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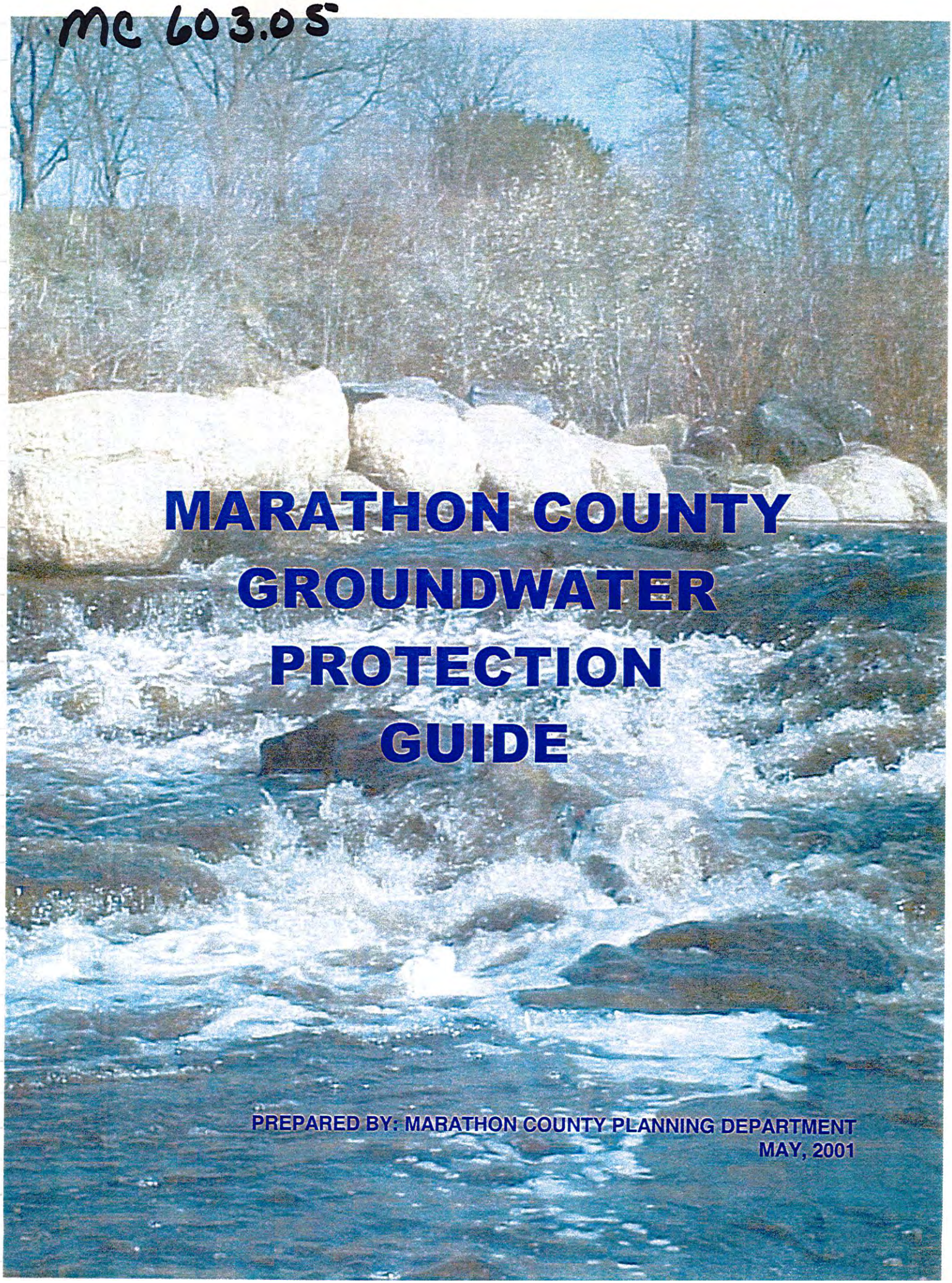

MARATHON COUNTY GROUNDWATER PROTECTION GUIDE

PREPARED BY: MARATHON COUNTY PLANNING DEPARTMENT

MAY, 2001

COUNTY OF MARATHON

500 FOREST STREET WAUSAU, WISCONSIN 54403-5568

COUNTY CLERK
NAN KOTTKE
(715) 261-1500
FAX (715) 261-1515

May 16, 2001

Ed Hammer
Planning Director
210 River Drive
Wausau, WI 54403

Dear Ed:

Enclosed is a certified copy of Marathon County Resolution #R-32-01, approving the 2001 Marathon County Groundwater Protection Guide.

