WISCONSIN

A Summary of Cooperative Water Resources Investigations

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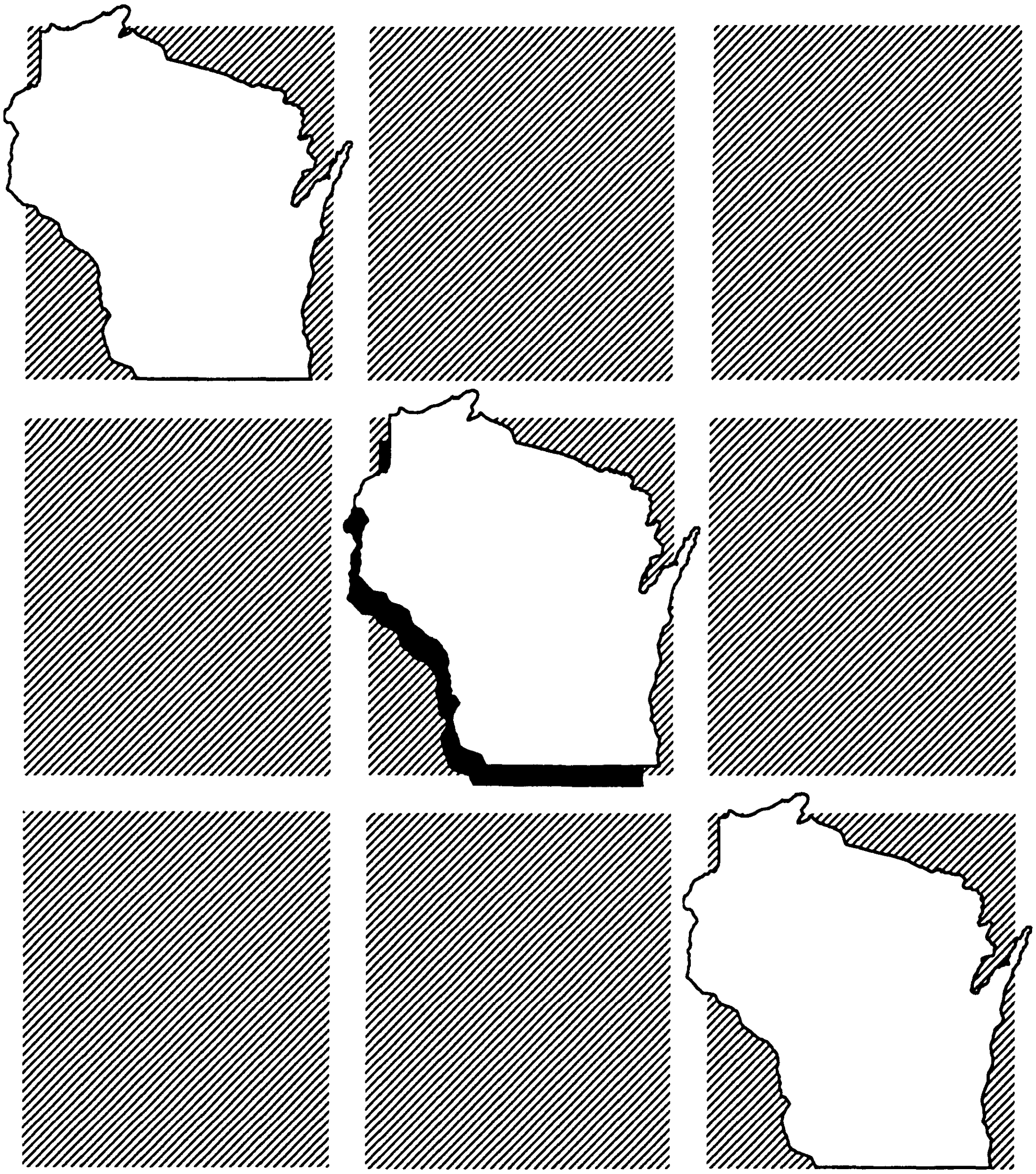
U.S. Geological Survey and
Wisconsin Department of Natural Resources



2002

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CONTENTS

FIGURE

COLLECTION OF BASIC RECORDS–SURFACE WATER

COOPERATORS

Bad River Band of Lake Superior Chippewa Indians
City of Barron
City of Beaver Dam
City of Fort Atkinson
City of Hillsboro
City of Peshtigo
City of Sparta
City of Thorp
City of Waupun
Dane County Department of Planning and Development
Dane County Regional Planning Commission
Federal Energy Regulatory Commission Licensees
- Black River Falls Municipal Utilities
- Dairyland Power Cooperative
- Northern States Power Company
- Stora Enso, Niagra Mill
- Wisconsin Electric Power Company
- Wisconsin Public Service Corporation
- Wisconsin Valley Improvement Company

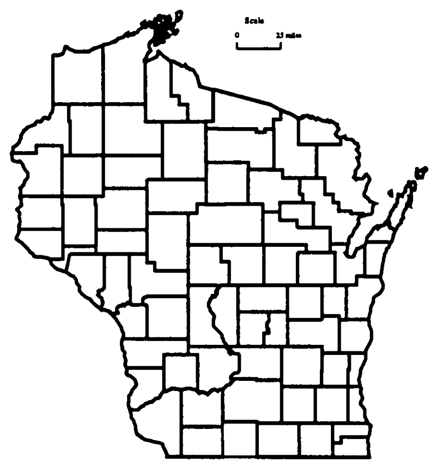
Fontana/Walworth Water Pollution Control Commission
Green Bay Metropolitan Sewerage District
Illinois Department of Transportation
Kickapoo Valley Reserve
Lac du Flambeau Band of Lake Superior Chippewa
Madison Metropolitan Sewerage District
Menominee Indian Tribe of Wisconsin
Mole Lake Sokaogon Chippewa Community
Oneida Tribe of Indians of Wisconsin
Rock County Public Works Department
Southeastern Wisconsin Regional Planning Commission
- City of Racine
- Kenosha Water Utility
- Milwaukee Metropolitan Sewerage District
- Waukesha County

Stockbridge-Munsee Band of Mohican Indians
U.S. Army Corps of Engineers
Village of Wittenberg
Walworth County Metropolitan Sewerage District
Wisconsin Department of Natural Resources
Wisconsin State Historical Society-Wade House Historic Site

LOCATION
Statewide

PROJECT CHIEF:
Robert J. Waschbusch

PERIOD OF PROJECT:
July 1913–Continuing



PROBLEM

Surface-water information is needed for surveillance, planning, design, hazard warning, operation, and management in water-related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development. An appropriate database is necessary to provide this information.

OBJECTIVE

The objectives of this study are to provide continuous discharge records for selected rivers at specific sites to supply the needs for regulation, analytical studies, definition of statistical properties, trends analysis, determination of the occurrence, and distribution of water in streams for planning. The project is also designed to determine lake levels and to provide discharge for floods, low-flow conditions, and for water-quality investigations. Requests for streamflow data and information relating to streamflow in Wisconsin are answered. Basic data are published annually in the report "Water Resources Data–Wisconsin."

APPROACH

A network of streamflow stations and lake-level stations will be maintained throughout Wisconsin. This includes operating the equipment at the gaging station to record river or lake stage, making periodic discharge measurements at each streamflow station to establish or verify a stage-discharge rating curve, reducing the stage records to instantaneous and daily discharges, compilation of monthly and annual discharges, and preparing data for publication in the annual report "Water Resources Data–Wisconsin."

PROGRESS (July 2001 to June 2002)

During the current fiscal year, streamflow data were collected at a total of 118 sites and lake-level data were collected at six. These sites are listed in the following table, "Surface-Water Gaging Stations Expected to be Operated in 2003 FY." A map showing the location of all continuous-record streamflow-gaging stations in Wisconsin is shown on page 5.

Computation of streamflow and lake-level records for all the network stations for the 2001 water year was completed, stored in our NWIS computer database, and published in the annual report "Water Resources Data-Wisconsin, water year 2001."

PLANS (July 2002 to June 2003)

Data will be collected at 118 continuous-streamflow stations (see the following list) and lake levels at 6 stations. Streamflow records will be computed and data published for the 2002 water year. Requests for streamflow information will be answered.

Real-time data can be accessed on the World Wide Web at http://wi.water.usgs.gov

Station 04077400 Wolf River at Shawano was discontinued by the cooperator for 2002. The USGS received federal funding to install and operate the Kinnickinnic River near River Falls station (04073365). In addition, 7 new sites were established through cooperator funding:

04074538	Swamp Creek above Rice Lake—Mole Lake Sokaogon Chippewa Community
04074548	Swamp Creek below Rice Lake—Mole Lake Sokaogon Chippewa Community
04085746	Mullet River near Greenbush—Wisconsin State Historical Society
05400664	Mill Creek near Hewitt—Wisconsin Department of Natural Resources
05400705	Mill Creek near Junction City—Wisconsin Department of Natural Resources
054070396	Fennimore Fork near Castle Rock—Wisconsin Department of Natural Resources
05427850	Yahara River at Hwy. 113 near Madison—Wisconsin Department of Natural Resources

SURFACE-WATER GAGING STATIONS EXPECTED TO BE OPERATED IN 2003 FY

Station number	Name and location	Drainage Area	Period of record (water year)	Cooperator
464646092052900	Superior Bay, Duluth Ship Canal at Duluth, MN	4200	1994-	C of E, Detroit
04024430	Nemadji River - South Superior	420	1974-	WDNR
04025500	Bois Brule River - Brule	118	1943-81, 1984-	USGS Federal Program
04027000	Bad River - Odanah	597	1914-22, 1948-	Bad River Band of Lake Superior Chippewa Indians
04027500	White River - Ashland	301	1948-	NSP/WDNR
04029990	Montreal River - Saxon Falls	262	1987	NSP/WDNR
04063700	Popple River - Fence	139	1964-	USGS Federal Program
04064500	Pine River - Pine River Powerplant - Florence	533	1924-76, 1996-	WEPCO/WDNR
04065106	Menominee River - Niagara	2470	1993-	FERC
04066003	Menominee River - Pembine	3140	1950-	WEPCO/WDNR
04066030	Menominee River - White Rapids Dam - Banat, MI	3190	1999-	FERC
04066500	Pike River - Amberg	255	1914-70, 2000-	USGS Federal Program
04066800	Menominee River - Koss, MI	3700	1907-09, 1913-81, 1998-	FERC
04067500	Menominee River - McAllister	3930	1945-61, 1979-86 1988-90, 1993-95, 1998-	WDNR
04067958	Peshtigo River - Wabeno	447	1998-	WPS/WDNR
04069416	Peshtigo River - Porterfield	1020	1998-	FERC
04069500	Peshtigo River - Peshtigo	1080	1953-	City of Peshtigo
04071000	Oconto River - Gillett	705	1906-09, 1914-	USGS Federal Program
04071765	Oconto River - Oconto	966	1989-90, 1998-	WDNR
04072150	Duck Creek - Howard	108	1988-	Oneida Tribe of Indians of WI
04073365	Fox River - Princeton		2001-	USGS Federal Program
04073500	Fox River - Berlin	1340	1898-	C of E, Detroit
04074538	Swamp Creek - above Rice Lake at Mole Lake	46.3	1977-83, 1984-86, 2001-	Sokaogan Chippewa Community
04074548	Swamp Creek - below Rice Lake at Mole Lake	56.8	1977-79, 1982-85, 2001-	Sokaogan Chippewa Community
04074950	Wolf River - Langlade	463	1966-79, 1981-	Menominee Indian Tribe of WI
004077630	Red River - Morgan	114	1993	Stockbridge-Munsee Band of Mohican Indians
0407809265	Middle Branch Embarrass River - Wittenberg	76.3	1990-	Village of Wittenberg
04078500	Embarrass River - Embarrass	384	1919-85, 1994-	USGS Federal Program
04079000	Wolf River - New London	2260	1896-	C of E, Detroit
04082400	Fox River - Oshkosh	5310	1991	C of E, Detroit
04084445	Fox River - Appleton	5950	1986-	C of E, Detroit
04084500	Fox River - Rapide Croche Dam - Wrightstown	6010	1896-	LFRDA/WDNR
040851385	Fox River - Oil Tank Depot - Green Bay	6330	1989-	Green Bay MSD
04085200	Kewaunee River - Kewaunee	127	1964-96, 1998-	WDNR
04085395	S.Br. Manitowoc River - Hayton	109	1993-	WDNR
04085427	Manitowoc River - Manitowoc	526	1972-96, 1998-	WDNR
04085746	Mullet River - Greenbush	24.3	2001-	Wisconsin State Historical Soc.
04086000	Sheboygan River - Sheboygan	418	1916-24, 1951-	WDNR
04086500	Cedar Creek - Cedarburg	120	1930-70, 73-81, 1983-87, 1991-	WDNR
04086600	Milwaukee River - Pioneer Road - Cedarburg	607	1982-	SEWRPC
04087000	Milwaukee River - Milwaukee	696	1914-	SEWRPC
04087030	Menomonee River - Menomonee Falls	34.7	1975-77, 1979-	SEWRPC
04087088	Underwood Creek - Wauwatosa	18.2	1975-	SEWRPC
04087120	Menomonee River - Wauwatosa	123	1962-	SEWRPC
04087160	Kinnickinnic River - Milwaukee	20.4	1976-	SEWRPC
04087204	Oak Creek - South Milwaukee	25	1964-	SEWRPC
04087220	Root River - Franklin	49.2	1964-	SEWRPC
04087233	Root River Canal - Franklin	57	1964-	SEWRPC
04087240	Root River - Racine	190	1963-	SEWRPC
04087257	Pike River - Racine	38.5	1972-	SEWRPC
05332500	Namekagon River - Trego	488	1928-70, 1988	NSP/WDNR
05333500	St. Croix River - Danbury	1580	1914-81, 1984-	USGS Federal Program
05340500	St. Croix River - St. Croix Falls	6240	1902-	NSP/WDNR
05341500	Apple River - Somerset	579	1901-70, 1987	NSP/WDNR
05356000	Chippewa River - Winter	790	1912-	NSP/WDNR
05356500	Chippewa River - Bruce	1650	1914-	NSP/WDNR
05357254	Trout River - CTH H - Boulder Junction	58.9	1999-	Lac du Flambeau Band of Lake Superior Chippewa (LDF)
05357335	Bear River - Manitowish Waters	81.3	1991	LDF
05360500	Flambeau River - Bruce	1860	1951-	NSP/WDNR, FERC
05362000	Jump River - Sheldon	576	1915-	USGS Federal Program
05365500	Chippewa River - Chippewa Falls	5650	1888-1983, 1987	NSP/WDNR
05365707	North Fork Eau Claire River - Thorp	51	1986	City of Thorp
053674464	Yellow River - Barron	153	1991	City of Barron
05368000	Hay River - Wheeler	418	1951-	USGS Federal Program
05369000	Red Cedar River - Menomonie	1770	1907-08, 1913-	NSP/WDNR
05369500	Chippewa River - Durand	9010	1928-	C of E, St. Paul
05369900	Eau Galle River - Woodville	39.4	2001-	C of E, St. Paul
05370000	Eau Galle River - Spring Valley	64.1	1944-	C of E, St. Paul

SURFACE-WATER GAGING STATIONS EXPECTED TO BE OPERATED IN 2003 FY

Station number	Name and location	Drainage Area	Period of record (water year)	Cooperator
05379400	Trempealeau River - Arcadia	606	1960-77, 2001-	USGS Federal Program
05379500	Trempealeau River - Dodge	643	1914-19, 1934	C of E, St. Paul
05381000	Black River - Neillsville	749	1905-09, 1914-	USGS Federal Program
053813595	Black River - Black River Falls	1590	1985-	C of E, St. Paul, City of Black River Falls
05382000	Black River - Galesville	2080	1932-	C of E, St. Paul
05382325	La Crosse River - Sparta	167	1992-	City of Sparta
05383075	La Crosse River - LaCrosse	471	2000-	WDNR
05391000	Wisconsin River - Lake Tomahawk	757	1936-	WVIC/WDNR
05393500	Spirit River - Spirit Falls	81.6	1942-	WVIC/WDNR
05394500	Prairie River - Merrill	184	1914-31, 1939	WVIC/WDNR
05395000	Wisconsin River - Merrill	2760	1903-	WVIC/WDNR
05397500	Eau Claire River - Kelly	375	1914-27, 1939-	WVIC/WDNR
05398000	Wisconsin River - Rothschild	4020	1945-	WVIC/WDNR
05399500	Big Eau Pleine River - Stratford	224	1914-26, 1937-	WVIC/WDNR
05400760	Wisconsin River - Wisconsin Rapids	5420	1914-50, 1958-	WVIC/WDNR
05401050	Tenmile Creek - Nekoosa	73.3	1963-79, 1988-94, 1998-	WDNR
05402000	Yellow River - Babcock	215	1944-	WVIC/WDNR
05404000	Wisconsin River - Wisconsin Dells	8090	1935-	WVIC/WDNR
05404116	S. Br. Baraboo River - Hillsboro	39.1	1988-	City of Hillsboro
05405000	Baraboo River - Baraboo	609	1914-22, 1943-	USGS Federal Program
05406500	Black Earth Creek - Black Earth	45.6	1954-	DCRPC
05407000	Wisconsin River - Muscoda	10400	1903-04, 1914-	C of E, St. Paul
054070396	Fennimore Fork near Castle Rock	21.7	2001-	WDNR
05407470	Kickapoo River - Ontario	151	2001-	USGS Federal Program
05408000	Kickapoo River - LaFarge	266	1939-	Kickapoo Reserve
05410490	Kickapoo River - Steuben	687	1933-	C of E, St. Paul
05413500	Grant River - Burton	269	1935-	C of E, R. Island
05414000	Platte River - Rockville	142	1935-	C of E, R. Island
05423500	S. Br. Rock River - Waupun	63.6	1948-69, 1987	City of Waupun
05425500	Rock River - Watertown	969	1931-70, 1977-	C of E, R. Island, Rock County PWD
05425912	Beaverdam River - Beaver Dam	157	1984-	City of Beaver Dam
05426000	Crawfish River - Milford	762	1931-	Rock County PWD, Jefferson County
05426250	Bark River - Rome	122	1980-	SEWRPC
05427570	Rock River - Indianford	2630	1975-	Rock County PWD
05429500	Yahara River - McFarland	327	1930-	DCDP&D
05427850	Yahara River at Hwy. 113 at Madison	114	2002-	WDNR, Town of Westport, DCRPC
05430150	Badfish Creek - Cooksville	82.6	1977-	MMSD
05430175	Yahara River - Fulton	517	1977	MMSD
05430500	Rock River - Afton	3340	1914-	C of E, R. Island
05431032	Turtle Creek - Delavan	83.3	1996-	WALCOMET
05431486	Turtle Creek - Clinton	199	1939-	C of E, Rock Island, WALCOMET
05432500	Pecatonica River - Darlington	273	1939-	C of E, R. Island
05433000	E. Br. Pecatonica River - Blanchardville	221	1939-1986, 1988	C of E, R. Island
05434500	Pecatonica River - Martintown	1034	1940-	C of E, R. Island
05435943	Badger Mill Creek - Verona	20.3	1997-	MMSD
05436500	Sugar River - Brodhead	523	1914-	C of E, Rock Island
05438283	Piscasaw Creek - Walworth	9.58	1992-	Fontana/Walworth WPCC
05543830	Fox River - Waukesha	126	1963-	SEWRPC
05544200	Mukwonago River - Mukwonago	74.1	1973-	SEWRPC
05545750	Fox River - New Munster	811	1940-	IL. DOT
		LAKES		
04082500	Lake Winnebago - Oshkosh	5880	1882-	C of E, Detroit
04084255	Lake Winnebago - Stockbridge	5880	1983-	C of E, Detroit
05404500	Devil's Lake - Baraboo	4.79	1922-30, 1932, 1934-81, 1985-	WDNR
05427235	Lake Koshkonong - Newville	2560	1987	Rock County PWD
05428000	Lake Mendota - Madison	233	1903, 1916-	DCDPW
05429000	Lake Monona - Madison	279	1915-	DCDPW

