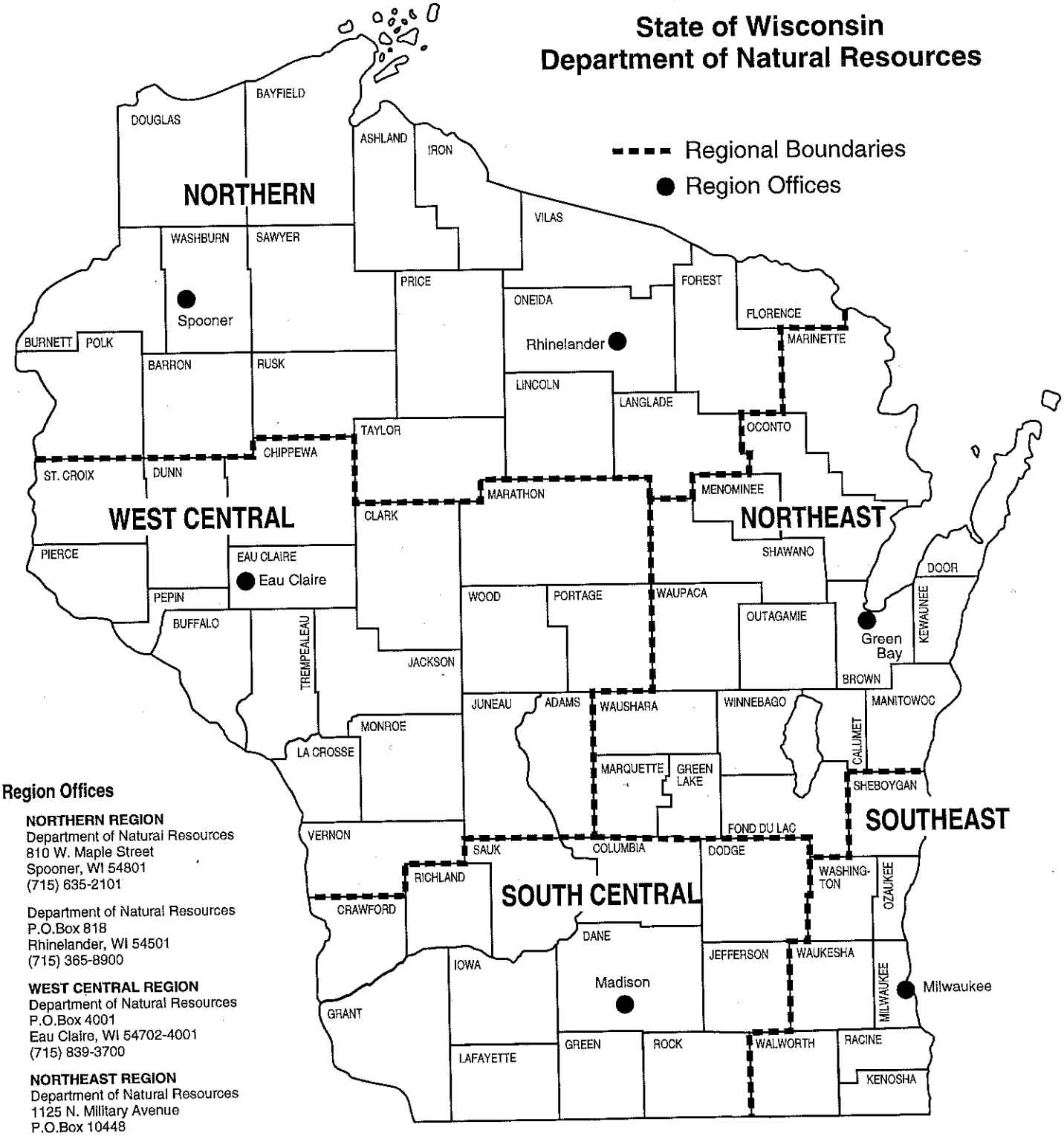

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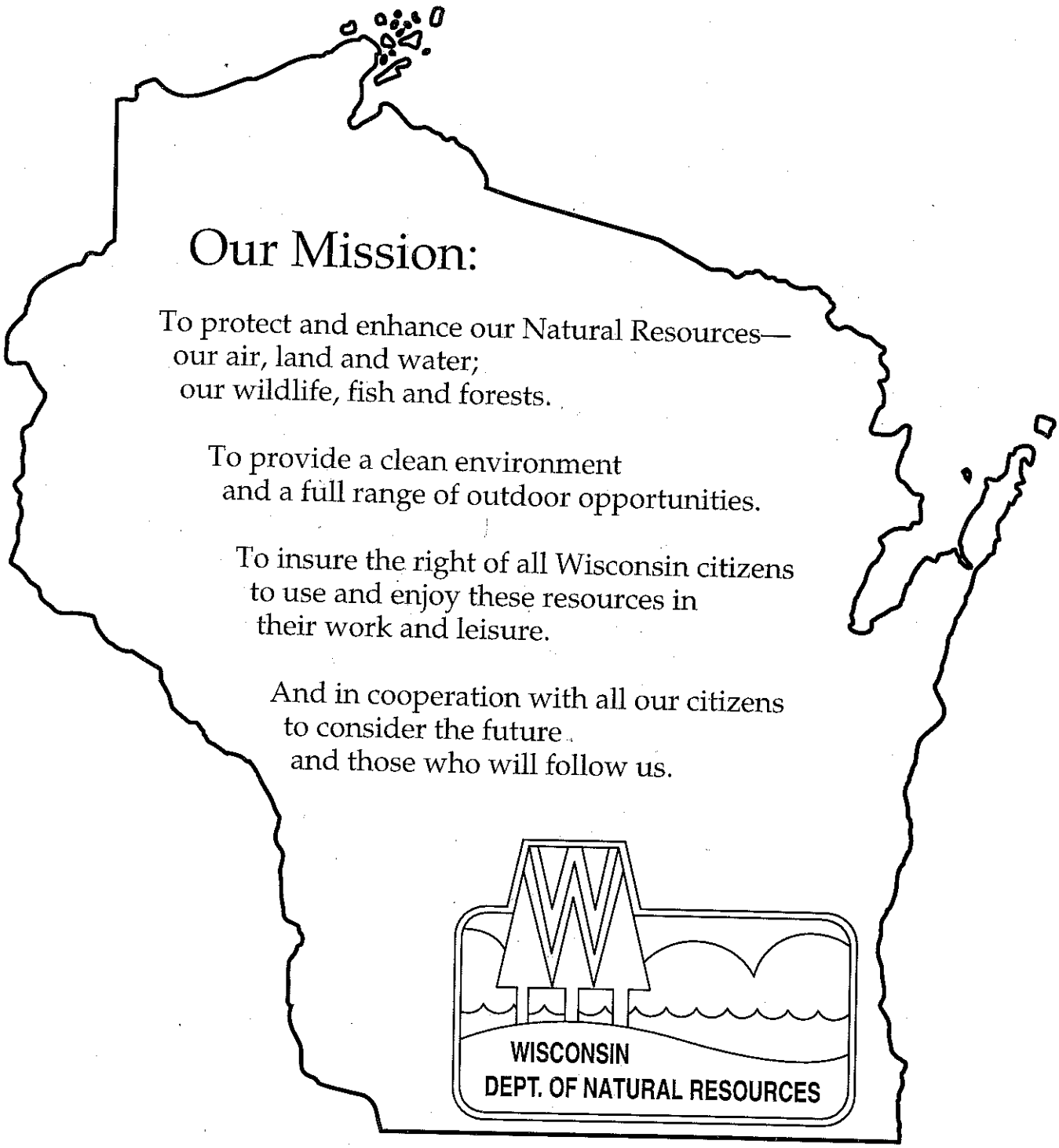

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To protect and enhance our Natural Resources—
our air, land and water;
our wildlife, fish and forests.

To provide a clean environment
and a full range of outdoor opportunities.

To insure the right of all Wisconsin citizens
to use and enjoy these resources in
their work and leisure.

And in cooperation with all our citizens
to consider the future
and those who will follow us.

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