This resolution was adopted by the Marathon County Board of Supervisors at their Adjourned Organizational meeting which was held May 15, 2001.

Yours truly,

Nan

Nan Kottke
Marathon County Clerk

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MARATHON COUNTY
2001 GROUNDWATER PROTECTION GUIDE

Prepared for:

Marathon County Executive Committee and
Marathon County Board of Supervisors

MARATHON COUNTY
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Marathon County Hazardous Waste Facility
Marathon County Health Department
Marathon County Land Conservation Department
Marathon County Solid Waste Department
Marathon County Zoning Department
University of Wisconsin Extension - Marathon County
Wausau Water Utility
Wisconsin Department of Natural Resources
Wisconsin Department of Commerce
Wisconsin Department of Agriculture, Trade and Consumer Protection

Cover Photograph by Michele Parara, Marathon County Planning Department

Resolution # R-_32_-01

A JOINT RESOLUTION APPROVING
THE 2001 MARATHON COUNTY GROUNDWATER PROTECTION GUIDE

WHEREAS, the County Board of Supervisors of the County of Marathon created the Environmental Resources Committee whose responsibility is to "...review and monitor land use activity by towns, villages, cities, and private entities, and . . . review and recommend land use policies to the County Board, including but not limited to groundwater, transportation, population, demographic and census related issues, growth and development, and development issues related to the State of Wisconsin "Smart Growth" initiative;" and

WHEREAS, the Environmental Resources Committee of the County Board of Supervisors of the County of Marathon received, reviewed and recommended approval of the *2001 Marathon County Groundwater Protection Guide*; and

WHEREAS, the Executive Committee of the County Board of Supervisors of the County of Marathon received, reviewed and recommended approval of the *2001 Marathon County Groundwater Protection Guide.*

NOW, THEREFORE the County Board of Supervisors of the County of Marathon does hereby ordain and resolve as follows: to approve the attached *2001 Marathon County Groundwater Protection Guide.*

Dated this 15th day of May, 2001

ENVIRONMENTAL RESOURCE COMMITTEE

EXECUTIVE COMMITTEE

Fiscal Impact: None. Passage of this resolution does not commit expenditure of any funds.

F:\document1\m15groundwater

STATE OF WISCONSIN)
)SS.
COUNTY OF MARATHON)

I, Nan Kottke, County Clerk in and for Marathon County, Wisconsin, hereby certify that the attached Resolution #R-32-01 was adopted by the Marathon County Board of Supervisors at their Adjourned Organizational meeting which was held May 15, 2001.

Nan Kottke

SEAL

Nan Kottke
Marathon County Clerk

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INTRODUCTION
AND
RECOMMENDATIONS

INTRODUCTION

In January 1988, Marathon County called attention to the need to protect groundwater in Marathon County by adopting the Marathon County Groundwater Plan. The 1988 Groundwater Plan not only served to bring attention to groundwater protection, but also proposed specific recommendations that County departments could implement to safeguard this resource. The purpose of the 2001 Groundwater Protection Guide is to continue the efforts of the 1988 plan and ensure that groundwater protection remains a priority in Marathon County as we move into the twenty-first century.

This groundwater protection guide is intended for use by local and County elected officials, technical and professional staff, and interested citizens. Elected officials should use the information and recommendations within for setting policy on a variety of groundwater concerns. Staff personnel can utilize this information to better understand and communicate the complicated interrelationships between groundwater, the physical environment, and human land use activities. Interested citizens can use this information to take measures to protect their groundwater resources, just as a local government would to protect groundwater within their jurisdiction.

Like its predecessor, this resource guide discusses and characterizes the landscape (geology and soils) in which our groundwater exists, the current patterns of groundwater use by the community, and contamination sources that potentially impact the quality of the groundwater resource. Furthermore, the guide provides strategies and information on groundwater protection techniques.

The original 1988 Groundwater Plan Recommendations are evaluated to show the County its accomplishments in relation to groundwater protection over the past thirteen years and also address issues and areas where work is still needed.

The Marathon County Environmental Resources Committee is the guardian of this Groundwater Protection Guide. The Committee will be responsible for monitoring the efforts that are proposed in this guide, as well as evaluating the funding expenditures and programs required by the guide.

We believe that all recommendations contained in this groundwater protection guide, if adopted, will greatly decrease the potential for further groundwater contamination and subsequently increase the County's potential for growth, economic development, and maintenance of a high quality environment.

We ask for the County's utmost consideration on this groundwater protection guide and recommendations.

THE ENVIRONMENTAL RESOURCES COMMITTEE

GROUNDWATER RECOMMENDATIONS FOR MARATHON COUNTY

Introduction: In 1988, Marathon County introduced the Groundwater Plan with 19 specific recommendations. The following section evaluates the current status of the recommendations and, where appropriate, suggests future actions along with identifying responsibility for implementation.