C of E, Detroit – Corps of Engineers, Detroit, Michigan
C of E, R. Island – Corps of Engineers, Rock Island, Illinois
C of E, St. Paul – Corps of Engineers, St. Paul, Minnesota
DCDP&D – Dane County Department of Planning and Development
DCRPC – Dane County Regional Planning Commission
FERC – Federal Energy Regulatory Commission Licensees
Fontana/Walworth WPCC – Fontana/Walworth Water Pollution Control Commission
Green Bay MSD – Green Bay Metropolitan Sewerage District
IL. DOT – Illinois Department of Transportation
LFRDA – Lower Fox River Dischargers' Association
MMSD – Madison Metropolitan Sewerage District
NSP – Northern States Power Company
Rock County PWD – Rock County Public Works Department
SEWRPC – Southeastern Wisconsin Regional Planning Commission
WALCOMET – Walworth County Metropolitan Sewerage District
WDNR – Wisconsin Department of Natural Resources
WEPCO – Wisconsin Electric Power Company
WPS – Wisconsin Public Service
WVIC – Wisconsin Valley Improvement Company

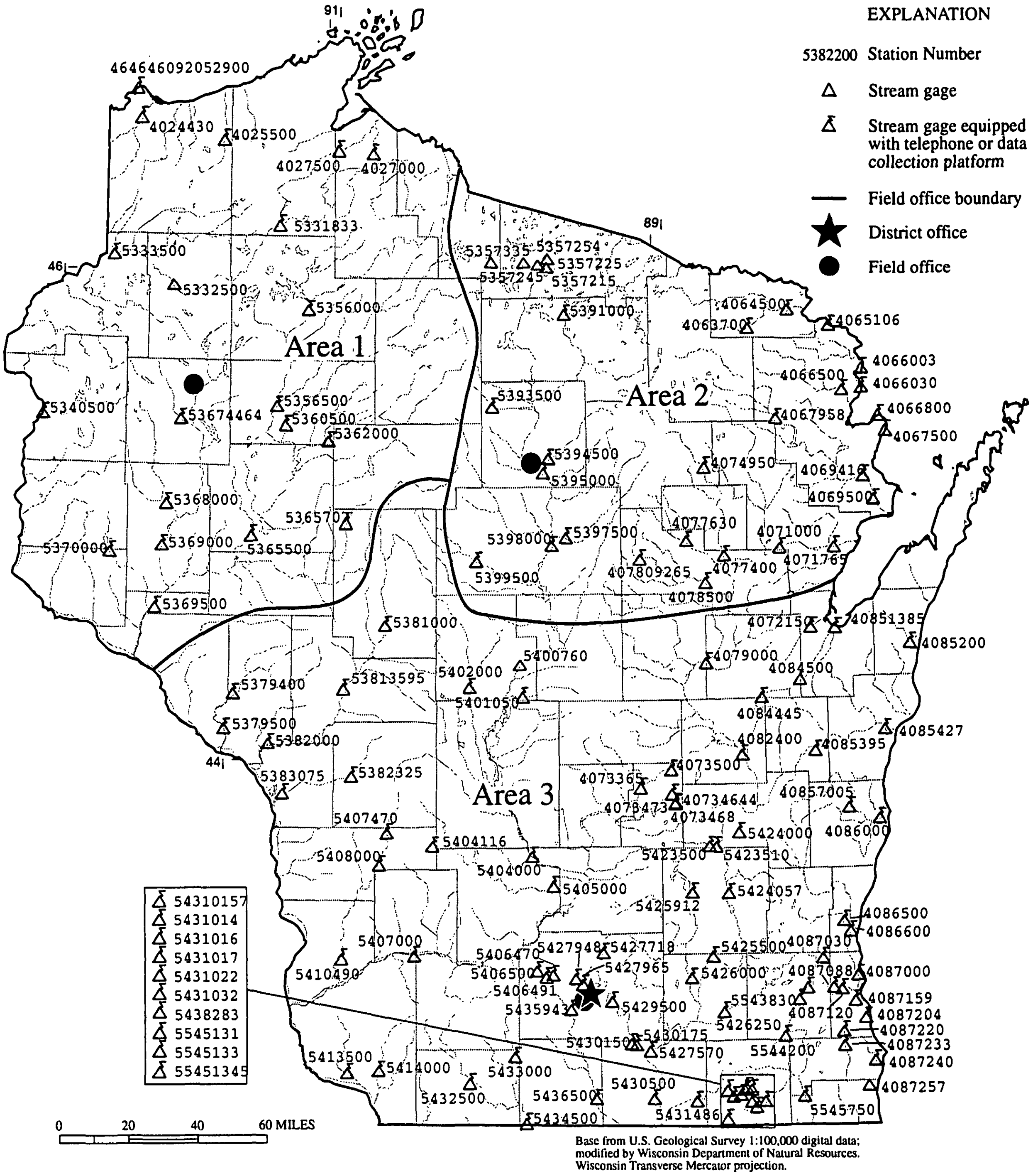


Figure 1. Location of continuous-record data-collection stations.

DISCONTINUED SURFACE-WATER DISCHARGE STATIONS

The following continuous-record surface-water discharge stations in Wisconsin have been discontinued. Daily streamflow records were collected and published for the period of record, expressed in water years, shown for each station. Those stations with an asterisk (*) after the station number are currently operated as crest-stage partial-record stations. Some of the discontinued project stations with less than 3 years of record have not been included. Information regarding these stations may be obtained from the District Office at the address given on the back side of the title page of this report.

Station name	Station number	Drainage area (mi^2)	Period of record
STREAMS TRIBUTARY TO LAKE SUPERIOR			
Tower Avenue at Superior, WI	04024080	0.034	1993–95
Little Balsam Creek at Patzau, WI	04024314	4.89	1976–78
Little Balsam Creek near Patzau, WI	04024315	5.05	1976–78
Little Balsam Creek Tributary near Patzau, WI	04024318	0.60	1976–78
Little Balsam Creek near Foxboro, WI	04024320	6.27	1977–78
Amnicon River near Poplar (Amnicon Falls), WI	04025000	110	1914–16
Bois Brule (Brule) River near Brule, WI	04026000	160	1914–17
Sioux River near Washburn, WI	04026300*	33.9	1965–66
Pine Creek at Moquah, WI	04026347	6.20	1976–78
Pine Creek Tributary at Moquah, WI	04026348	0.48	1976–78
Pine Creek near Moquah, WI	04026349	19.9	1976–78
Bad River near Mellen, WI	04026450*	82.0	1971–75
Bad River at Mellen, WI	04026500	98.3	1948–55
Alder Creek near Upson, WI	04026870	22.2	1972–77
Montreal River near Kimball, WI	04028500	100	1924–26
West Fork Montreal River at Gile, WI	04029000	75.0	1918–26, 1943–47
West Fork Montreal River near Kimball, WI	04029500	86.2	1924–26
STREAMS TRIBUTARY TO LAKE MICHIGAN			
North Branch Pine River at Windsor Dam near Alvin, WI	04063640*	27.8	1967–68
Pine River near Florence, WI	04064000	510	1914–23
Menominee River, at Mouth, at Marinette, WI	04067651	4,070	1988–90, 1994–95
Peshtigo River at High Falls near Crivitz, WI	04068000	537	1912–57
Pensaukee River near Krakow, WI	04071795	35.8	1993–95
Pensaukee River near Pensaukee, WI	04071858	134	1973-96
Suamico River at Suamico, WI	04072000	60.7	1951–52
Lawrence Creek near Westfield, WI	04072750	13.4	1968–73
Grand River near Kingston, WI	04073050	73.5	1968–75
West Branch White River near Wautoma, WI	04073405	38.9	1964–65
Silver Creek at South Koro Road near Ripon, WI	040734644	36.2	1987-96
Wolf River near White Lake, WI	04075000	485	1935–38
Evergreen Creek near Langlade, WI	04075200*	8.09	1964–73
Wolf River above West Branch Wolf River, WI	04075500	616	1928–62
West Branch Wolf River at Neopit, WI	04076000	93.2	1911–17
West Branch Wolf River near Keshena, WI	04076500	163	1928–32
Little Wolf River near Galloway, WI	04079602	22.6	1974–79
Spaulding Creek near Big Falls, WI	04079700*	5.57	1964–66
Little Wolf River at Royalton, WI	04080000	507	1914–70, 1983–85
Tomorrow River near Nelsonville, WI	04080798	44.0	1993–95
Emmons Creek near Rural, WI	04080950	25.1	1968–74
Storm Sewer to Mirror Lake at Waupaca, WI	04080976	0.04	1971–74
Waupaca River near Waupaca, WI	04081000	265	1916–66, 1983–85
Daggets Creek at Butte Des Morts, WI	04081800	10.6	1977
West Branch Fond du Lac River at Fond du Lac, WI	04083000	83.1	1939–54
East Branch Fond du Lac River near Fond du Lac, WI	04083500	78.4	1939–54
Brothertown Creek at Brothertown, WI	04084200	5.10	1976–77
East River at Midway Road near De Pere, WI	04085109	47.0	1993–95
Bower Creek, at County MM, near De Pere, WI	04085119	14.8	1991–95, 1996–97
East Twin River at Mishicot, WI	04085281	110	1972-96
Onion River at Hingham, WI	04085813	37.2	1979–80
Onion River near Sheboygan Falls, WI	04085845	94.1	1979–82

DISCONTINUED SURFACE-WATER DISCHARGE STATIONS

Station name	Station number	Drainage area (mi^2)	Period of record
STREAMS TRIBUTARY TO LAKE MICHIGAN–CONTINUED			
Milwaukee River at Kewaskum, WI	04086150	138	1968–81
East Branch Milwaukee River near New Fane, WI	04086200	54.1	1968–81
North Branch Milwaukee River near Random Lake, WI	040863075	51.4	1993–95
North Branch Milwaukee River near Fillmore, WI	04086340	148	1968–81
Milwaukee River at Waubeka, WI	04086360	432	1968–81, 1994
Mud Lake Outlet near Decker Corner, WI	04086488	7.36	1983–84
Lincoln Creek, at 47th Street, at Milwaukee, WI	040869415	9.56	1993–1995, 1997[1]
Milwaukee River above North Ave Dam at Milwaukee, WI	04087010	702	1982–84
Menomonee River at Germantown, WI	04087018	19.0	1975–77
Jefferson Park Drainageway at Germantown, WI	04087019	1.82	1976–78
Menomonee River at Butler, WI	04087040	60.6	1975–79
Little Menomonee River near Freistadt, WI	04087050	8.0	1975–79
Noyes Creek at Milwaukee, WI	04087060	1.94	1975–80, 1990
Little Menomonee River at Milwaukee, WI	04087070	19.7	1975–77
Honey Creek at Wauwatosa, WI	04087119	10.3	1975–81
Schoonmaker Creek at Wauwatosa, WI	04087125	1.94	1975–79
Hawley Road Storm Sewer at Milwaukee, WI	04087130	1.83	1975–77
Menomonee River at Milwaukee, WI	04087138	134	1982–84
Kinnickinnic River at Milwaukee, WI	04087160	20.4	1976–83
Milwaukee River at Mouth at Milwaukee, WI	04087170	872	1994–96
ST. CROIX RIVER BASIN			
Namekagon River at Trego, WI	05332000	433	1914–27
Loon Creek near Danbury, WI	05335010	17.6	1970–71
Bashaw Brook near Shell Lake, WI	05335380	26.6	1964–66
Clam River near Webster, WI	05335500	361	1941–42
St. Croix River near Grantsburg, WI	05336000	2,980	1923–70
Wood River near Grantsburg, WI	05339000	185	1939–40
Rice Creek near Balsam Lake, WI	05341375	12.5	1988–89
Balsam Branch at Balsam Lake, WI	05341402	52.8	1988–90
Kinnickinnic River near River Falls, WI	05342000	165	1917–21
CHIPPEWA RIVER BASIN			
West Fork Chippewa River at Lessards, near Winter, WI	05355500	474	1912–16
Couderay River near Couderay, WI	05356121	169	1981–83
Flambeau River at Flambeau Flowage (Flambeau Reservoir), WI	05357500	622	1927–61
Flambeau River near Butternut, WI	05358000	688	1914–39
Pine Creek near Oxbo, WI	05358300	38.9	1971–75
Flambeau River at Babbs Island near Winter, WI	05358500	967	1929–75
South Fork Flambeau River near Phillips, WI	05359500	609	1929–75
Price Creek near Phillips, WI	05359600*	16.9	1964–66
Flambeau River near (at) Ladysmith, WI	05360000	1,790	1903–06, 1914–61
Chippewa River near Holcombe, WI	05361000	3,720	1944–49
South Fork Jump River near Ogema, WI	05361500	327	1944–54
Chippewa River at Holcombe, WI	05362500	4,680	1943–49
Fisher River at (near) Holcombe, WI	05363000	81.5	1944–45
O'Neil Creek near Chippewa Falls, WI	05363500	78.1	1944–45
Yellow River near Hannibal, WI	05363700	86.7	1962–63
Yellow River at Cadott, WI	05364000*	364	1943–61
Duncan Creek at Bloomer, WI	05364500*	50.3	1944–52
Duncan Creek Tributary near Tilden, WI	05364850	4.17	1987–89
Duncan Creek at Chippewa Falls, WI	05365000	117	1943–55
Eau Claire River near Augusta, WI	05366000	509	1914–26
Bridge Creek at Augusta, WI	05366300	35.0	1980
Eau Claire River near Fall Creek, WI	05366500*	760	1943–55
Chippewa River at (near) Eau Claire, WI	05367000	6,620	1903–09, 1944–54

DISCONTINUED SURFACE-WATER DISCHARGE STATIONS

Station name	Station number	Drainage area (mi^2)	Period of record
CHIPPEWA RIVER BASIN–CONTINUED			
Red Cedar River near Cameron, WI	05367425	442	1966–70
Red Cedar River near Cameron, WI	05367426	443	1971–73
Red Cedar River near Colfax, WI	05367500	1,100	1914–61, 1990
Eau Galle River at Low-Water Bridge at Spring Valley, WI	05369945	47.9	1982–83, 1986–96
French Creek near Spring Valley, WI	05369955	6.03	1981–83
Lousy Creek near Spring Valley, WI	05369970	5.97	1981–83
Lohn Creek near Spring Valley, WI	05369985	2.53	1981–83
Eau Galle River at Elmwood, WI	05370500	91.6	1943–54
BUFFALO RIVER BASIN			
Buffalo River near Tell, WI	05372000	406	1933–51
WAUMANDEE CREEK BASIN			
Joos Valley Creek near Fountain City, WI	05378183	5.89	1990-96
Eagle Creek, at County Highway G, near Fountain City, WI	05378185	14.3	1990-96
TREMPEALEAU RIVER BASIN			
Bruce Valley Creek near Pleasantville, WI	05379288	10.1	1980
Elk Creek near Independence, WI	05379305	108	1980
Trempealeau River at Arcadia, WI	05379400	553	1960–77
Trempealeau River near Trempealeau, WI	05380000	719	1932–34
BLACK RIVER BASIN			
Black River at Medford, WI	05380806	48.1	1984–87
Poplar River near Owen, WI	05380900*	155	1964–66
LA CROSSE RIVER BASIN			
Little La Crosse River near Leon, WI	05382500	76.9	1934–61, 1979–81
La Crosse River near West Salem, WI	05383000	396	1914–70
COON CREEK BASIN			
Spring Coulee Creek near Coon Valley, WI	05386490	9.01	1979–81
Coon Creek at Coon Valley, WI	05386500	77.2	1934–40, 1978–81
Coon Creek near Stoddard, WI	05386999	120	1934–40, 1979–81
BAD AXE RIVER BASIN			
North Fork Bad Axe River near Genoa, WI	05387100*	80.8	1964–66
WISCONSIN RIVER BASIN			
Wisconsin River at Conover, WI	05390180	177	1967–71
Pelican River near Rhinelander, WI	05391226	101	1976–79
Wisconsin River at Whirlpool Rapids, near Rhinelander, WI	05392000	1,220	1906–61
Bearskin Creek near Harshaw, WI	05392350*	31.1	1964–66
Tomahawk River near Bradley, WI	05392400	422	1915–27, 1929
Tomahawk River at Bradley, WI	05393000	544	1930–73
New Wood River near Merrill, WI	05394000	82.2	1953–61
Rib River at Rib Falls, WI	05396000	303	1925–57
Little Rib River near Wausau, WI	05396500	79.1	1914–16
East Branch Eau Claire River near Antigo, WI	05397000	81.5	1949–55
Eau Claire River near Antigo, WI	05397110	185	1975–81
Bull Junior Creek (Bull Creek Junior) near Rothschild, WI	05398500	27.4	1944–52
Big Eau Pleine River near Colby, WI	05399000	78.1	1941–54
Hamann Creek near Stratford, WI	05399431	11.3	1977–79
Wisconsin River at Knowlton, WI	05400000	4,530	1921–42
Plover River near Stevens Point, WI	05400500	145	1914–20, 1944–52
Little Plover River near Arnott, WI	05400600	2.24	1959–75
Little Plover River at Plover, WI	05400650	19.0	1959–87

DISCONTINUED SURFACE-WATER DISCHARGE STATIONS

Station name	Station number	Drainage area (mi²)	Period of record
WISCONSIN RIVER BASIN--CONTINUED			
Fourmile Creek near Kellner, WI	05400870	75.0	1964–67
Buena Vista Creek near Kellner, WI	05400853	53.1	1964–67
Tenmile Creek Ditch 5 near Bancroft, WI	05401020	9.73	1964–73
Fourteenmile Creek near New Rome, WI	05401100	91.1	1964–79
Wisconsin River near Necedah, WI	05401500	5,990	1903–14, 1944–50
Big Roche a Cri Creek near Hancock, WI	05401510	9.61	1964–67
Big Roche a Cri Creek near Adams, WI	05401535	52.8	1964–78
Yellow River at Sprague, WI	05402500	392	1927–40
Yellow River at Necedah, WI	05403000	491	1941–57
Lemonweir River at New Lisbon, WI	05403500	507	1944–87, 1994
Hulbert Creek near Wisconsin Dells, WI	05403630	11.2	1971–77
Dell Creek near Lake Delton, WI	05403700	44.9	1957–65, 1971–80
Narrows Creek at Loganville, WI	05404200	40.1	1964–66
Wisconsin River at Prairie du Sac, WI	05406000	9,180	1946–54
Black Earth Creek at Cross Plains, WI	05406460	12.8	1985–86, 1990–93
Black Earth Creek at Mills Street at Cross Plains, WI	05406476	25.5	1990-95
Garfoot Creek near Cross Plains, WI	05406491	5.39	1985–86, 1990–94, 1994–98
Black Earth Creek at South Valley Road nr Black Earth, WI	05406497	40.6	1990–93
Trout Creek at Confluence with Arneson Creek near Barneveld, WI	05406573	8.37	1976–78
Trout Creek at Twin Parks Dam 8 near Barneveld, WI	05406574	9.02	1976–79
Trout Creek at County Highway T near Barneveld, WI	05406575	12.1	1976–78
Trout Creek near Ridgeway, WI	05406577	13.5	1976–79
Knight Hollow Creek near Arena, WI	05406590	7.57	1976–78
Otter Creek near Highland, WI	05406640	16.8	1968–69, 1970–75
Kickapoo River at Ontario, WI	05407500	151	1939, 1973–77
Knapp Creek near Bloomingdale, WI	05408500	8.44	1955–69
West Fork Kickapoo River near Readstown, WI	05409000	106	1939
Kickapoo River at Soldiers Grove, WI	05409500	530	1939
North Fork Nederlo Creek near Gays Mills, WI	05409830	2.21	1968–79
Nederlo Creek near Gays Mills, WI	05409890	9.46	1968–80
Kickapoo River at Gays Mills, WI	05410000	617	1914–34, 1964–77
GRANT RIVER BASIN			
Pigeon Creek near Lancaster, WI	05413400*	6.93	1964–66
Kuenster Creek at Muskellunge Road nr North Andover, WI	054134435	9.59	1982–96
Rattlesnake Creek near North Andover, WI	05413449	42.4	1987–96
Rattlesnake Creek near Beetown, WI	05413451	45.2	1990–91
GALENA RIVER BASIN			
Little Platte River near Platteville, WI	05414213	79.7	1987–90
Sinsinawa River near Hazel Green, WI	05414800	24.9	1987–90
Pats Creek near Belmont, WI	05414894	5.42	1981–82
Madden Branch Tributary near Belmont, WI	05414915	2.83	1981–82
Madden Branch near Meekers Grove, WI	05414920	15.04	1981–82
Galena River at Buncombe, WI	05415000	125	1939–92
APPLE RIVER BASIN			
Apple River near Shullsburg, WI	05418731	9.34	1981–82
ROCK RIVER BASIN			
West Branch Rock River near Waupun, WI	05423000	40.7	1949–70, 1978–81
West Branch Rock River at County Trunk Highway D near Waupun, WI	05423100	43.9	1978–81
Johnson Creek near Johnson Creek, WI	05425537	1.13	1978–80

DISCONTINUED SURFACE-WATER DISCHARGE STATIONS

Station name	Station number	Drainage area (mi^2)	Period of record
ROCK RIVER BASIN--CONTINUED			
Johnson Creek near Johnson Creek, WI	05425539	13.3	1978–80
Pratt Creek near Juneau, WI	05425928	3.54	1978–80
Rock River at Jefferson, WI	05426031	1,850	1978–94[2]
Whitewater Creek near Whitewater, WI	05426500	11.8	1926–28, 1946–54
Whitewater Creek at Millis Road near Whitewater, WI	05426900	20.6	1978–81
Whitewater Creek at Whitewater, WI	05427000	22.8	1926–28, 1946–54
Koshkonong Creek near Rockdale, WI	05427507	150	1977–82
Token Creek near Madison, WI	05427800	24.3	1964–66, 1976–81
Sixmile Creek near Waunakee, WI	05427900	41.1	1976–82
South Fork Pheasant Branch at Highway 14 near Middleton, WI	05427945	5.74	1978–81
Pheasant Branch at Century Avenue at Middleton, WI	05427950	20.8	1977–81
Pheasant Branch at mouth at Middleton, WI	05427952	24.5	1978–81
Willow Creek at Madison, WI	05427970	3.15	1974–83
Olbrich Park Storm Ditch at Madison, WI	05428665	2.57	1976–80
Manitou Way Storm Sewer at Madison, WI	05429040	0.23	1971–77
Nakoma Storm Sewer at Madison, WI	05429050	2.30	1972–77
Lake Wingra Outlet at Madison, WI	05429120	6.00	1971–77
Nine Springs Creek Storm Sewer Tributary at Madison, WI	05429268	0.18	1991–93
Door Creek near Cottage Grove, WI	05429580	15.3	1976–79
Yahara River near Edgerton, WI	05430000	430	1917–18
Oregon Branch at Oregon, WI	05430030	9.93	1979–81
Badfish Creek at County Highway A near Stoughton, WI	05430095	40.9	1956–66, 1986–88
Badfish Creek near Stoughton, WI	05430100	41.3	1956–66
Delavan Lake Trib at South Shore Drive at Delavan, WI	05431018	7.66	1985–86, 1989–91
Jackson Creek at Petrie Road near Elkhorn, WI	05431014	8.96	1984–95
Livingston Branch Pecatonica River near Livingston, WI	05432055	16.4	1987–91
Yellowstone River near Blanchardville, WI	05433500*	28.5	1954–65, 1978–79
Pecatonica River at Dill, WI	05434000	944	1914–19
Steiner Branch near Waldwick, WI	05433510	5.9	1978–79
Skinner Creek at Skinner Hollow Road near Monroe, WI	05434235	32.6	1978–81
Skinner Creek at Klondyke Road near Monroe, WI	05434240	35.0	1978–81
West Branch Sugar River near Mount Vernon, WI	05435980	32.7	1979–80
Mount Vernon Creek near Mount Vernon, WI	05436000	16.4	1954–65, 1976–80
ILLINOIS RIVER BASIN			
Fox River, at Watertown Road, near Waukesha	05543800	77.4	1992-2000
White River near Burlington, WI	05545300	110	1964–66, 1973–82

[1]No winter record in water year 1997.

[2]No winter record in water years 1993 and 1994.

EVALUATION MONITORING IN WISCONSIN PRIORITY WATERSHEDS

PROBLEM

An evaluation strategy is needed to assess the effectiveness of nonpoint-source pollution control measures in priority watersheds. Specifically, research is needed to determine the impact of management practices stream-water quality and biology. Several techniques need to be developed and/or refined, such as detecting trends in stream-water chemistry, sampling of fish and fish habitat, relation between fish/fish habitat and changes resulting from watershed management practices, and use of habitat models for determining impact of watershed management on fish populations.

OBJECTIVE

The overall objective of this project is to determine the trends in water quality for four sites during and after implementation of improved land-management practices in three priority watersheds and to use GIS to understand changes in land use/land cover.

APPROACH

Post-practice implementation monitoring will be done for Otter, Bower, Eagle, and Joos Valley Creeks, which are in the Sheboygan River, East River, and Waumandee River Priority Watershed Projects, respectively. The pre-practice implementation is complete for all of these sites. Continuous-record streamflow, water temperature, and dissolved-oxygen gaging stations were installed at each stream site. Water-quality samples will be collected during events and low flows and analyzed for selected constituents. Land-use inventories will be taken each year to help determine the cause of any changes in water quality. Monitoring at Bower Creek will be initiated again during the summer of 2003.

PROGRESS (July 2001 to June 2002)

Post-practice implementation monitoring for Otter Creek has been ongoing for two years. Water-quality loads were calculated for selected parameters and storm periods. All the data were summarized and published in the report "Water-Resources Data—Wisconsin." Land-use inventories were completed for each basin.

PLANS (July 2002 to June 2003)

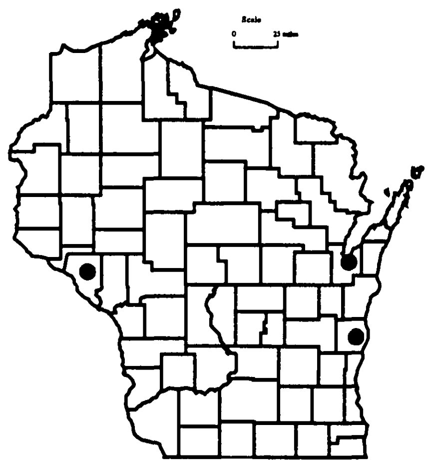
Streamflow and water-quality monitoring will be continued at Otter Creek site through September 2002. Eagle and Joos Valley Creeks will be monitored for streamflow and water quality beginning in May 2002. At Otter Creek, water-quality samples will be collected weekly during the period of July–October. For other sites, water-

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Priority watersheds in Brown, Buffalo, and Sheboygan Counties

PROJECT CHIEF:
David J. Graczyk
Steven R. Corsi
Judy A. Horwatich

PERIOD OF PROJECT:
October 1990–Continuing



quality samples are collected bi-weekly from April through October, and monthly from December through March. Samples will be collected at all sites during runoff periods. Land use will be updated for each basin. Bower Creek site installation and trouble shooting will begin in summer 2003 and be ready for monitoring the following year. Water-quality loads for selected parameters and storm periods will be calculated and compared to data collected in previous years. The data will be analyzed to determine if there are any apparent trends in water quality during implementation of best management plans. A report will be published on post monitoring of Brewery and Garfoot Creeks in the Black Earth Creek Priority Watershed Project.

REPORTS

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Wierl, J.A., Giddings, E.M., and Bannerman, R.T., 1998, Evaluation of a method for comparing phosphorus loads from barnyards and croplands in Otter Creek watershed, Wisconsin: U.S. Geological Survey Fact Sheet 168–98, 4 p.

Corsi, S.R., Graczyk, D.J., Owens, D.W., and Bannerman, R.T., 1997, Unit-area loads of suspended sediment, suspended solids, and total phosphorus from small watersheds in Wisconsin: U.S. Geological Survey Fact Sheet 195–97, 4 p.

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Wierl, J.A., Rappold, K.F., and Amerson, F.U., 1996, Summary of the land-use inventory for the nonpoint-source evaluation monitoring watershed in Wisconsin: U.S. Geological Survey Open-File Report 96–123, 23 p.

Greb, S.R., and Graczyk, D.J., 1995, Frequency-duration analysis of dissolved-oxygen concentrations in two southwestern Wisconsin streams: Water Resources Bulletin, v. 31, no. 3, p. 431–438.

FERTILIZATION AND RUNOFF FROM URBAN LAWNS

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Statewide

PROJECT CHIEF:
Todd D. Stuntebeck

PERIOD OF PROJECT:
March 1994–Continuing

PROBLEM

Excessive phosphorus entering lakes is known to promote unsightly weed growth, decrease recreational uses, and ultimately speed the eutrophication process. Structural or "end-of-pipe" management practices designed to reduce phosphorus are generally expensive. Reducing phosphorus at the source may be a less-expensive alternative. Bannerman and others (1992), found that lawns in residential areas in a portion of the Lake Wingra watershed contribute a significant amount of the phosphorus load in storm runoff. Restricting fertilizer use in the watershed to phosphorus-free brands would seem to be a potentially inexpensive way to reduce phosphorus loads to Lake Wingra. However, there is little applicable field evidence supporting the hypothesis that runoff from fertilized lawns is greater in phosphorus concentrations than runoff from non-fertilized lawns.

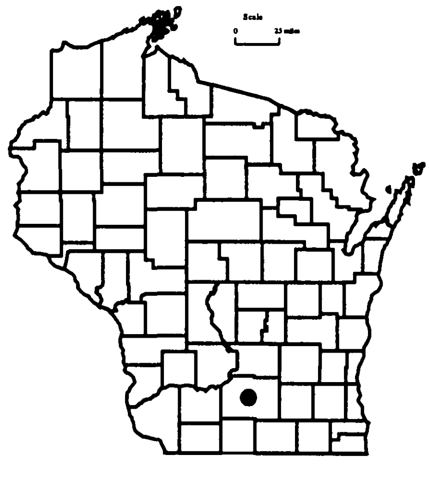
In addition to the paucity of data for concentrations in runoff from fertilized versus unfertilized lawns, runoff volumes from lawns are also not well understood. Most studies of turf grass are done on field plots, which are well cared for and may not represent the average conditions of urban lawns. A better understanding of how much water runs off a typical urban lawn and under what conditions will help watershed investigators to improve their ability to predict the impacts of management decisions.

OBJECTIVE

Objectives are to: (1) determine if the concentrations of total phosphorus, dissolved phosphorus, suspended solids, and total solids in runoff from fertilized lawns are different than concentrations from lawns that are not fertilized, (2) use the concentration data in an existing Source Area Loading and Management Model (SLAMM) model to estimate phosphorus loads entering Lake Wingra from both fertilized and non-fertilized lawns, (3) determine the potential reduction in phosphorus loads to Lake Wingra by restricting fertilizer use in the watershed to phosphorus-free brands, (4) obtain rainfall and runoff data with site characteristic data for lawns from different soil types, and (5) use the concentration/runoff information to make improvements to the SLAMM model.

APPROACH

Lake Wingra Lawn Fertilization Study (Water-quality samplers only)—Lawn-runoff samples were collected from 30 water-quality samplers between May 1999 and September 2001. Fifteen of the samplers were located in lawns that were fertilized, and the other 15 were in lawns that were not fertilized. Samples were analyzed for total phosphorus, dissolved phosphorus, total solids, and suspended



solids. Two tipping-bucket rain gages and three bulk-precipitation gages were located within the Lake Wingra watershed. Site characteristic data such as soil type and chemical contents, grass density, lawn slope, soil compaction, and infiltration capacity were measured for each of the 30 lawns. Several small experiments were conducted in order to better understand what happens when the bottles overfill and how much phosphorus is likely to come from grass clippings only.

Lawn Runoff Study (Volume/QW samplers)—Runoff volumes are being measured and water-quality samples are being collected for five specialized samplers in the Lake Wingra watershed. In addition to the runoff data, several explanatory variables will be measured for each lawn, including grass density, lawn slope, soil compaction, and infiltration rate. Using statistical regression techniques, an equation will be developed to help explain much of the variability in lawn runoff volumes. Sites will be operated through September 2003. Ten additional sites are planned to be added—five sites with sandy soil and five sites with clayey soil—to explain runoff characteristics in different soil regimes. We expect installation of the new sites starting in July 2002.

PROGRESS (July 2001 to June 2002)

Nearly 1,200 sample concentrations have been obtained for 42 runoff periods since May 1999. Soil samples have been collected and analyzed at two depths for each of the 30 lawns. Five volume samplers have been installed and operated on silt-loam soils. Collectively, these five samplers have recorded runoff data and collected water-quality data for over a dozen snowmelt and rainfall-runoff events.

PLANS (July 2002 to June 2003)

All of the data from the initial lawn-runoff study (water-quality samplers only) will be compiled and analyzed. A fact sheet describing the findings will be published. Ten additional lawn volume/QW samplers will be installed in sandy and clayey soils. A Fact Sheet will be published explaining the Lake Wingra Fertilization Study.

DISCOVERY FARMS

PROBLEM

Agricultural nonpoint pollution in the form of nutrients, sediment, and pesticides threatens many of Wisconsin streams and lakes. Understanding how to help reduce these pollutants while allowing farmers to remain economically viable provides a great challenge.

OBJECTIVE

Under the new Wisconsin Environmental Stewardship Initiative, groups will work together to develop science-based, productive, and profitable approaches to farming. Projects will be conducted on numerous "Discovery Farms" which will represent diverse land characteristics and management styles. Information learned from these projects will then be shared with the agricultural community to allow them the tools to remain competitive in today's market while taking environmentally sound approaches to farming.

APPROACH

Stream Buffer Investigation—Traverse Valley Creek on the Joe Bragger Farm, Buffalo County—A "paired-watershed" study design will be applied in which a control site will be compared to a treatment site. The basis of this approach is that water-quality relation can be established between the treatment and the control site before BMPs (Best Management Practices) are implemented. When BMPs are implemented at the treatment site, the established relation will change if the BMPs have had a significant impact on water quality. The monitoring period will last approximately five years, with two years of pre-BMP data collection, a one-year implementation/transition period with no sampling, and a two-year post-BMP sampling phase. At this time, a specific BMP has not been decided; however, it will likely focus either on buffer strips and/or nutrient management.

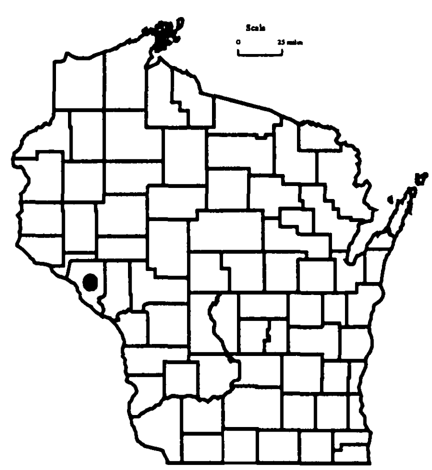
Four gaging stations will be installed on or near the Bragger Discovery Farm: one each on two tributaries to Traverse Valley Creek and two on nearby hillslopes. The two stream gages will be equipped to monitor water levels, water temperature, and precipitation; and to collect automated, refrigerated water samples, while the hillslope gages will be equipped to measure flow and samples. Surface-water samples will be collected from the stream sites during baseflow periods and storms. Baseflow samples will be collected at each monitoring station on a bi-weekly basis starting after the gages are installed. Samples will be analyzed at the Wisconsin State Laboratory of Hygiene for total phosphorus, total dissolved phosphorus, suspended solids, volatile suspended solids, total suspended sediment, nitrate plus nitrite, total Kjeldahl nitrogen, ammonia, chloride,

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Buffalo County

PROJECT CHIEF:
Todd D. Stuntebeck

PERIOD OF PROJECT
July 2001 to June 2003



fecal coliform bacteria, alkalinity, conductivity, and pH. Flow-composite, automated, water samples will be collected for all storms with a significant overland-runoff component. Samples will be triggered by a combination of precipitation and water-level increases, and will be analyzed for the same constituents as baseflow samples.

In addition to the paired-watershed design, several other investigations will be conducted on various aspects on the farm. These studies may include, but not be limited to: a whole-farm mass balance of nitrogen and phosphorus, comparisons of stream gage-measured sediment loads versus RUSTLE II predicted values, development, calibration, and verification of a phosphorus-loss risk index, development, calibration and, verification of a hydrologic and chemical model (surface and ground water), and cow diet/manure implications.

PROGRESS (July 2001 to June 2002)

Both of the stream gages at the Bragger Discovery Farm became fully operational in September 2001. Since then, seven baseflow and seven storm samples have been collected. A cursory review of the collected data shows that nitrate concentrations in the north basin are significantly higher than those in the south basin. The north basin has much more cropped agriculture than the south basin. It has also become apparent that aspect to the sun is very important for winter/spring snowmelt: north-facing slopes melt much more slowly than do south-facing slopes. This phenomenon has important implications for the hydrologic models that will be created. For this reason, each of the hillslope gages will be placed on slopes of different aspect.

PLANS (July 2002 to June 2003)

Two flumes will be installed on two forested hillslope drainages at the Bragger Discovery Farm—each on slopes of different aspect. The purpose of these gages will be to determine how much stormwater, and associated chemicals, comes from these steep, unfarmed areas. Based on a nearby study, it is suspected that these areas act as significant recharge zones for ground water.

An additional monitoring site will be included in this project sometime after July 2002. Specific sites to be monitored and the research to be conducted on each site has not yet been determined.

Baseflow and storm sampling will continue on the Bragger Discovery Farm.

IMPACT OF PHOSPHORUS AND NITROGEN CONCENTRATIONS ON THE BIOLOGICAL INTEGRITY OF WISCONSIN STREAMS

PROBLEM

Excessive phosphorus and nitrogen (nutrient) loss is frequently associated with water-quality problems in Wisconsin's water bodies. The implementation of the WDNR's proposed agricultural performance standards and prohibitions should decrease the risk of excessive nutrient loss from croplands and livestock operations. Landowners would be asked to limit their amount of commercial fertilizer use and reduce the impacts of manure storage and spreading. Implementation of TMDLs and the enforcement of phosphorus criteria would also reduce the problems caused by nutrients. The expected water-quality improvements due to the application of agricultural performance standards will vary due to differences in nutrient responses in each water body. In order to evaluate the environmental benefits of the proposed performance standards and phosphorus criteria, sufficient data would need to be collected on each stream to define the nutrient response.

OBJECTIVE

Objectives of the project are to: (1) determine what phosphorus and nitrogen concentrations impair the biological integrity of a stream, (2) develop a database that can be used to refine the phosphorus criteria for Wisconsin streams, (3) determine how watershed characteristics affect the relations between phosphorus and nitrogen concentrations in streams and the biological integrity of the streams, and (4) improve our biological assessment of nutrient impairments by developing a nutrient index of biological integrity.

APPROACH

The approach for the project is to statistically determine if any significant relations exist between a stream's phosphorus and nitrogen. A statistical evaluation of the significant relations between nutrient concentrations and watershed characteristics will be completed. A multivariate statistical analysis will be used to sort out the importance of the many different variables. Since these nutrient relations are expected to vary with stream size and location of the stream in the state, streams will be grouped by size, two nutrient ecoregions and four nutrient zones. Streams will be divided into those with smaller watersheds of 4 to 50 square miles, those with medium watershed sizes of 50 to 200 square miles, and those with large watersheds of 200 to 1,000 square miles.

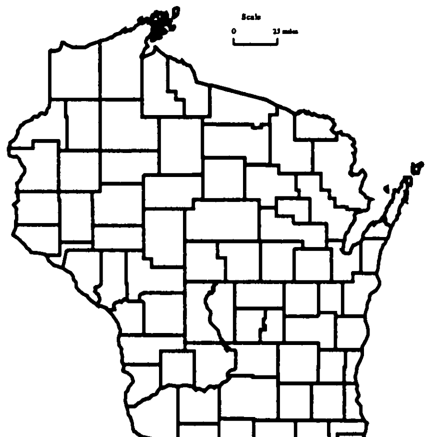
The variables in these statistical analysis will be based on five indicators of biological integrity, eight types of nutrient concentrations, and eight watershed characteristics. The five biological indicators are fish abundance and diversity, habitat quality, macroinvertebrate

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Statewide

PROJECT CHIEF:
David J. Graczyk
Dale M. Robertson

PERIOD OF PROJECT:
March 2001 to June 2004



diversity, periphyton biomass, and suspended and attached chlorophyll *a* concentrations. Water samples collected from the stream will be analyzed for total phosphorus, dissolved phosphorus, nitrate, total Kjeldahl nitrogen, ammonia, turbidity, conductivity, and suspended chlorophyll *a*. Watershed characteristics to be compiled from existing databases include drainage-area size, stream gradient, climate data, land use, annual runoff, surficial deposits data, soil types, soil erodability, and riparian buffer data.

Small streams will be monitored in the first year. Based on the effort needed to collect water and periphyton samples and summarize the watershed characteristics, 160 small streams will be selected. There will be about 40 small streams in each nutrient zone or about 80 in each nutrient ecoregion. Many of the small streams will be selected from the streams sampled over the last five years. This fish and habitat data has been collected the same way at all the sites and the data is stored in a readily accessible database.

A total of six water-quality samples will be collected between the months of May and October at each site. The average concentrations of these six samples will be used in the statistical analysis.

Nutrient concentrations will be determined from samples collected at each stream by standard sampling methods. Samples will be iced and delivered to the State Laboratory of Hygiene for analysis. A flow measurement will be collected at the time of the water-quality grab sample.

PROGRESS (July 2001 to June 2002)

Samples were collected at 160 sites in four ecoregions and four phosphorus zones in July through October. Samples were collected monthly at the 160 sites. Samples were analyzed for nutrients and chlorophyll *a*. Field measurements include stream discharge, water temperature, dissolved oxygen, pH, turbidity, conductance, and stream clarity.

The median total phosphorus concentration for all samples by ecoregion was 0.079 mg/L for the Driftless Area (DFA) ecoregion, 0.161 mg/L for the North Central Hardwoods Forest (NCHF), 0.039 mg/L for the Northern Lakes and Forest (NLF), and 0.112 mg/L for the Southern Wisconsin Till Plains (SWTP). The median total phosphorus concentration was statistically significantly different and less when comparing the NLF with the other three ecoregions. The DFA had the next lowest median total phosphorus concentration and was statistically significantly less than the SWTP and NCHF. The median total phosphorus concentration for the NCHF and SWTP was not statistically significantly different from each other. The other parameters have similar results with the NLF having the lowest median concentration and being statistically significantly less than the other three ecoregions.

The sites were also sorted by phosphorus zone. The median total phosphorus concentration of phosphorus zone 2 was statistically significantly less than phosphorus zone 1, 3, and 4. No statistically significant difference was found between phosphorus zones 1, 3, and 4. All of the sites in phosphorus zone 2 are exclusively in the NLF ecoregion.

Samples will be collected at 80 medium size streams in May and June. Data will be entered into the database. All data was summarized and published in the report "Water Resources–Wisconsin, 2001."

PLANS (July 2002 to June 2003)

Samples will be collected at the 80 medium size streams for the months of July through October. All data will be summarized and published in the report "Water Resources–Wisconsin, 2002." Large size streams will be selected and sampled in May and June.

HYDROLOGY AND WATER-QUALITY IMPACTS OF DIFFERENT PASTURE MANAGEMENT PRACTICES IN SOUTHWESTERN WISCONSIN

PROBLEM

Nonpoint-source pollution is a major concern in Wisconsin. There are approximately 24,000 dairy farms in Wisconsin which may be sources of sediment, nutrients, and pesticides to surface and ground water. Managed Intensive Rotational Grazing (MIRG) is a system that uses pastures as a major source of feed for milking cows (Jackson-Smith and others, 1996). MIRG farmers rely on pastures for their dairy herds' forage needs and move their cows to a new pasture at least once a week (Jackson-Smith and others, 1996). In 1992, roughly 7 percent of Wisconsin dairy farms used MIRG but in 1994, 14 percent of Wisconsin dairy farms used MIRG (Jackson-Smith and others, 1996). MIRG can be used as a best management practice (BMP) and may reduce the amount of sediments, nutrients, and pesticides to receiving waters. In a study in Oklahoma, rotational grazed pastures evidenced a reduction in average annual runoff and sediment discharges when compared to a continuously grazed basin (Menzel and others, 1978).

This study will compare surface-water runoff and water quality from three small pastured watersheds. The pastures will be located at the USDA Dairy Forage Research Center at Prairie du Sac.

OBJECTIVE

The overall objective of this study is to determine differences in quantity and quality of surface-water runoff from three different pasture-management strategies. These strategies consist of a variety of practices which are available to pasture managers, both during the growing and dormant seasons. Combinations of management practices have been chosen to represent commonly used strategies. In addition to examining differences in overall management strategies, differences related to individual seasonal practices will be determined. A secondary objective will be to determine a water budget for each pasture. The water budget will be determined by measuring surface-water runoff and precipitation. Evaporation and transpiration will be estimated by using empirical equations and ground-water flow will be estimated as a residual.

APPROACH

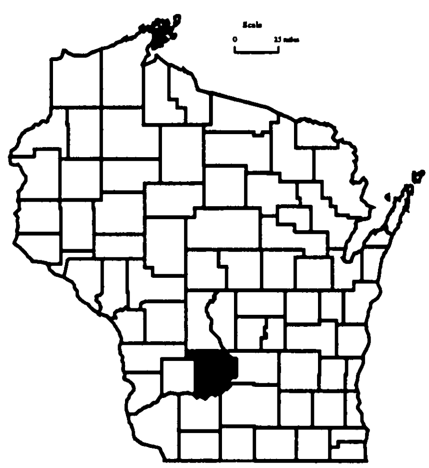
The management practices to be examined include: (1) intensive rotational grazing and continuous grazing during the growing season, (2) pasture "stockpiling" during late summer and continued grazing throughout the summer, and (3) two outwintering practices and no outwintering. An artificial hydraulic control was installed at each pasture outlet. The control is a three-inch Parshall flume. Each site will use a pressure transducer to measure stage and a CR-10 data

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Sauk County

PROJECT CHIEF:
David J. Graczyk

PERIOD OF PROJECT:
October 1997 to September 2003



recorder. Daily, monthly, and annual surface-water runoff will be calculated at each pasture. A tipping-bucket rain gage was installed at each site. Evapotranspiration will be estimated using empirical equations. Air temperature and solar radiation will be collected at one of the pastures for use in the evapotranspiration calculation. Meteorological data collected at the USDA Research Station will supplement data collected at this pasture. Ground-water flow will be calculated as a residual. An ISCO automatic water-quality sampler was installed at each site. The sampler will collect discrete samples. These samples will be composited on a flow-weighted basis. One composite sample per rainfall or snowmelt event will be sent to the Wisconsin State Laboratory of Hygiene for analysis. All events will be monitored. Approximately 5–10 samples per pasture will be collected. All samples will be analyzed for soluble reactive phosphorus, total phosphorus, ammonia nitrogen, nitrate and nitrite nitrogen, total Kjeldahl nitrogen, total suspended solids, and volatile suspended solids.

PROGRESS (July 2001 to June 2002)

Three small basins were monitored for continuous streamflow and rainfall. Four runoff samples collected at site 1, six runoff samples at site 2, and one runoff sample at site 3. Water-quality-constituent loads and subsequent yields were calculated at all three sites. Runoff events include summer thunderstorms and early winter rainfall and snowmelt events. Suspended solids yields were compared at the three sites. The median yields for suspended solids were the greatest at site 1 (5.77 lb/acre), at site 2 the median suspended solids yield was 1.53 lb/acre, and at site 3 the suspended solids yield was 0.24 lb/acre. A nonparametric Wilcoxon test was done to determine if the median yields were statistically the same or the alternative hypothesis that the medians were less than or greater than each other. The median suspended solids yields were statistically significantly different than each other when comparing site 1 with site 2 and site 3. The median yields were not statistically different from each other when comparing site 2 and site 3. The ammonia nitrogen yields ranged from 0.004 lbs/acre (site 3) to 0.008 lb/acre (site 1). None of the median ammonia nitrogen yields were statistically significantly different from each other at the 5-percent probability level. The total phosphorus median yield was 0.016 lb/acre at site 1, 0.005 lb/acre at site 2, and 0.007 lb/acre at site 3. The total phosphorus yield at site 1 was statistically significantly different from the median total phosphorus yields at site 2 but not at site 3 at the 5-percent probability level. All data was summarized and published in the report "Water Resource Data–Wisconsin, 2001."

PLANS (July 2002 to June 2003)

Monitoring at all three sites will be continued. Water-quality samples will be collected at the three sites for all storms that produce runoff and water-quality loads and yields will be calculated for each storm. Animal grazing will be allowed according to the Managed Intensive Rotational Grazing for each site. Yields will be compared at each site before grazing was started at each basin and after grazing was started. In addition site 1 (no out-wintering of animals) and site 2 and 3 (where out-wintering is part of the grazing plan) will be compared with each other to determine if differences can be found. All streamflow and water-quality data will be published in the annual report "Water Resources Data–Wisconsin, 2002."

EVALUATION OF THE EFFECTIVENESS OF LOW IMPACT DEVELOPMENT PRACTICES

PROBLEM

Farmland in Wisconsin is rapidly being converted to urban land uses. This urban development, with the associated increase in impervious area, generally impacts the water quality and increases the runoff volume that is delivered to the receiving water-body. When new site plans are proposed, many of the plans use "end-of-pipe" structural Best Management Practices (BMPs) such as wet and dry detention ponds. These structural BMPs however are primarily designed to reduce the flood peak of a runoff event. They have limited water quality and quantity benefits.

Low-impact development is designed to reduce the volume and improve the quality of runoff while attempting to preserve the natural hydrology of the site. Low impact practices include the reduction of impervious surfaces and installation of infiltration devices, such as rain gardens.

OBJECTIVE

To evaluate the effectiveness of low impact practices for reducing runoff quantity and improving runoff water quality.

APPROACH

Test and control sites have been selected in Cross Plains, Wisconsin. The control site, which was developed from 1988 to 1991, used traditional urban design practices such as storm sewers, curbs and gutters, and a wet detention basin. The second site began development in May 1999 and is implementing low impact development practices. Both sites are finger valleys that are approximately a quarter mile apart.

Equipment at both sites are maintained to continuously monitor water level, precipitation, and water temperature and are housed in a gaging station that has phone telemetry and electrical power. An automatic water-quality sampler at each site is taking flow proportional samples from runoff producing storm events. Water-quality samples for the majority of the runoff events will be analyzed for total and suspended solids, and total and dissolved phosphorus. Periodically, samples from each site will be processed for particle size distribution and selected total and dissolved metals.

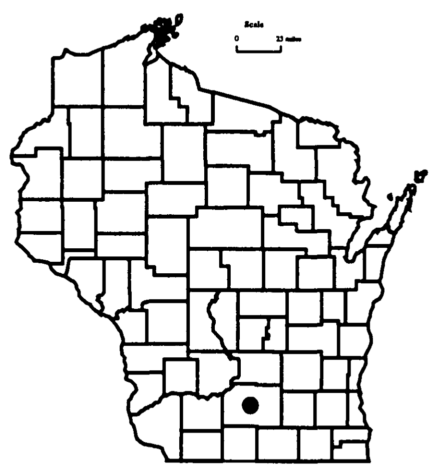
Comparisons will be made between the BMPs based on unit-area runoff and unit-area loads. Furthermore, the data collected during the 7-year period will document the changes in water quality and quantity during the construction cycle (from platting to site closeout).

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Cross Plains

PROJECT CHIEF:
William R. Selbig

PERIOD OF PROJECT:
July 1998 to September 2005



PROGRESS (July 2001 to June 2002)

Continued monitoring and sampling at both sites. Additional equipment was installed at three detention pond inlets and the detention pond outlet to measure runoff velocity and discharge. These sites are also equipped to capture water-quality samples. Soil reflectometers and thermocouples were installed near the center of the infiltration basin to continuously measure soil moisture levels at various depths. Also, soil cores were taken at various locations within the infiltration basin to better understand the performance of the practice.

PLANS (July 2002 to June 2003)

Continue to monitor and sample both sites. Additional infiltration tests will be performed not only on the infiltration practice but also on outlying pervious surfaces to comprehensively understand expected infiltration rates and track any decreases over time. Two flumes will be installed to measure volume of water that enters the infiltration basin from the north end. A piezometer will be installed near the detention pond invert to measure fluctuations in storage previous to and during runoff events.

INFLUENCES OF RIPARIAN CORRIDORS ON IN-STREAM HABITAT, FISH, AND MACROINVERTEBRATE COMMUNITIES FOR SMALL STREAMS IN WISCONSIN

PROBLEM

Riparian corridor land cover can play an important role in determining stream-water quality by reducing runoff, sediments, and nutrients; and maintaining more stable flows, water temperature, and channel morphology. Numerous studies have also shown the importance of riparian corridors in determining in-stream habitat and aquatic biota, yet little is know about the influence of riparian corridor width, continuity, or proximity of an undisturbed riparian corridor to a sampling site versus these measures. A better understanding of these factors will assist resource managers in developing guidelines for establishing and maintaining riparian corridors for small non-urban streams in Wisconsin.

OBJECTIVE

The objectives of this project are to: (1) examine the influence of riparian corridor width on in-stream habitat, and fish and macroinvertebrate communities, (2) examine the effect of distance to the sampling site from a disturbed versus an undisturbed riparian corridor, on in-stream habitat, and fish and macroinvertebrate communities, and (3) identify the influence of the continuity of an undisturbed riparian corridor to in-stream habitat, and fish and macroinvertebrate communities.

APPROACH

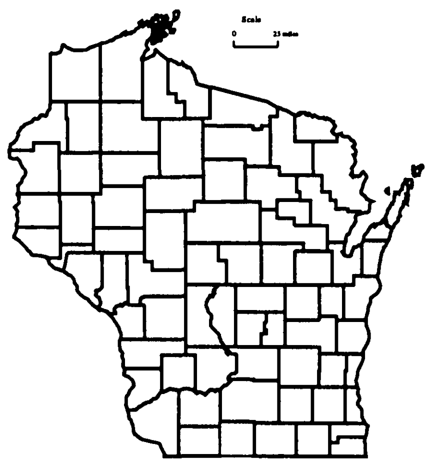
A subset of streams will be selected for this project from 160 small and 80 medium streams that are being sampled as part of Nutrient Impacts on Streams, a cooperative project between the USGS and WDNR. The first step will be to categorize all streams into four groups, based on the ecoregion (Omernik, 1987) in which they are located. Eighty sites will be selected for this study based on availability of digital orthophotography, similarities of slope and surficial deposits within ecoregions, and preliminary assessments of riparian corridor land cover using the WISCLAND satellite-derived land cover data. For the selected watersheds, riparian corridor land cover will be interpreted from digital and orthophotography. Streams within each ecoregion will be categorized into four groups based on the width of an undisturbed riparian corridor (narrow versus wide) and distance upstream, from the sampling site to an undisturbed riparian corridor (near versus far). Multi-variate statistics will be used to look at relations between riparian-corridor width, proximity of an undisturbed riparian corridor to the sampling site, and continuity of an undisturbed riparian corridor versus in-stream habitat, and fish and macroinvertebrate communities.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Statewide

PROJECT CHIEF:
Judy A. Horwatich

PERIOD OF PROJECT:
July 2001–Continuing



PROGRESS (July 2001 to June 2002)

The 160 sampling sites have been selected for the Nutrient Impacts on Streams study. Eighty new sites on larger streams were selected. A preliminary design has been developed for the riparian corridor study based on the objectives and the type and location of the nutrient impact sites.

PLANS (July 2001 to June 2002)

Forty sites will be selected for this study based on availability of data and preliminary analysis of ancillary data, including ecoregions, watershed slope, surficial deposits, and land cover. Stream networks and riparian corridor land cover will be interpreted from digital orthophotography and summary statistics calculated for riparian-corridor width, proximity of the sampling site to an upstream undisturbed riparian corridor, and continuity of an undisturbed riparian corridor.

CALIBRATION OF THE SOURCE LOADING AND MANAGEMENT MODEL (SLAMM)

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Statewide

PROJECT CHIEF:
Judy A. Horwatich

PERIOD OF PROJECT:
July 2001–Continuing

PROBLEM

Wisconsin municipalities are using urban runoff models to help them prepare stormwater management plans. Planners and engineers use the models to identify the most important sources of pollutants and quantify the benefits of different management alternatives. The Source Loading and Management Model (SLAMM) is one of the models recommended for stormwater planning by the WDNR.

All watershed models should be calibrated before they are applied. Large errors in flow and pollutant concentrations can result if the model is not adjusted as much as possible to the places it will be used. In most cases the municipalities will not have the resources to collect the necessary flow and pollutant concentration data. Fortunately, enough stormwater data has been collected to adjust SLAMM for use by municipalities in Wisconsin.

OBJECTIVE

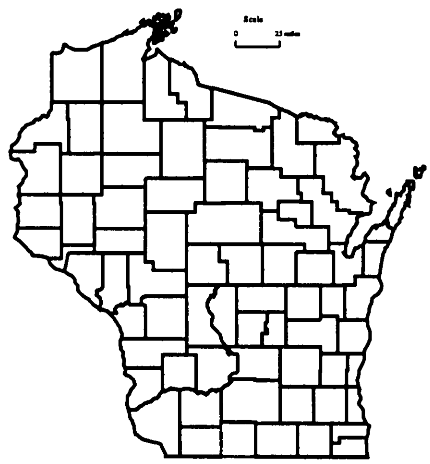
The objective of the project is to calibrate and verify the SLAMM model with the stormwater flow and pollutant concentration data available from urban studies conducted in Wisconsin.

APPROACH

Flow and pollutant concentrations are available from eight stormwater projects conducted by the Wisconsin USGS. Source-area concentrations were collected for four of the projects. The USGS collected flow and concentration data at the end of the pipe for all the projects. Land use and development characteristics, such as percent-connected imperviousness, were determined for each study area. All the above information is needed to calibrate and verify SLAMM.

There are three basic steps to calibrate SLAMM. First, the predicted runoff volumes should be adjusted to match the values observed at the end of the pipe. After the appropriate rainfall file is created, the runoff volumes are predicted for each rainfall event. To determine what adjustments are needed to the model's rsv (runoff coefficients) file, plots are made to describe the bias and variance between the predicted and observed values. Runoff coefficients in the rsv files are increased or decreased to minimize the bias and variance. Multiple model runs must be made until the rsv values produce the best results possible for all eight sites.

Second, the predicted particle solids loads should be adjusted to match, as much as possible, the observed particle solids loads at all eight sites. The two parts of adjusting the predicted particle solids loads are: (1) entering the average source area particle solids concentrations into



the model's particulate solids concentration files, and (2) modify the std (street delivery) file until the predict and observed end of the pipe particulate loads are reasonably close for all eight sites.

All remaining pollutants are calibrated in the last step. Normalized particulate concentrations are determined for phosphorus, zinc, copper, and PAHs. The geometric mean for each source is entered into the model's ppd file. Then the geometric mean of the dissolved concentrations for each source area is entered into the ppd file. Large differences in predicted and measured loads could justify some adjustment to the measured values in the ppd files. Again the files would have to be adjusted so the predicted values match as best as possible for all eight study sites.

All the files created by the calibration will be placed on the USGS web page. A link will be made from the DNR web page to the USGS web page.

PROGRESS (July 2001 to June 2002)

Compiling the flow, pollutant concentrations, and land use data has been completed. Calibration of the runoff volume is also completed. Plots have been prepared describing the bias and variance between the predicted and measured values. Calibration of the particulate solids loads is almost completed. Files are available on the USGS web page.

PLANS (July 2002 to June 2003)

Calibration work will be completed for the particulate solids, phosphorus, zinc, copper, and PAHs. At the end of this year we plan to compile the data from three more storm-water studies and verify SLAMM. Calibrated the rsv file for pervious areas based on lawn runoff study. An Open-File Report will be published explaining calibration of the model.

VERIFICATION OF A PRESSURIZED STORMWATER FILTRATION SYSTEM AT ST. MARY'S HOSPITAL

PROBLEM

Urban stormwater is degrading Wisconsin waters. Cost-effective treatment technologies are needed to reduce adverse impacts that urban stormwater runoff can have on surface-water quality. A variety of advanced technologies have emerged in recent years that can help communities achieve compliance with new regulations. The EPA's Environmental Technology Verification (ETV) Program established a cooperative agreement with the National Standards Foundation (NSF) International to verify the treatment capabilities of the proprietary treatment devices.

The Wisconsin Department of Natural Resources and the USGS will conduct a study of a pressurized stormwater filtration system as an ETV program. The system has been installed at St. Mary's Hospital in Green Bay and is being used to treat runoff from its parking lot and rooftops. Stormwater is captured and pumped through a two-phase filter system and discharged into a city storm sewer. Backflush water is discharged into a sanitary sewer.

OBJECTIVE

The project objective is to determine the efficiency of the pressurized filtration system in extracting sediment, nutrients, and zinc from stormwater runoff.

APPROACH

To accomplish the above objective, the following approach will be used: (1) install flow-monitoring and water-quality sampling equipment at the inflow, outflow, and bypass of the system, (2) continuously monitor rainfall and flow, and collect water-quality samples for 15 runoff events in 2001, (3) analyze samples for sediment, total and dissolved phosphorus, Kjeldahl N, NO_2-NO_3 N, and zinc, (4) compute loads for inflow, filtered outflow, and bypass for the above constituents, (5) compute a mass balance on flow and water-quality loads for all events, and (6) publish a technical report on the results of the study.

PROGRESS (September 2000 to June 2001)

All equipment has been installed and is operational. Several test samples have been collected.

PLANS (July 2001 to June 2002)

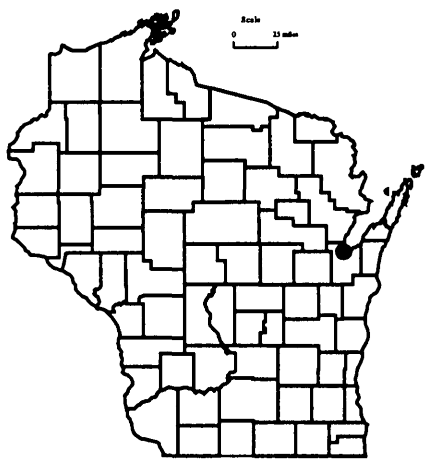
Plans are to: (1) monitor 9 additional consecutive storms that have more than 0.2 inches of rain, (2) compute the discharge record and water-quality loads for the three monitoring locations, (3) complete a mass balance summary for the monitored storms, and (4) publish the results of the study.

COOPERATORS:
Wisconsin Department of Natural Resources
National Science Foundation

LOCATION:
Green Bay

PROJECT CHIEF:
Judy A. Horwatich
Steve R. Corsi

PERIOD OF PROJECT:
September 2000–Continuing



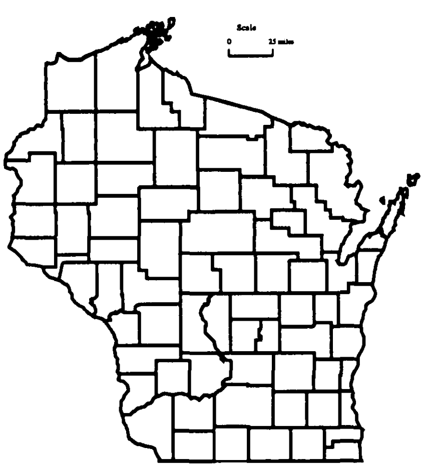
THRESHOLDS OF TOXICITY IN URBAN STREAMS (URBAN STREAM TOXICITY)

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Statewide

PROJECT CHIEF:
Steve R. Corsi

PERIOD OF PROJECT:
July 2001 to September 2002



PROBLEM

The State of Wisconsin has recently implemented a federally mandated program that requires cities with populations greater than 10,000 to develop stormwater management plans. The intent is to eventually regulate stormwater as a point source of pollution by setting limits on the quantity and quality of runoff entering receiving waters. The critical problem that needs to be addressed is the degree to which toxicants found in urban runoff need to be regulated in order to protect the biological integrity of receiving streams. Fish and invertebrate communities of streams in Wisconsin have been shown to be severely degraded where land surface imperviousness, which is a good surrogate for the level of urban impact, in the watershed is greater that 8–12 percent. Extensive testing over a five-year period on one stream in the metropolitan Milwaukee area with watershed imperviousness greater than 25 percent showed toxicity repeatedly in test organisms exposed to water or stream sediment for more than seven days. This toxicity was not substantially reduced by passing the runoff through a pilot-scale stormwater retention basin similar to those presently used in urban areas. One question that needs to be addressed is whether there is a threshold level of watershed imperviousness below which regulation of toxicants in stormwater runoff is not needed? Another question that needs to be answered is at what field concentration of potential toxicants do we see adverse effects in stream-dwelling organisms? This will permit regulatory effort to be more effectively focused on problem areas and problem chemicals.

The Wisconsin Department of Natural Resources would use this information to identify areas where regulation of toxicants in runoff is necessary to protect, enhance, or restore aquatic communities. Municipalities will need this information to most economically and effectively comply with these impending regulations.

OBJECTIVE

The purpose of this study is to examine the relation of watershed imperviousness in urban river systems to measures of toxicity in aquatic organisms. Specific objectives include: (1) determine the chronic toxicity of urban river systems to *P. promelas* in 30-day tests using in-situ caged fish tests; and (2) support an effect by University of Wisconsin–Stevens Point (UWSP) and University of Wisconsin– Milwaukee (UWM) to study acute and chronic toxicity of urban river systems on several organisms as well as short-term effects on reproductive success of *P. promelas,* effects on reflex/predator avoidance behaviors in *P. promelas* offspring, and effects on preference-avoidance behavior and habitat selection in *P. promelas* adults.

APPROACH

The USGS portion of this project will include the caged-fish study and support of the UWSP-UWM monitoring efforts by providing an adequate shelter for testing, water level for determination of stream status, and coordination of shelter transport between sites.

In-stream fathead minnow exposures will involve the following details: (1) in-stream fathead minnow exposures will consist of a number of test chambers (3 or 4 at a time) and one control chamber placed at different locations longitudinally on the stream, (2) tests will ideally coincide with other toxicity monitoring by UWSP-UWM, (3) chambers consist of 4 cartridges with 5 adult minnows (3 months old) per cartridge, (4) the ideal stream will flow from 0.0 percent urban impact to a high urban impact and changes will be placed at several places longitudinally along the stream. The control chamber will be defined as the chamber at the location with 0.0 percent urban impact. Exact placement of chambers will be dependent on the depth and flow conditions of each individual stream, (5) if suitable conditions do not exist for placement of chambers in some portions of the stream, nearby streams with appropriate urban impact will be considered as well, and (6) site visits will be made by UWSP personnel each day to check on the condition of the minnows. During each site visit, dissolved oxygen, conductivity, and water temperature will be recorded in the stream and in each cartridge.

Support of the UWSP-UWM effort will include the following: (1) the monitoring shelter will consist of a rented construction trailer that will be used by UWSP, UWM, and paid for from the USGS budget, (2) the site will be located near a stream gage or other nearby source to provide electrical connections, and (3) the trailer rental agency will transport the monitoring station between sites.

PROGRESS (July 2001 to June 2002)

The sites have been selected and procurement at the shelter is ongoing.

PLANS (July 2002 to June 2003)

Four to five sites will be monitored during the 2002 summer and another four to five sites during the 2003 summer.

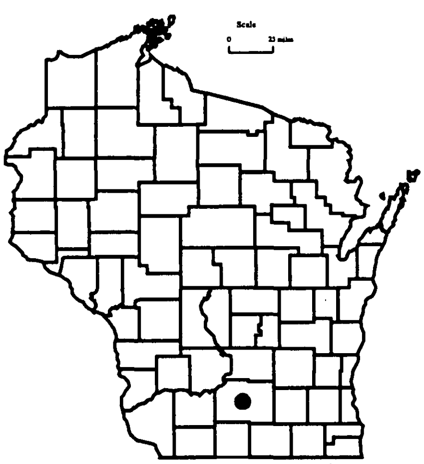
EVALUATION OF STREET SWEEPING AS A WATER-QUALITY MANAGEMENT TOOL IN RESIDENTIAL BASINS IN MADISON

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Dane County

PROJECT CHIEF:
William R. Selbig

PERIOD OF PROJECT:
May 2001 to September 2005



PROBLEM

The City of Madison is required to control the quality of stormwater runoff as part of the National Pollution Discharge Elimination System (NPDES). Previous studies have indicated that runoff from street surfaces is a major contributor of pollution in the city (Waschbusch and others, 1999). One way to control roadway runoff is to use street sweeping to remove pollutants before they are entrained in runoff. This option may be preferable to structural Best Management Practices (BMPs) since structural BMPs can be expensive and often require land. In addition, the city already conducts street sweeping and may only need to modify their sweeping practices.

OBJECTIVE

The primary objective of this project is to determine if the dirt load on residential streets is reduced by various street sweeping scenarios and if so to what degree. Water-quality samples will be collected from two basins to determine if water quality benefits are realized by the street sweeping program and to what extent. The water-quality sampling results from these basins and the street dirt load data will be used to estimate the benefits that may be achieved using the other street sweeping programs.

Secondary objectives are: (1) characterize street dirt loadings with and without the street sweeping program from residential streets, and (2) characterize the water quality in street runoff from residential watersheds.

APPROACH

This study will use a paired basins approach, meaning that data will be collected from three basins and then compared to each other. One basin will be the "control" basin and will have minimal sweeping. The data from the other 2 basins (the "test" basins), which will have various sweeping regimens implemented, will be compared to data from the control basin.

The three basins will be swept as follows:

1. One will have no sweeping except at the start of the equilibration periods. This will be the *control* basin.
2. One basin will be swept using a new generation sweeper.
3. One basin will have sweeping as is currently done throughout the city.

The basins listed in items 2–3 are the *test* basins.

The USGS will collect vacuum samples once a week from three study basins for the duration of the study. These samples will be collected using equipment and methods similar to that described in Pitt (1979) and Waschbusch and others (1999). During the sweeping periods, samples will be collected immediately before the street sweeping occurs and immediately after. Street dirt data will be used to determine the pick-up efficiency of the street sweepers and the rate of dirt build-up on and wash off from the streets. The USGS will dry, sieve, and weigh the vacuum samples. The samples will be sieved through a 62 μm screen to determine the fraction that is above and below sand size. The sieved dirt data will be used to see if there is a difference in the collection efficiency of the two size fractions between the new generation sweeper and sweepers currently used.

In addition to the street dirt sampling, the control basin and the basin with the most intense street sweeping program will have water-quality samples collected and compared. The two basins will be equipped with dataloggers, flow measurement devices or structures, phones, modems, ISCO samplers, and raingages. AC power will be necessary for battery chargers, refrigerated samplers, heating tapes on sampler intakes, and possibly area-velocity meters.

Sweeping periods will have the test basins swept at a rate of once per week and the control basin unswept except at the beginning of an equilibration period. The City of Madison will be responsible for getting the streets swept on schedule. On days when it is raining or snowing, the street sweeping will be delayed for a day or two until the streets are dry. The sweeping schedule has been selected to provide an equal number of sweeping versus non-sweeping samples from spring, summer, and fall runoff events.

PROGRESS (July 2001 to June 2002)

Three residential basins were selected in southwest Madison. The control and test basins were outfitted with water quantity and quality monitoring equipment at the outfall. Several runoff samples were collected and analyzed throughout the year. In addition to water-quality samples, vacuum samples were collected weekly at all three basins to characterize street dirt loadings during a non-sweeping year.

PLANS (July 2002 to June 2003)

Continue to monitor water quantity and quality at the control and test basins. Vacuum samples will be collected weekly at each basin beginning in April 2002 and will continue until late fall. Additionally, modified bedload samplers will be installed at the control and test basins to estimate the mass of bedload moving through the system.

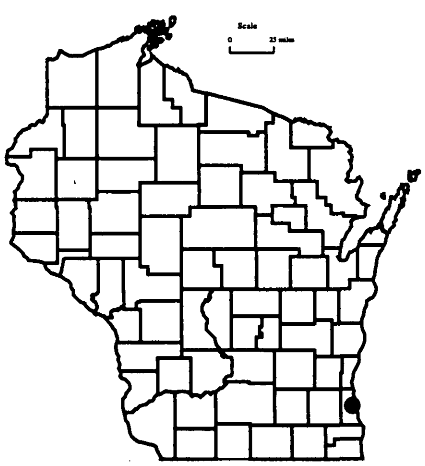
VERIFICATION OF TREATMENT PERFORMANCE OF THE VORTECHNICS AND STORMWATER MANAGEMENT FILTER

COOPERATOR:
Wisconsin Department of Transportation

LOCATION:
City of Milwaukee

PROJECT CHIEF:
Judy A. Horwatich
David W. Owens

PERIOD OF PROJECT:
October 2000 to September 2003



PROBLEM

The Wisconsin Department of Transportation (WDOT) is required to improve the quality of runoff from roadways under their control as part of the National Pollution Discharge Elimination System (NPDES) and an agreement with the Wisconsin Department of Natural Resources (WDNR). In addition, future state and federal regulations will prescribe new performance standards for nonpoint runoff management and calculation requirements for total maximum daily loads (TMDLs) of contaminants discharging in watershed basins.

OBJECTIVES

The objectives of this project are to: (1) determine the effectiveness of a Vortechnics Stormwater Treatment System and a Stormwater Management Storm Filter System in removing pollutants from highway runoff water, (2) compare the measured removal efficiencies with manufacturers' estimates, (3) characterize the variability in freeway runoff quality, (4) characterize pollutant loading in freeway runoff, and (5) determine the practical application of the treatment devices (for example, installation, operation, and maintenance costs).

APPROACH

Discharge and event mean concentration (EMC) data will be collected at the BMP inlets and outlets for 15 consecutive large (more than 0.15 inches of precipitation) runoff events. These samples will be analyzed for total phosphorus, suspended and dissolved solids, zinc, copper, and chloride. Other samples from small (less than 0.15 inches of precipitation) events occurring between the larger events will be analyzed only for suspended solids. The data will be used to calculate individual event water-quality loads entering and exiting the BMPs. The calculated loads will be used to determine the removal efficiencies of the two treatment systems for the test period and to determine if there are any efficiency patterns related to event size.

PROGRESS (July 2001 to June 2002)

The project proposal has been completed and monitoring equipment has been installed. Treatment systems have been installed.

PLANS (July 2002 to June 2003)

It is expected that sampling will be initiated in May 2002 and should be concluded by October 2002. This schedule depends on timely delivery and setup of the treatment devices. A data report will be written describing the BMPs, the monitoring system, and a summary of the data collected.

CRANDON GROUND WATER

PROBLEM

A large underground zinc-copper mine is being proposed at a site about five miles south of Crandon, Wisconsin, in Forest County. The Wisconsin Department of Natural Resources (WDNR) requested that District staff review the development of a ground-water-flow model and associated hydrologic documents as part of a permitting process for the proposed mine.

OBJECTIVE

The objective is to review documents related to water resources submitted to WDNR from the Crandon Mining Company (CMC) and their consultants; and to make suggestions to WDNR on studies and approaches that will improve the understanding of the hydrology and effects of mining on the water resources in the vicinity of the proposed mine.

APPROACH

The schedule for review of documents will be mutually agreed upon between WDNR and USGS.

PROGRESS (July 2001 to June 2002)

The Technical Working Group's draft report for the ground-water-flow model was completed. A review of the TMA and Reflooded mine contaminant transport models was continued. Monitoring of lake stage and shallow ground-water levels adjacent to Little Sand Lake and Skunk Lake were continued.

PLANS (July 2002 to June 2003)

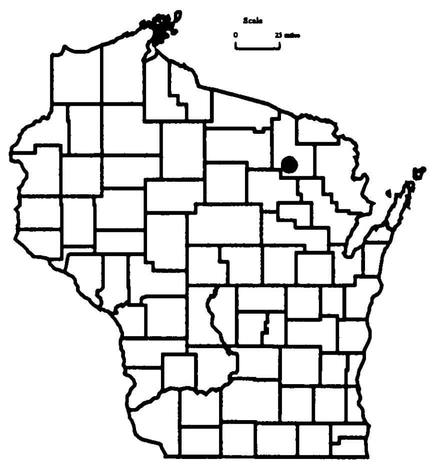
Documents will be reviewed and meetings attended at the request of the WDNR. Complete the Technical Working Group's report for the ground-water-flow model. A review of the TMA and Reflooded mine contaminant transport models will be continued. Monitoring of lake stage and shallow ground-water levels adjacent to Little Sand Lake will be continued.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Forest County

PROJECT CHIEF:
James T. Krohelski

PERIOD OF PROJECT:
October 1994–Continuing



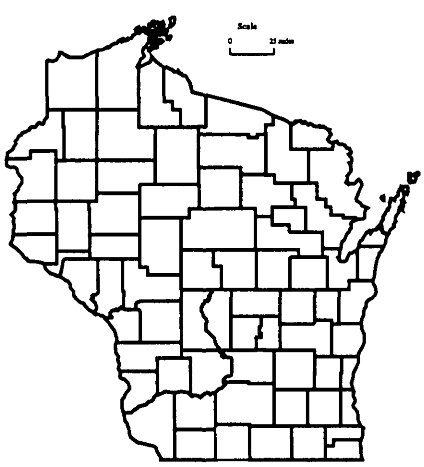
WISCONSIN WATER-USE DATA FILE

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Statewide

PROJECT CHIEF:
Bernard R. Ellefson

PERIOD OF PROJECT:
March 1978–Continuing



PROBLEM

The need for reliable water-use data by State and Federal planning agencies is increasing as the competition for use of the State's water resources increases. Water-use data in a standardized format needs to be available to assist in making decisions on future water use.

OBJECTIVE

The purpose of this project is to collect accurate and complete data on Wisconsin's water use, to store data, and to prepare periodic reports on water use in the State.

APPROACH

Sources of water-use information will be evaluated. The best available data will be entered into a database. Efforts will be made to upgrade the accuracy of the water-use data.

PROGRESS (July 2001 to June 2002)

The database was updated with current water-use data. These data included high capacity well data, public-supply information, and data used to estimate irrigation water use. These and other data were used to make water-use estimates for the 2000 water use summary.

PLANS (July 2002 to June 2003)

Plans include: (1) continue to update and maintain the database with current water-use data, (2) supply water-use data for water-resources studies currently being conducted in the State, and (3) publish an atlas-type report, "Water Use in Wisconsin, 2000."

REPORTS

Ellefson, B.R., Fan, C.H., and Ripley, J.L., 1995, Water use in Wisconsin, 1995: U.S. Geological Survey Open-File Report 97–356, 1 sheet, scale 1:5,000,000.

Ellefson, B.R., Sabin, T.J., and Krohelski, J.T., 1993, Water use in Wisconsin, 1990: U.S. Geological Survey Open-File Report 93–118, 1 sheet, scale 1:5,000,000.

Ellefson, B.R., Rury, K.S., and Krohelski, J.T., 1988, Water-use in Wisconsin, 1985: U.S. Geological Survey Open-File Report 87–699, 1 sheet, scale 1:5,000,000.

U.S. Geological Survey, 1990, National Water Summary, 1987– Hydrologic events and water supply and use: U.S. Geological Survey Water-Supply Paper 2350, 553 p.

Krohelski, J.T., Ellefson, B.R., and Storlie, C.A., 1987, Estimated use of ground water for irrigation in Wisconsin, 1984: U.S. Geological Survey Water-Resources Investigations Report 86–4079, 12 p., 1 pl.

Lawrence, C.L., and Ellefson, B.R., 1984, Public-supply pumpage in Wisconsin, by aquifer: U.S. Geological Survey Open-File Report 83–931, 40 p.

____1982, Water use in Wisconsin, 1979: U.S. Geological Survey Open-File Report 82–444, 98 p.

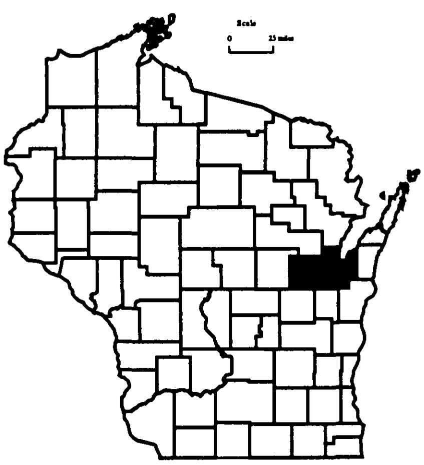
FOX RIVER REMEDIATION

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Outagamie County
Brown County

PROJECT CHIEF:
Jeffrey J. Steuer

PERIOD OF PROJECT:
August 1998 to September 2003



PROBLEM

Several Fox River bottom sediment deposits have been considered for pilot-scale remediation based upon high PCB concentrations. The pilot remediation project at deposit "N" (Kimberly) began in November 1998 and, in August 1999, pre-dredge sampling commenced at the Sediment Management Unit (SMU) 56_57 (Green Bay). There was a need, as part of the Fox River Remediation Assessment Team (FRRAT) efforts, to monitor and collect environmental data before, during, and after the remediation operation. Most recently, the Wisconsin Department of Natural Resources and the U.S. Environmental Protection Agency have a 7-year plan to remediate PCBs from the bottom sediments in the Fox River. The plan calls for a pre-remediation assessment of PCB transport followed with a 40-year monitoring program upon completion of the remediation program. There is a need to monitor and collect environmental data before, during, and after this full-scale remediation operation.

OBJECTIVE

During the pilot-scale remediation efforts, monitoring and sampling will be conducted to meet the project Quality Assurance Project Plan objectives. The objectives are to: (1) evaluate baseline conditions prior to dredging activities, (2) evaluate short-term impacts, including PCB mass fluxes during dredge activities, and (3) evaluate conditions following the completion of dredge-related activities. Objectives for the full-scale remediation have yet to be finalized.

APPROACH

Pilot-Scale remediation at Deposit "N"—The baseline investigation consisted of water-column samples collected at four upstream locations and four downstream locations prior to the commencement of dredging. Bottom sediment samples were collected from a minimum of 30 locations in Deposit N and an intermediate zone located between the sediment deposit and the silt-containment barrier.

Evaluation of short-term impact at Deposit "N" includes water-column sampling at four upstream and four downstream locations, dredge slurry samples and continuous-flow monitoring, composite samples of all on-shore processing locations, composite samples of processed solids for landfill disposal, samples of filter media, and treated carriage water samples.

Evaluation of long-term impact included collecting sediment core samples from the same locations as the pre-dredge sample sites, and an intermediate zone characterization using visual reconnaissance and sampling.

Pilot-Scale remediation at SMU 56_57—The baseline investigation consisted of water-column samples collected at four upstream locations and five downstream locations prior to the commencement of dredging.

Evaluation of short-term impact SMU 56_57 included water-column sampling at four upstream and five downstream locations, dredge slurry samples with continuous-flow monitoring and composite samples of processed and treated carriage water samples.

PROGRESS (July 2001 to June 2002)

Deposit "N"—Pre- and post-dredge cores have been collected and processed at 30 locations along with the intermediate zone. Over 90 PCB samples, 800 TSS samples, and over 6,400 water-quality measurements have been collected at the water-column sites. Shore-side (remediation process) samples and slurry flow data have been collected for 29 continuous days. The USGS mercury lab has completed the bottom sediment and remediation process sample analyses. The data analyses is complete and the final report has been written evaluating the water-column transport and the shore-side processes.

SMU 56_57—Over 90 PCB samples, 800 TSS samples, and over 6,400 water-quality measurements have been collected at the water-column sites. Assistance was provided in the slurry sampling and five 80-liter effluent samples were processed. The data analyses is complete and the final report has been written evaluating the water-column transport and the overall PCB fluxes.

PLANS (July 2002 to June 2003)

The USGS will participate in determining the sampling scope and monitoring design in support of the full scale remediation effort. The low level (80-liter; limits of detection of approximately 0.01 ng/L) water-column PCB samples along with ancillary data will be collected beginning in June 2002

REPORTS

Fox River Remediation Advisory Team, 2000, Evaluation of the effectiveness of remediation dredging: The Fox River Deposit N Demonstration Project November 1998–January 1999: Water Resources Institute Special Report 00–01.

Steuer, J.J., 2000, A mass-balance approach for assessing PCB movement during remediation of a PCB-contaminated deposit on the Fox River, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 00–4245, 8 p.

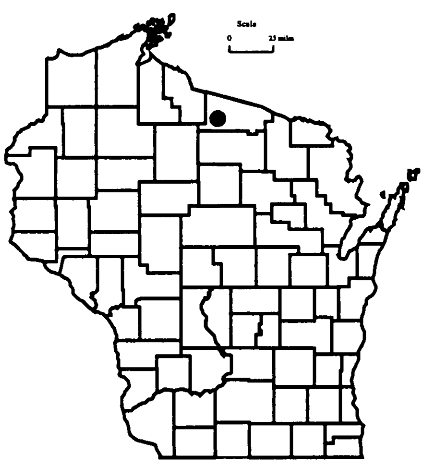
HYDROLOGIC INVESTIGATION OF POWELL MARSH AND ITS RELATION TO DEAD PIKE LAKE

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Vilas County

PROJECT CHIEF:
William J. Rose
James T. Krohelski

PERIOD OF PROJECT:
May 2000 to July 2002



PROBLEM

An extensive system of ditches and shallow ponds was constructed in Powell Marsh in the 1950s. The marsh is a large part of Dead Pike Lake's watershed. Lake-area residents are concerned that the ditch and pond system has fostered the production of an iron precipitate and is damaging the aesthetic quality of the lake. The hypothesis is that iron, which is likely to be present in wetland soils, is being mobilized by anoxic conditions and locally increased ground-water gradients due to ditch and pond construction. Once the reduced iron reaches the main ditch draining to Dead Pike Lake, the iron is oxidized, forming the precipitate.

OBJECTIVE

The objectives are to: (1) identify the chemistry (parameters that govern iron) of water at various points in the marsh, pond, aquifer, ditch, and lake system, (2) define the hydrology of the pond, marsh, aquifer, ditch, and lake system, and (3) determine the effects of lowering ground-water gradients near the ditch conveying the iron precipitate to Dead Pike Lake.

APPROACH

A first phase of the study will consist of reconnaissance, identification of site chemistry, monitoring, and development of a ground-water-flow model. The second phase will consist of monitoring, and model calibration and prediction. At the conclusion of the first phase, a meeting will be held with WDNR personnel and interested lake-area residents to explain study findings and plans for the second phase. The second phase will include a report describing findings and results of model prediction. The model will be available to WDNR and the USGS, if required, will answer requests for additional model runs.

PROGRESS (July 2001 to June 2002)

The final interpretive report for the study has been completed, approved, and published.

PLANS

Project is completed.

REPORT

Krohelski, J.T., Rose, W.J., and Hunt, R.J., 2002, Hydrologic investigations of Powell Marsh and its relation to Dead Pike Lake, Vilas County, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 02–4034, 20 p.

RESPONSE OF THE ST. CROIX RIVER POOLS TO VARIOUS PHOSPHORUS LOADING SCENARIOS

PROBLEM

The St. Croix National Scenic Riverway, Wisconsin and Minnesota, is one of the original eight components of the National Wild and Scenic Rivers Act. Due to the proximity of this area to the Minneapolis/St. Paul, Minnesota metropolitan area, the Riverway has experienced increased use and developmental pressure. Several pools are in the lower 100 km of the Riverway. Presently, each of the pools in the lower reach of the Riverway is eutrophic to hypereutrophic because of high nutrient loading, primarily phosphorus loading. To protect these pools, managing agencies understand the need to limit phosphorus loading to the pools; however, it is not known how the pools will respond to changes in phosphorus loading.

OBJECTIVE

The objectives of this study were to calibrate and apply the BATHTUB model to the St. Croix River pools to provide a better understanding of the sensitivity and expected response of each of the pools to decreased and increased phosphorus loading. In future studies, the calibrated model can be used to evaluate the effects of specific management scenarios supplied by the Basin Team.

APPROACH

To determine the sensitivity of each of the St. Croix River pools to decreases and increases in phosphorus loading, the BATHTUB model was calibrated using pool and tributary data collected in previous studies (WI21300: Lenz, B.N., Robertson, D.M., Fallon, J.D., and Ferrin, R., 2001, Nutrient and suspended-sediment loads and benthic invertebrate data for tributaries to the St. Croix River, Wisconsin and Minnesota, 1997–99: U.S. Geological Survey Water-Resources Investigations Report 01–4162, 57 p.). Two separate BATHTUB models were attempted to be developed; one model for St. Croix Falls Reservoir and one for Lake Mallalieu/Lake St. Croix. Water quality in the various pools may respond differently during various flow regimes. Therefore, sensitivity and scenario evaluations for total phosphorus and chlorophyll *a* concentrations and water clarity were performed for 1999, and also for a period with relatively low flows throughout the basin (using flow data from 1988) and for a period with relatively high flows throughout the basin (using flow data from 1996). During each of these flow regimes, phosphorus loading from each tributary was estimated by use of flow-to-load relations based on 1997–99 data, and loading from other sources were assumed to be similar to that estimated for 1999.

PROGRESS (July 2001 to June 2002)

All modeling was completed and draft of final report is in review.

PLANS (July 2002 to June 2003)

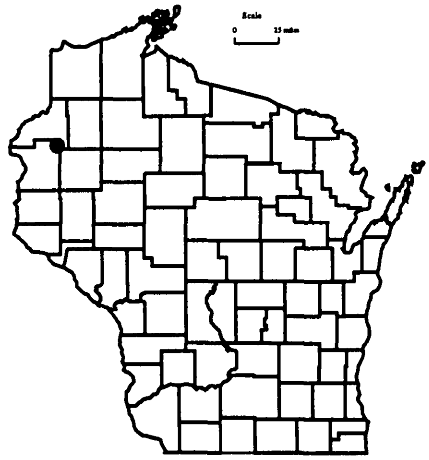
Publish final report.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
St. Croix National Scenic Riverway

PROJECT CHIEF:
Dale M. Robertson
Bernard N. Lenz

PERIOD OF PROJECT:
December 2001 to September 2003



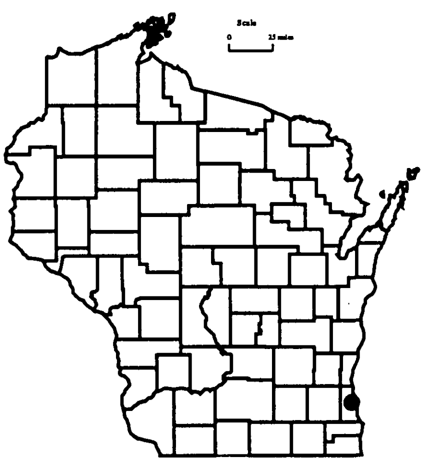
LINCOLN CREEK PCBs

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
City of Milwaukee

PROJECT CHIEF:
Peter E. Hughes

PERIOD OF PROJECT:
June 2001 to June 2003



PROBLEM

The Wisconsin Department of Natural Resources is evaluating alternatives for removing PCB contaminated sediments from the Estabrook Impoundment on the Milwaukee River. Lincoln Creek empties into this impoundment and it is important to identify if there are continuing sources of PCBs coming from Lincoln Creek drainages.

OBJECTIVE

The primary objective of this study is to collect water-column samples during runoff events to quantify the PCB load being transported in Lincoln Creek.

APPROACH

The USGS will establish a gaging station on Lincoln Creek at 27th Street and install equipment to automatically collect water samples during runoff events. A total of 19 event composite samples will be collected and processed for analysis by the Wisconsin State Laboratory of Hygiene for particulate and dissolved PCBs. A total of 110 discrete suspended solids samples will also be analyzed. Streamflow will be continuously monitored and used to compute the PCB and suspended solids loads transported during runoff events.

PROGRESS (June 2001 to June 2002)

The gaging equipment has been installed and is operational. Sampling of runoff events has started.

PLANS (July 2002 to June 2003)

Complete collection of the storm samples and submit samples to the lab. Prepare a summary of the data for WDNR. A data report will be prepared which will summarize the storm event loads and flow data collected for this project.

FISH CREEK

PROBLEM

North Fish Creek has accelerated erosion and sedimentation problems that have potentially negatively impacted a highly valued fishery resource. Previous USGS studies identified bluff erosion along the upper main stem as the major source of sediment to downstream reaches. Bioremediation techniques for bluff stabilization were attempted but failed. Erosion control techniques are limited because of the remoteness of the site and lack of access.

OBJECTIVES

The main goal of this study is to demonstrate the ability of an in-stream restoration technique (submerged vanes on the channel bed) to reduce bluff erosion along a flashy, high-energy stream, and ultimately reduce subsequent sedimentation problems in North Fish Creek and potentially Lake Superior. Reducing sediment loads of Lake Superior tributaries is important not only for protecting or restoring aquatic habitat, but also for dredging issues.

APPROACH

Submerged vanes were installed in the channel bed at two eroding bluff sites along the upper main stem of North Fish Creek in the summer of 2000 and 2001. The number, size, and layout of the vanes depend on the channel morphology, velocity, and depth at a meander bend. Typically, about 15 vanes are installed in groups of one to three. Vanes modify the secondary flows that cause erosion along the toe of a bank in a meander bend. Vanes stabilize a channel reach without inducing changes upstream or downstream of that reach. The vanes are not visible in time (they become buried by depositing sediments yet remain effective), and aid the stream in doing the work by redistributing the flow energy to produce a more uniform cross-section without an appreciable increase in the energy loss through the reach.

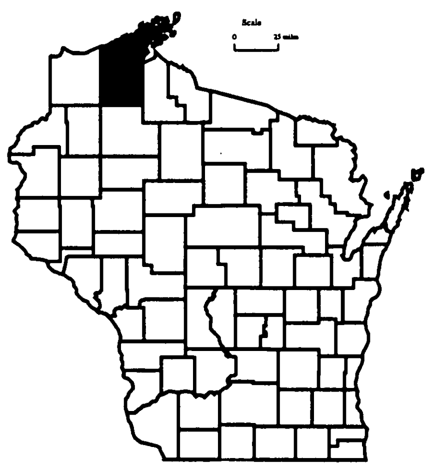
Monitoring the success of the study will be conducted through surveys of the bluff face, streamflow, and channel conditions before, during, and after installation of the submerged vanes. The bluff and channel will be resurveyed after flood events. The bluff surveys will be used to compare pre- and post-installation bluff retreat rates. Channel cross section surveys will be conducted at the site and in upstream and downstream locations to quantify changes in the shape and location of the channel. A streamflow-gaging station will be reactivated downstream of the site to properly quantify flood magnitudes experienced during the demonstration. Stage recorders will be installed at the bluff sites

COOPERATOR:
Wisconsin Department of Natural Resources
U.S. Fish and Wildlife Service

LOCATION:
Bayfield County

PROJECT CHIEF:
Faith A. Fitzpatrick

PERIOD OF PROJECT:
July 2000 to September 2003



PROGRESS (July 2001 to June 2002)

Submerged vanes were installed at the second site. Bluff and channel surveys were conducted at both sites. Streamflow was monitored at a gage downstream of both sites. Stage data were collected at both bluff sites. A master's thesis was published on installation and monitoring of vanes at the first site.

PLANS (July 2002 to June 2003)

Bluff and channel surveys will be conducted at both sites following major floods. Stage data will be collected at both sites. Streamflow data will be collected at a USGS gaging station downstream of both sites.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES BIOLOGY DATABASE

PROBLEM

The Wisconsin DNR Bureau of Fisheries Management and Habitat Protection collects and manages a wide variety of biological data. Data from biological programs were previously managed and stored in multiple databases in a wide variety of formats, making retrieval and analysis of data from the different programs difficult and time consuming. Databases did not exist and were needed to manage the statewide fish propagation program data and also for the statewide habitat assessment programs.

OBJECTIVE

A single database was needed to unify data from five legacy databases and two new databases. The legacy databases are the Wisconsin Inland Fisheries (Paradox) Database, Wisconsin Fisheries Historical Database, Treaty Database, Master-Fish File Database, and the Macroinvertebrate Database. The two new databases that were developed and were incorporated into the project include the Fish Propagation Database and the Habitat Database.

APPROACH

Initial development of the project was directed toward providing data entry and data reporting capability on the Internet for data from all major field activities. The most widely used field forms for fish, habitat, and macroinvertebrate data were selected for initial development. The database was deployed over the Internet so that geographically-dispersed users across the State could input and access data using electronic forms and reports.

PROGRESS (July 2001 to June 2002)

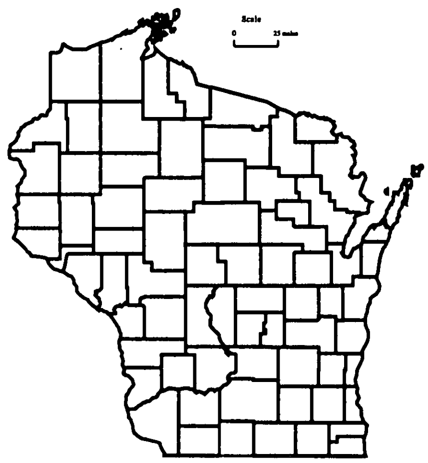
The URL for the database website is: http://infotrek.er.usgs.gov/pls/WDNR_BIOLOGY_WDB/WDNR_BIOLOGY_WDB.home. The database website, forms, and reports have undergone continual refinement in response to user needs in addition to ongoing development of new applications for the database. The first phase of the database was deployed on the Internet on January 1, 2001. Database use increased substantially and has remained high since November 2001 when the USGS Wisconsin District installed a direct T-1 line to the Internet which substantially increased database performance. The new propagation component of the database went online in January 2002 and includes data-capture and reporting for processes from stocking-quota development, hatchery production, egg and fish transport, and final stocking. The planned major redesign and refinement of all database applications was undertaken from February through June 2002.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Statewide

PROJECT CHIEF:
David W. Hall

PERIOD OF PROJECT:
January 2000–Continuing



PLANS (July 2002 to June 2003)

The basic structure of the fish and habitat components of the database will be redesigned from June through September 2002 to link data from related fish and habitat surveys with a comprehensive survey ID. Additional data from legacy datasets will be loaded as time and funding allow. All database hardware and software are continually being upgraded to increase performance and to enhance the utility of the database applications. A feasibility study may be continued to assess the utility of mobile applications and electronic field data-entry forms as a paperless field data-collection system.

THE EFFECT OF NEAR-SHORE DEVELOPMENT ON CONSTITUENT LOADING TO LAKES IN NORTHERN WISCONSIN

PROBLEM

Additions of nutrients, pesticides, and sediment from near-shore developments to lakes may seriously degrade lake-water quality. Shoreline-zoning regulations such as required setbacks, cutting restrictions, and buffers between the lake and development have been developed in the hope that these requirements can mitigate the effects of sediment and nutrient runoff.

Previous studies have estimated the amount of these loadings from the lake watershed but few studies have determined the processes and pathways in which these constituents are delivered to the lake at a site-specific scale (for example, one-acre parcel). The effectiveness of buffers or cutting restrictions on reducing the amount of chemical constituent loads and sediment has yet to be demonstrated.

OBJECTIVE

The objectives of the study are to: (1) estimate the quantity of surface-water runoff and ground water that flows into a lake from developed and undeveloped lands, and (2) determine the quality of surface-water runoff and ground water that flows into a lake from developed and undeveloped lands.

APPROACH

Effects of shoreline development on water and nutrient loading will be assessed using a paired approach. The comparison will focus on developed and undeveloped sites on four lakes in Vilas and Forest Counties in northern Wisconsin. Developed sites may include runoff from lawns, driveways, sidewalks, and roofs; undeveloped sites consist of mostly immature woods having woody and non-woody vegetation and relatively undisturbed ground. Both surface-water runoff and ground-water components will be characterized where appropriate.

Sites were divided into those where the lakes have ground-water inflow and those that do not. Those that had ground-water inflow will be instrumented to characterize the ground- and surface-water components. Sites with ground-water flow away from the lake will be instrumented to characterize surface-water components only. Each site will be surveyed and a detailed map will be prepared to determine the areas that contribute to surface runoff.

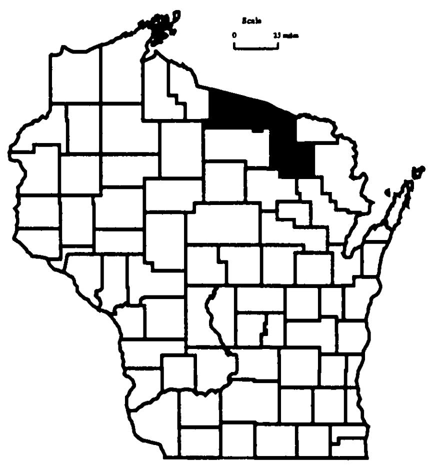
A tipping bucket rain gage will be installed at each site. Precipitation will be measured during the non-freezing portion of the year. Precipitation from a nearby National Weather Service gage will be used during freezing periods.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Vilas and Forest Counties

PROJECT CHIEFS:
David J. Graczyk
Randy J. Hunt

PERIOD OF PROJECT:
October 1999 to September 2003



Surface-water runoff will be measured by using two types of monitors depending on the site. An automatic collection monitor will be installed at four sites. A passive collection monitor will be installed at two sites. The quality of surface water will be determined from analyses of the runoff collected by both automated and non-automated systems.

Ground-water flow will be monitored by the installation of piezometer nests. The nests will be distributed along the topographic gradient. The most down-gradient nest will be installed adjacent to the lakeshore. The quality of ground water will be determined from a subset of water table wells and piezometers located at the nest sites. In addition, the quality of ground water that discharges to the lake will be characterized using seepage meters and pore-water diffusion equilibrators. All surface- and ground-water samples will be analyzed for total dissolved phosphorus, total phosphorus, ammonia nitrogen, nitrate and nitrite nitrogen, and total Kjeldahl nitrogen. Approximately 7 surface-water samples per site will be collected, and 5–10 ground-water samples will be collected. The Wisconsin State Laboratory of Hygiene will analyze all samples.

PROGRESS (July 2001 to June 2002)

Samples were collected and analyzed at selected ground-water wells and at the surface-water data-collection sites. There were 76 samples collected at the four lawn sites and 67 samples collected at the seven woods sites. The median surface runoff in inches from the woods catchments was an order of magnitude less than the median surface runoff from the lawn catchments. All surface-water samples from the lawn and the woods were composited; the median woods concentration for ammonia nitrogen, Kjeldahl nitrogen, total phosphorus, and dissolved total phosphorus was greater than the median lawn concentrations. The only median lawn concentration that was greater than woods median concentration was nitrate plus nitrite nitrogen. A nonparametric Wilcoxon rank-sum test determined that composite lawn median concentrations were statistically significantly different from the woods median concentrations. Although concentrations for most constituents were greater in the woods samples, the loads from the woods were lower than the lawns because of greater runoff volumes generated from the lawn catchments. There was a strong pattern of the lawn yields exceeding the woods median yields (within and between sites). This is due to more runoff from the lawns than from the woods sites. Surface-water runoff and subsequent loadings to the lake were a more important source of nutrients than the ground water.

PLANS (July 2002 to June 2003)

A final report is being prepared that will summarize all surface-water and ground-water data. The report will also summarize all loadings and yields to the lake from the different land uses. Final report will be published. The next data-collection phase will begin. Data-collection sites will be found and a buffer demonstration project will begin. This project will focus on the hydrology and determine how water moves across a lawn and then to a buffer and if this water eventually makes it to the lake. The study will use a rainfall simulator and inert tracers to determine how and the volumes of water that flow through the buffer.

OCCURRENCE AND VARIABILITY OF PATHOGENS IN WISCONSIN'S URBAN STREAMS

PROBLEM

Water-borne pathogens are a great concern to water-quality managers because of the potential impact on human health, aquatic life, and recreational use. Nowhere have pathogens been more in the public eye than Milwaukee, Wisconsin, where a 1993 Cryptosporidium outbreak was blamed for the death of over 100 people. In addition, recent Milwaukee beach closures have brought renewed concerns before an anxious public over area-wide sanitary and stormwater management. The origins of pathogenic organisms can be many and difficult to delineate. Obviously, sanitary sewer and combined sewer overflows can be a major source of pathogens originating from human fecal material. Sanitary sewer overflow (SSO) or bypassing is a technique used by sanitation utilities to relieve possible backup and surcharging problems during wet-weather periods. In 1999 alone, 120 bypasses were reported by municipalities in Wisconsin (WDNR report) and 87 of these were associated with storm events. They are not confined to just the large metropolitan areas. They occur in cities and villages of all sizes and in all geographic regions of the State. Though not as prevalent as SSOs on a statewide basis, combined sewers and their associated overflows (CSO) may also be important localized sources of pathogens. A third important source of pathogens is runoff water from storm sewers and diffuse inputs. Past research has shown microbial densities in stormwater runoff to be similar to those found in diluted raw sewage. Sources of these organisms include livestock, beavers, pets, and waterfowl. The documented presence of pathogenic organisms, such as Giardia, Cryptosporidium, Salmonellae, Pseudomonas aeruginosa in storm sewers with no sanitary sewer connections, suggests that diffuse or nonpoint sources of these microorganisms may be an overlooked water-quality issue.

OBJECTIVE

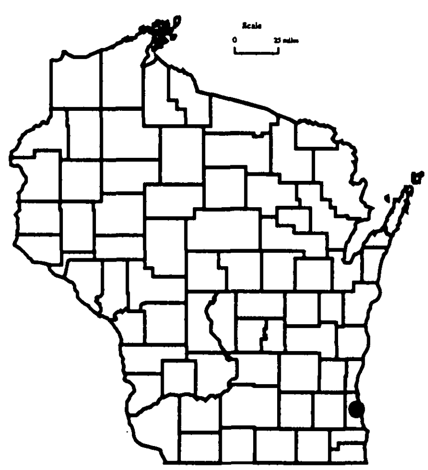
The overall goal of this project is to provide a greater understanding of the occurrence of pathogenic organisms in urban streams. Specific objectives include: (1) determine concentrations of pathogenic indicators and specific pathogens in urban streams of different sizes, land uses, and point source inputs, (2) determine ambient concentrations of total suspended solids, BOD, total phosphorus, and chloride, (3) collect 13 rounds of samples at each site—9 event samples and 4 baseflow samples, (4) explore the resulting data in an attempt to develop relations between watershed size, major land use, hydrologic and meteorological conditions, and water-quality parameters identified above, and (5) determine sources and relative contributions of *E. coli* bacteria to urban streams by use of strain identification and typing.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Milwaukee area

PROJECT CHIEF:
Robert J. Waschbusch
Steve R. Corsi

PERIOD OF PROJECT:
March 2001 to December 2003



APPROACH

The USGS will operate two continuous monitoring stations—one at the mouth of the Milwaukee River in Milwaukee and one further up in the Milwaukee River watershed on Cedar Creek at Grafton. The Wisconsin Department of Natural Resources (WDNR) will collect samples at numerous streams in the Milwaukee area. The focus of this study will be a synoptic survey of 12 stream sites in the Milwaukee metropolitan area and 2 in the Superior area. Milwaukee sites will be selected to spatially cover the watershed draining to the Milwaukee Harbor. All sites will be selected to represent a range of water-course size, land use (residential, industrial, open space), and point-source input locations (CSO, SSO, and stormwater discharges). A total of 14 stream sites will be chosen, with some streams having more than one site to examine downstream longitudinal changes. The sampling goal will be to collect a total of 13 grab samples at each site (flow composite samples at the USGS sites), 9 during periods of high flow, and 4 during base-flow conditions. Sampling will be spaced to address seasonal differences, and will occur over a period of 1-1/2 years. Recent advances in genetic strain identification will be used in conjunction with the sampling effort to attempt to identify the sources of *E. coli*. An analysis of this data will provide an assessment of the potential risks from the pathogenic presence.

PROGRESS (March 2001 to June 2002)

Sites have been operating since spring 2001, and the first six rounds of samples have been collected.

PLANS (July 2002 to June 2003)

Two more rounds of baseflow samples and five more rounds of event samples will be collected. Sampling will continue through September. Data analysis and final reporting will be conducted in the following fall and winter period.

TRANSPORT OF PCBs AT THREE SITES ON PINE CREEK AND MANITOWOC RIVER (HAYTON MILLPOND)

PROBLEM

High concentrations of polychlorinated biphenyls (PCBs) have been found in the Hayton Millpond and Pine Creek bed sediments, water column, and fish tissues. PCB transport trends are needed to assist in future management and remediation decisions.

OBJECTIVE

The objective is to determine PCB loading changes at the Hayton Millpond outlet along with PCB loading in reaches of Pine Creek.

APPROACH

From August 1994 to August 1995, 24 PCB samples were collected at the Hayton Millpond outlet. Total suspended solids, precipitation, chlorophyll *a*, and discharge data were used in conjunction with the PCB data to establish PCB concentration regression relations.

From August 2001 through June 2002, five additional 80-liter PCB samples (along with supporting constituents) will be collected at the Millpond outlet along with 10 PCB samples on Pine Creek. Utilizing these data, residuals from the 1993–95 regression relations will be examined to determine if PCB concentrations have statistically changed over time.

PROGRESS (July 2001 to June 2002)

Field equipment blanks have been collected; equipment, cleaning, and processing procedures have been found to be acceptable. Ten PCB samples and their related constituents have been collected. Laboratory results have been received for three of the samples. Relative loading between the sites may be similar to that observed seven years ago. During August 2001, one of the Pine Creek sites (Quarry Road) had a total PCB (congener summation) concentration of 730 ng/L.

PLANS (July 2002 to September 2003)

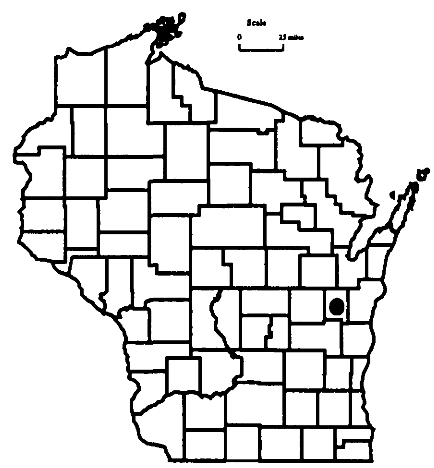
Collection of the remaining nine PCB samples along with related constituents and discharge measurements will be completed.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Calumet County

PROJECT CHIEF:
Jeffrey J. Steuer

PERIOD OF PROJECT:
April 1994 to September 2002



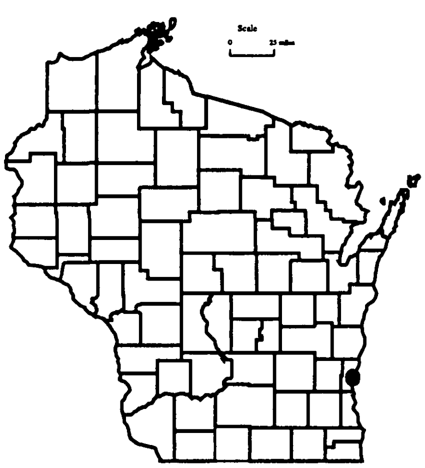
TRANSPORT OF PCBs AT TWO SITES ON CEDAR CREEK

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Ozaukee County

PROJECT CHIEF:
Jeffrey J. Steuer

PERIOD OF PROJECT:
April 2000 to September 2002



PROBLEM

High concentrations of polychlorinated biphenyls (PCBs) have been found in the Cedar Creek bed sediments, water column, and fish tissues. Partial remediation of Cedar Creek (Ruck Impoundment) was completed in 1994. PCB transport trends are needed to assist in future management decisions.

OBJECTIVE

The objective is to determine PCB loading changes at Columbia Avenue (downstream of the Ruck Impoundment) and Highland Road.

APPROACH

From August 1994 to August 1995, 24 PCB samples were collected at Columbia Avenue and Highland Road. Total suspended solids, chlorophyll *a*, and discharge data were used in conjunction with the PCB data to establish PCB concentration regression relations.

From December 2000 through October 2001, 24 additional 80-liter PCB samples (along with supporting constituents) will be collected at the two Cedar Creek sites. Utilizing these data, residuals from the 1994–95 regression relations will be examined to determine if PCB concentrations have statistically changed over time.

PROGRESS (July 2001 to June 2002)

Field equipment blanks have been collected; equipment, cleaning and processing procedures have been found to be acceptable. The 24 PCB samples and related constituents have been collected. Laboratory results have been received for 20 of the samples. Immediately downstream of the remediated Ruck Impoundment, several of the samples had no detected congeners in either the dissolved or particulate fractions. Downstream of the Highland Impoundment, total PCB (congener summation) concentrations have ranged from 0.44 to 23.6 ng/L.

PLANS (July 2002 to June 2003)

In conjunction with the WDNR, this office will conduct data analyses such as comparing previous and current regression residuals in addition to a neural network analysis.

MITIGATION OF FUTURE NORTH FORK URBANIZATION IMPACTS ON THE PHEASANT BRANCH HYDROLOGIC SYSTEM

PROBLEM

As Middleton and its surroundings continue to develop, the Pheasant Branch North Fork Basin is expected to undergo significant urbanization. For the downstream city of Middleton, headwater urbanization can mean increased flood peaks, increased water volume, and increased pollutant loads. It may also adversely effect down-gradient ecosystems such as Pheasant Branch Marsh and reduce ground-water recharge. Previous work has often not included the transient interaction between surface and ground water. The proposed work will combine ground- and surface-water modeling in the analysis of the Pheasant Branch system.

OBJECTIVE

Objectives are to: (1) locate potential sites for runoff controls and/or enhanced infiltration to ensure future flood peaks do not exceed the present condition flood peaks, (2) quantify the flood peak and ground-water recharge differences resulting from a fully-urbanized condition with and without treatment or runoff controls, (3) use the ground-water model to assess North Fork basin urbanization impacts on Pheasant Branch Marsh, and (4) construct a ground-water model able to address future needs such as siting future water supply.

APPROACH

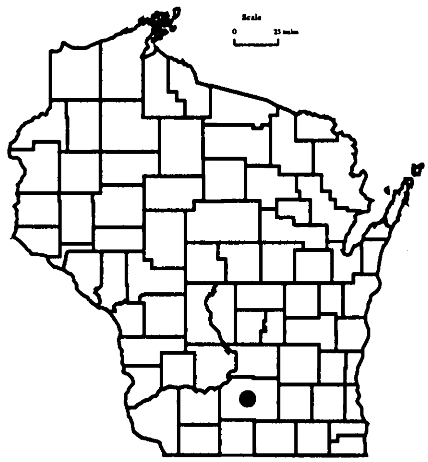
The overall approach will combine ground- and surface-water models to locate an effective combination of stormwater treatment or control sites within the North Fork basin which may be developed to produce minimal effects on the Pheasant Branch hydrologic system. The surface-water component will build upon the simulations detailed in "Effects of urbanization on streamflow, sediment loads, and channel morphology in Pheasant Branch Basin near Middleton, Wisconsin" (Krug and Goddard, 1985, WRIR 85–4068). To achieve the objectives of this project, the model will contain a spatial resolution to simulate 1 to 4 developments per square mile (approximately 40 model sub-areas). Significant development has occurred in the South Fork basin since 1981. Two of the areas simulated as not generating runoff in 1981 have developed and presently drain to the South Fork. It will be necessary to update the South Fork basin model to ensure that shifting of the North Fork hydrograph peak (due to runoff controls) will not produce an enhanced peak downstream of the confluence (Krug and Goddard, pages 16, 17). The new model efforts will calibrate to recently collected Pheasant Branch discharge and precipitation data collected at Highway 12.

COOPERATOR:
City of Middleton
Wisconsin Department of Natural Resources

LOCATION:
Dane County

PROJECT CHIEFS:
Jeffrey J. Steuer
Randy J. Hunt

PERIOD OF PROJECT:
July 1996 to January 2004



The ground-water component will use a model constructed at a smaller scale than the recently developed Dane County model (Krohelski and others, 2000) to have the appropriate resolution for the stormwater control alternatives. Similar to Krohelski and others (2000), the model will be constructed using MODFLOW (McDonald and Harbaugh, 1988). Recharge results from the surface-water model will be input into the ground-water-flow model to assess the effects of management alternatives on ground-water recharge distribution and magnitude. The model will also calculate the changes in ground-water-derived baseflow in the system for the different alternatives and assess the effectiveness of recharge enhancement scenarios.

In February 2000, the project was expanded when the models were accepted as part of an Environmental Protection Agency (EPA)/National Science Foundation (NSF) research grant. The expanded research will be coordinated by the WDNR and University of Wisconsin–Madison. To further that effort, the surface-water model will be modified to incorporate research findings in local infiltration and temperature pollution. The ground-water model will be refined to include additional geologic data and hydrologic features near the Pheasant Branch Marsh. The refined model will then be used for optimization to further assess the effects of development on surface-water resources in the area.

PROGRESS (July 2001 to June 2002)

The calibrated PRMS model was updated and verified for the period October 1998 through October 2000—an interval which included the largest recorded peak flow on Pheasant Branch Creek. Recurrence interval hydrographs for the South Fork Channel were provided to a private consultant in support of the City of Middleton.

Measurements have been made in the Frederick Springs area to detail individual seepage areas along with several sites that extend downstream to Century Avenue. A flume has been installed downstream of the Frederick Springs area with data displayed on the World Wide Web.

The PRMS model has been nearly converted (90 percent) to the Modular Modeling System to allow inclusion of local infiltration and head flux algorithms.

The Water-Resources Investigation Report, "Use of a watershed modeling approach to assessing the hydrologic effects of urbanization, North Fork Pheasant Branch Basin near Middleton, Wisconsin" and Fact Sheet, "Evaluating the effects of urbanization and land-use planning using ground-water and surface-water models," were published.

Assistance with geophysical logging of a monitoring well near the Springs was given to the Wisconsin Geological and Natural History Survey.

Assistance with drilling of monitoring wells near the study subdivision was given to the Wisconsin Geologic and Natural History Survey. Equipment for monitoring the site was installed.

PLANS (July 2002 to June 2003)

The conversion of the PRMS surface-water model to the Modular Modeling System will be completed and modules for the local infiltration and head flux algorithms will be written. The ground-water-flow model will be modified to include the insight gained from the new geochemical hydrologic data.

Support will be given to the larger Pheasant Branch project conducted by the Wisconsin Department of Natural Resources, the University of Wisconsin–Madison, and the Wisconsin Geological and Natural History Survey. The work includes well installation and instrumentation in a study subdivision and chemical and isotope analyses for water samples collected during the study.

REPORTS

Hunt, R.J., and Steuer, J.J., 2000, Simulation of the recharge area for Frederick Springs, Dane County, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 00–4172, 33 p.

Hunt, R.J., Steuer, J.J., Mansor, M.T.C., and Bullen, T.D., 2001, Delineating a recharge area for a spring using numerical modeling, Monte Carlo techniques, and geochemical investigation: Ground Water, v. 39, no. 5, p. 702–712.

Steuer, J.J., and Hunt, R.J., 2001, Use of a watershed-modeling approach to assess hydrologic effects of urbanization, North Fork Pheasant Branch Basin near Middleton, Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 01–4113, 49 p.

Hunt, R.J., and Steuer, J.J., 2001, Evaluating the effects of urbanization and land-use planning using ground-water and surface-water models: U.S. Geological Survey Fact Sheet FS–102–01, 4 p.

REGIONAL HYDROGEOLOGIC STUDY OF LA CROSSE COUNTY

PROBLEM

Ground water is the sole source of residential water supply in La Crosse County. Away from river valleys and the major population centers, bedrock aquifers are used for water supply. Approximately 75 percent of the residents are served by municipal water systems located along the Mississippi or Black Rivers (for example, La Crosse, Onalaska, and West Salem), which withdraw ground water from an alluvial aquifer. The alluvial aquifer is susceptible to contamination because of its proximity to the surface and lack of an areally extensive protective confining unit. Presently, there are over 120 ground-water contamination sites in La Crosse County, mostly in the vicinity of the cities of La Crosse and Onalaska. Knowledge of the regional ground-water system is needed in order to understand the sources of ground water for both the bedrock and alluvial fill aquifers.

OBJECTIVE

The purpose of the study is to understand and characterize the regional ground-water-flow system, as well as the local water resources around population centers. Specific objectives are as follows: collect, compile and analyze data to characterize the regional ground-water-flow system and form a conceptual hydrogeologic model; quantitatively identify the zone of contribution for each municipal ground-water supply system in the county using numerical modeling techniques; and encourage water-resource management and protection by introducing and promoting the use of study products through educational and outreach efforts in La Crosse County.

APPROACH

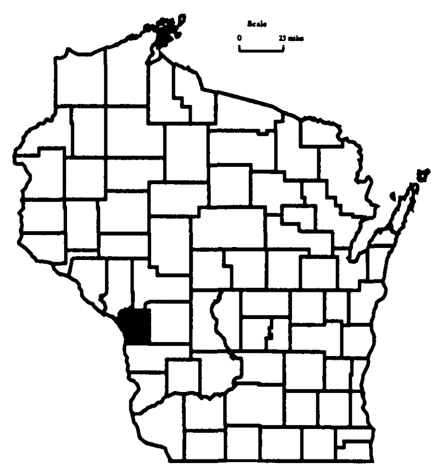
Existing information regarding the spatial distribution and hydraulic properties of hydrogeologic units and water-use data will be compiled. A database will be constructed so that data are accessible to staff working on the study as well as staff from interested state and local agencies. A three-dimensional model will be developed based on conceptual and initial analytic element screening models. Additional field data will be collected in areas requiring better definition or resolution of hydraulic parameters or to provide more complete coverage of water levels or streamflows. The model will be calibrated by comparing simulated ground-water levels and streamflows to measured. Zone of contributions for the 68 municipal supply wells within the county will be delineated using particle tracking and selected management scenarios will be simulated.

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
La Crosse County

PROJECT CHIEF:
Randy J. Hunt

PERIOD OF PROJECT:
July 2000 to October 2002



PROGRESS (July 2001 to June 2002)

Ground-water-level, streamflow, and precipitation data collection has continued. A deep observation well has been drilled and undergone geophysical and hydrologic testing in conjunction with the Wisconsin Geological and Natural History Survey. A three-dimensional MODFLOW model has been extracted from the analytic element model and calibrated to the ground-water-level data and streamflow data.

PLANS (July 2002 to June 2003)

A Water-Resources Investigations Report will be published describing the model construction and results.

SUSCEPTIBILITY OF LA CROSSE MUNICIPAL WELLS TO ENTERIC VIRUS CONTAMINATION FROM SURFACE WATER CONTRIBUTIONS

PROBLEM

Viruses derived from surface water are potential contaminants because they can move readily through the soil profile due to their extremely small size and negative charge at typical soil pH levels. Data on the extent and temporal nature of virus contamination of water-supply wells are limited because the techniques are expensive and specialized.

OBJECTIVE

Project objectives are: (A) document the presence of viruses in water-supply wells that have varying amounts of surface-water components, (B) assess the temporal nature of virus occurrence, (C) quantify the amount of surface water present in the well discharge and determine the time of travel, and (D) relate C to A and B.

APPROACH

Particle-tracking identified three classes of water-supply wells: (1) those that are expected to have high surface water contributions, (2) those that have intermediate surface water contributions, and (3) those that are expected to have little or no surface water contributions. The sampling includes a surface water source, two wells of the first class of wells, and one well in each of the latter two classes, for a total of five samples per sampling period. Because of the transient nature of virus occurrence, the sites will be sampled frequently over time (12 times per year). Biological analyses will include reverse transcription—polymerase chain reaction (RT-PCR) for detecting human enteric viruses and analyses for microbiological indicators of water sanitary quality. In addition, water analyses will include water isotopes ($^{18}O/^{16}O$, $^{2}H/^{1}H$) to identify amounts of surface water, and water tracers to date the age of the water.

PROGRESS (March 2001 to June 2002)

Samples have been collected monthly since March 2001. Virus and indicator analyses are on going. Water isotope sampling indicates detectable surface water contribution in two of the four wells. Two additional monitoring wells were installed between the surface water source and these municipal wells to collect water samples specific to the surface water source rather than a bulk average of all the flowlines that enter the well. The new wells were sampled for water isotopes, viruses, and age-dating using CFCs and ^{3}H-^{3}He. In addition to continuing monthly virus, indicator, and water isotope sampling until February 2002, methodology for improving the virus test sensitivity are being performed.

PLANS (March 2002 to June 2002)

Analyses will be completed and a report written detailing the findings of the work.

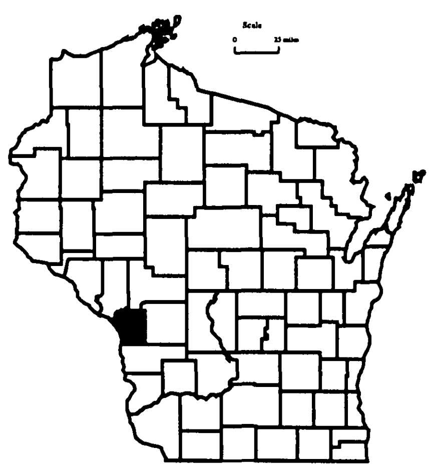
COOPERATOR:
U.S. Geological Survey and
Marshfield Medical Research Foundation

LOCATION:
La Crosse County

FUNDING AGENCY:
Wisconsin Department of Natural Resources
Groundwater Management Practice
Monitoring Program

PROJECT CHIEF:
Randy J. Hunt

PERIOD OF PROJECT:
March 2001 to June 2002



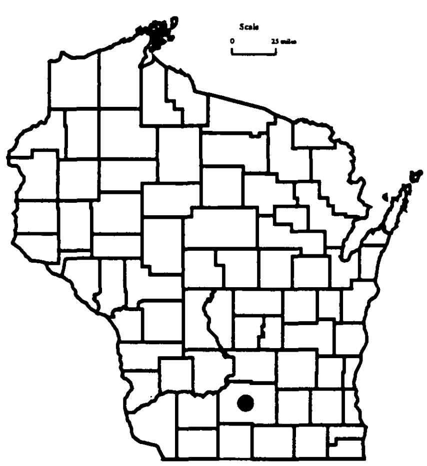
MONITORING CONTAMINANT FLUX FROM A STORMWATER INFILTRATION FACILITY TO GROUND WATER

COOPERATOR:
Wisconsin Department of Natural Resources

LOCATION:
Dane County

PROJECT CHIEF:
Charles Dunning

PERIOD OF PROJECT:
July 2001 to July 2003



PROBLEM

Wisconsin is in the process of finalizing administrative code NR 151 which will in part define performance standards for infiltration of stormwater from new development. The stormwater infiltration standards are intended to preserve ground-water recharge and stream baseflow. However, depending on the characteristics of a drainage area, infiltration of stormwater may introduce significant amounts of contaminants to ground water including hydrocarbons, pesticides, bacteria, and chloride. Because of the impending performance standards for infiltration, it is imperative to quantify the relation between quality of infiltrated stormwater and the flux of contaminants to the ground-water system.

OBJECTIVE

The objective of the proposed study is to quantify through field data the relation between the quality of infiltrated stormwater and the flux of contaminants through the unsaturated zone to ground water.

APPROACH

Following preliminary investigation at sites in central Dane County, it has been decided to focus on two sites in the city of Middleton. One site is an infiltration basin that serves Stonefield, a residential neighborhood, and has been in place for about 10 years. The other is an infiltration trench installed next to a new parking lot that is a part of the expansion of the Middleton High School. At these two sites, a small diameter water-table monitoring well will be installed to observe the specific relation between stormflow events and the elevation of the water table. The use of an equilibrium-tension lysimeter at these sites has been abandoned in favor of porous cup suction lysimeters, because of the need to be able to change the vertical location of sampling points in response to insight gained as the project progresses. During installation of monitoring wells we expect to characterize the soil and moisture profiles of each site. This information will be used in choosing initial installation points for lysimeters in the vadose zone. The disadvantage of the new approach is that it will be more difficult to infer with precision the hydraulic balance of stormflow infiltration and/or mass-balance of contaminants than would have been possible with the equilibrium-tension lysimeter. Monitoring and sampling of lysimeter leachate, stormwater and ground water will be carried out using a combination of automated and manual means. Data gathered over the course of this study will be compiled and interpreted to characterize the flux of infiltrated contaminants to ground water. The relation between stormwater quality and contaminant flux will be evaluated.

PROGRESS (July 2001 to June 2002)

Soil borings have been conducted to the water table at both sites. Pressure transducers have been installed to monitor ground-water levels. Pressure transducers have been installed to monitor water levels of stormwater events at the infiltration pond and infiltration trench. Porous cup suction lysimeters have been installed. Hydrologic monitoring and water-quality analyses of stormwater events is underway.

PLANS (July 2002 to June 2003)

During selected stormwater events water-quality samples will be taken of the stormwater, leachate from the unsaturated zone, and water table. Initial water-quality samples will serve to check the integrity of the lysimeters and well points, and provide a measure of initial contaminant concentrations. Water-quality sampling may be conducted at regular time intervals, in response to an infiltration event, or in both instances. Data will be compiled, interpreted, and

APPENDIXES A–B

APPENDIX A
PROPOSED PROGRAM FOR THE PERIOD 7/1/02-6/30/03
USGS/Wisconsin Department of Natural Resources Cooperative Program

STREAMFLOW FOR HYDROPOWER DATA

Wisconsin Electric Power Company (WEPCO) funds two stations at a cost of $11,000. Complete records are collected at nine stations and partial records at one station for the Wisconsin Valley Improvement Company (WVIC); total cost of the WVIC program is $52,300. Partial records are collected at five of the ten Northern States Power Company stations; total cost of Northern States Power Company program is $42,340. Wisconsin Public Service funds one station at a cost of $5,500.

		Record began (water year)	Funds provided to WDNR
04027500	1/ White River near Ashland	1948	$3,520
04029990	1/ Montreal River at Saxon Falls	1987	3,520
04064500	2/ Pine River below Pine River powerplant near Florence	1924–76, 1996	5,500
04066003	2/ Menominee River near Pembine	1950	5,500
04067958	4/ Peshtigo River near Wabeno	1998	5,500
05332500	1/ Namekagon River near Trego	1928-70, 1987	3,520
05340500	1/ St. Croix River at St. Croix Falls	1902	3,520
05341500	1/ Apple River near Somerset	1901–70, 1987	3,520
05356000	1/ Chippewa River at Bishops Bridge near Winter	1912	5,500
05356500	1/ Chippewa River near Bruce	1914	5,500
05360500	1/ Flambeau River near Bruce	1951	2,740
05365500	1/ Chippewa River at Chippewa Falls	1888–1983, 1987	5,500
05369000	1/ Red Cedar River at Menomonie	1913	5,500
05391000	3/ Wisconsin River near Lake Tomahawk	1936	5,500
05393500	3/ Spirit River at Spirit Falls	1942	5,500
05394500	3/ Prairie River near Merrill	1914–31, 1939	5,500
05395000	3/ Wisconsin River at Merrill	1903	5,500
05397500	3/ Eau Claire River near Kelly	1914–27, 1939	5,500
05398000	3/ Wisconsin River at Rothschild	1945	5,500
05399500	3/ Big Eau Pleine River near Stratford	1914	5,250
05400760	3/ Wisconsin River at Wisconsin Rapids	1914	2,800
05402000	3/ Yellow River at Babcock	1944	5,500
05404000	3/ Wisconsin River near Wisconsin Dells	1935	5,500
			$111,140

1/ WDNR cooperates with Northern States Power Company
2/ WDNR cooperates with Wisconsin Electric Power Company
3/ WDNR cooperates with Wisconsin Valley Improvement Company
4/ WDNR cooperates with Wisconsin Public Service

WDNR STREAMFLOW MONITORING PROGRAM

		Cost
04024430	Nemadji River near South Superior	$5,500
04067500	Menominee River near McAllister	5,500
04071765	Oconto River near Oconto	5,500
04085200	Kewaunee River near Kewaunee	5,500
04085395	South Branch Manitowoc River at Hayton	5,500
04085427	Manitowoc River at Manitowoc	5,500
04086000	Sheboygan River at Sheboygan	5,500
04086500	Cedar Creek near Cedarburg	5,500
05401050	Tenmile Creek near Nekoosa	5,500
05383075	La Crosse River near La Crosse	5,500
TOTAL		$55,000

OTHER MONITORING

05404500	Devil's Lake near Baraboo (stage and precipitation data)	2,150
04084500	Fox River at Rapide Croche Dam near Wrightstown (WDNR cooperates with Lower Fox River Dischargers' Association)	2,500
TOTAL		$4,650

APPENDIX B

WDNR-USGS FUNDING FOR 2001-2002 AND PROPOSED FUNDING FOR 2002-2003

Project Information	2001-2002 DNR Share	Proposed Program 2002-2003 DNR Share	Proposed Program 2002-2003 USGS Share	Proposed Program 2002-2003 Total	Remarks
Streamflow-Hydropower					DNR receives funding from power companies as listed
WI-001					
Waschbusch/Sullivan					
Wis Public Service Corp	$ 5,250	$ 5,500	$ 4,950	**$ 10,450**	
Northern States Power	$ 40,375	$ 42,340	$ 38,180	**$ 80,520**	
Wis Valley Improvement	$ 49,900	$ 52,300	$ 47,070	**$ 99,370**	
Wis Electric Power	$ 10,500	$ 11,000	$ 9,900	**$ 20,900**	
Sub Total	**$ 106,025**	**$ 111,140**	**$ 100,100**	**$ 211,240**	
CBR-Rivers					
WI-001					
Cedar Cr nr Cedarburg	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
S Br Manitowoc @ Hayton	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Steuer/Velleux					
Tenmile Cr nr Nekoosa	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Garn/Zimmerman					
Sheboygan R @Sheboygan	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
Kewaunee R nr Kewaunee	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
Manitowoc R @ Manitowoc	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
Menominee R nr McAllister	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
Oconto R nr Oconto	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
La C+A32rosse R nr LaCros:	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
Nemadji R nr Superior	$ 5,250	$ 5,500	$ 4,950	$ 10,450	
Waschbusch/Jaeger					
Sub Total	**$ 52,500**	**$ 55,000**	**$ 49,500**	**$ 104,500**	
Other Monitoring					
WI-001					
Wrightstown Gage(LFDRA)	$ 2,400	$ 2,500	$ 2,100	$ 4,600	
Waschbusch/Jaeger					
Devils Lake	$ 2,050	$ 2,150	$ 2,150	$ 4,300	
Waschbusch/Evans					
East R in Green Bay	$ 8,060	0	0	0	
Garn/Reyburn					
Rock R @ Horicon	$ 4,100	0	0	0	Funded thru Nov 2002 by Sinissippi Lake
Garn/Condgon					
Yahara R nr Hwy 13 Bridge	$ 16,800	$ 9,100	$ 6,100	$ 15,200	
Garn/Johnson					
Fennimore Fk @ Castle Rk	$ 6,000	$ 6,270	$ 4,180	$ 10,450	
Garn/Jaeger					
Mill Cr Monitoring	$ 30,000	0	0	0	
Waschbusch/Jaeger					
Sub Total	**$ 69,410**	**$ 20,020**	**$ 14,530**	$ 34,550	
Nonpoint Program(WI-172xx)					Planned to continue - cost not determined
Evaluation Monitoring(02)	$ 42,600			$ -	
Corsi/Bannerman					
Phosphorus Lds Lawns(14)	$ 20,700			$ -	
Stuntebeck/Bannerman					
Discovery Farms(39)	$ 58,500			$ -	
Stuntebeck/Bannerman					
Nutrient Impacts Strms(23)	$ 128,700			$ -	
Graczyk/Bannerman					
Rotational Grazing(29)	$ 15,200			$ -	
Graczyk/Bannerman					
Low Impact Develop(33)	$ 40,900			$ -	
Selbig/Bannerman					
Riparian Buffer(13)	$ 23,900			$ -	
Horwatich/Bannerman					
Calibration of SLAMM(19)	$ 10,800			$ -	
Horwatich/Bannerman					
Test of Pressurized Flt(08)	$ 26,600			$ -	
Horwatich/Bannerman					
Urban Stream Toxicity(16)	$ 12,000			$ -	
Corsi/Bannerman					
Madison St Sweep Test(37)	$ 22,100			$ -	
Selbig/Bannerman					
Vortechnics Test(07)	$ 10,500				
Horwatich/Bannerman					
Sub Total	**$ 412,500**	$ -	$ -	$ -	

APPENDIX B
WDNR-USGS FUNDING FOR 2001-2002 AND PROPOSED FUNDING FOR 2002-2003

	2001-2002	Proposed Program 2002-2003			
Project Information	DNR Share	DNR Share	USGS Share	Total	Remarks
Crandon WI-00201 Krohelski/Tans	$ 70,000	$ 50,000	$ -	$ 50,000	
Water Use Data WI-00700 Ellefson	$ 75,000	$ 75,000	$ 75,000	$ 150,000	DNR share in form of Direct State Services
Fox River PCB WI-145 Steuer/Hill	0	$ -	$ -	$ -	Work scheduled to begin in June Cost not determined
Dead Pike Lake WI-17309 Rose/Knauer	$ 2,000	0	0	0	
Lake St Croix Model WI-17319 Robertson/Sorgee	$ 25,000	0	0	0	
Lincoln Creek PCB WI-19101 Hughes/Westenbrook	$ 18,500	$ 15,000	$ 6,000	$ 21,000	
Fish Cr Vanes WI-19300 Fitzpatrick/Walz,Shea	$ 15,915	$ 23,385	$ 15,590	$ 38,975	
Prototype Database System WI-21005 House/Nate,Westenbrook	$ 272,000	$ 15,800		$ 15,800	Funds for period 7/1/02-9/30/02 Cost for period 10/1/02-6/30/03 not yet determined
Riparian Vegetative Zones WI-21800 Graczyk,Hunt/Greb,Knauer	$ 55,200	$ 26,400	$ 17,600	$ 44,000	
Urban Microorganism WI-22300 Corsi/Greb	$ 33,000	$ 7,000	$ 7,000	$ 14,000	
Hayton Milpond WI-19102 Steuer/Liebenstein	$ 13,000			$ -	Planned to continue - cost not determined
Ruck Pond WI-19100 Steuer/Walz	$ 3,000	0	0	0	
Total Main Agreement	**$ 1,223,050**	**$ 398,745**	**$ 285,320**	**$ 684,065**	
Stand Alone Agreements					
Phreflow Software WI-00205 Hunt/Helmuth	$ 2,500	0	0	0	
Pheasant Branch Model WI-20203 Hunt/Lathrop	$ 55,000	$ 20,000	$ 20,000	$ 40,000	FY03 funding part of Agreement for period 7/1/2000-12/312002
LaCrosse Co GW WI-21900 Hunt/McLimans	$ 75,000	$ 20,750	$ 20,750	$ 41,500	FY03 finding part of agreement for period 7/1/2000-10/31/2002
LaCrosse Co GW Virus WI-21901 Hunt/McLimans	$ 39,333	0	0	0	
Stormwater Infiltration WI-17238 Dunning/McClimans	$ 22,600	$ 19,250	$ 19,250	$ 38,500	DNR will transfer an additional $15,750 to SLOH
Total Stand Alones	**$ 194,433**	**$ 60,000**	**$ 60,000**	**$ 120,000**	
Total All Agreements	**$ 1,417,483**	**$ 458,745**	**$ 345,320**	**$ 804,065**	

A Summary of Cooperative Water Resources Investigations in Wisconsin, 2002