The original 1988 Recommendation numbers are shown in parentheses.

1. HAZARDOUS WASTE ISSUES

A. 1988 Recommendation:

(1) Because of the enthusiastic response and the benefit to the County, "Operation Clean Sweep" efforts such as those carried out in September 1985, 1986, and 1987 are to be continued in Marathon County to prevent groundwater contamination from improper storage and disposal of hazardous wastes. Department of Natural Resources (DNR) should aid local government in any way possible to repeat this service periodically. (Solid Waste, University of Wisconsin Extension (UWEX), Health)

(10b) Create ½ time position in the Health Department for Groundwater/Hazardous Material Coordinator, commencing in 1989.

Current Status:

With the enthusiastic response and the benefits to the County created by the "Operation Clean Sweep" efforts of the mid-1980's, the 1988 Groundwater Plan recommended that similar efforts be continued in Marathon County to prevent groundwater contamination from improper storage and disposal of hazardous wastes. Due to high costs, in 1992 "Operation Clean Sweep" was changed from a yearly program to one that occurs every 16 to 20 months. In 1992 and 1995, Marathon County completed Agricultural Clean Sweeps sponsored by the Wisconsin Department of Agriculture and Consumer Protection.

Through these efforts, the County created a full time Hazardous Waste Coordinator position within the Health Department in 1992. In 1997, this position began overseeing the maintenance and operation of the newly created Marathon County Hazardous Waste Collection Facility. This position also maintains the coordination activities necessary for community outreach services pertaining to hazardous waste.

The Marathon County Hazardous Waste Facility now coordinates and collects household, agricultural, and Very Small Quantity Generator (VSQG's) hazardous waste. In addition to the "normal" hazardous materials that have been traditionally collected, a battery-recycling program has been started and a computer-recycling program is currently being developed.

Recommendation:

The County should continue to help fund this program to ensure that its residents and area businesses have a safe place to dispose of their hazardous waste and decrease the risk of groundwater contamination.

Responsible Department/Agency:

Marathon County Health Department

B. 1988 Recommendation:

(18) *Municipal governmental units within Marathon County will inventory all purchased stock items for the purpose of identifying hazardous and toxic materials. (Emergency Government and Health Department)*

Current Status:

Currently, with Administrative Code NR600, the Department of Natural Resources regulates the proper handling, storage, and disposal of hazardous wastes. Any large capacity business or enterprise that generates 2,200 pounds or more of an identified hazardous waste per month needs to obtain an EPA Identification Number so that waste type, estimated volumes, and handling protocol are inventoried and trackable.

Additionally, through the work of Office of Emergency Management and the Local Emergency Planning Committee (LEPC) all businesses, industries and municipalities must submit a "Local Emergency Plan" where types and volumes of potential releases of toxins to the environment are evaluated and emergency planning outlined.

Recommendation:

Continue program activity.

Responsible Department:

Marathon County Office of Emergency Management

C. 1988 Recommendation:

(15) *Establish a licensed hauler's transportation network to collect all hazardous waste.*

Current Status:

The Wisconsin Department of Natural Resources and Department of Transportation regulate the transport of all hazardous waste within the state. Specifically, all haulers of hazardous waste must obtain a state license to conduct business. All reporting and documentation protocol are monitored by the state departments.

Recommendation:

Marathon County needs no action.

Responsible Department:

Not applicable.

2. EDUCATIONAL ISSUES

A. 1988 Recommendation:

(3b) *The Marathon County UWEX will continue to educate growers in proper pesticide management practices pertaining to groundwater protection. (UWEX)*

Current Status:

Marathon County's UW-Extension staff provides approximately five to eight educational workshops and training sessions to nearly 175 to 250 pesticide applicators annually. The educational courses provide certification requirements and continuing educational credits for interested people. The course provides information relative to current pesticide laws and regulations that minimize dangers to both humans that use chemicals and to environmental resources such as surface and ground waters. Furthermore, course work addresses proper storage, loading, mixing, and emergency planning to minimize environmental releases.

Recommendation:

Continue program activity.

Responsible Department:

Marathon County UW-Extension

B. 1988 Recommendation:

(9) *Groundwater and hazardous waste education efforts are one of the most important long-term, cost-effective measures against contamination incidents. A formal groundwater education PLAN will be developed by Marathon County University of Wisconsin Extension and the Marathon County Health Department with help from all other affected County and Municipal Departments including school districts and VTAE districts. These educational efforts should be undertaken for the following groups: civic organizations, youth groups, rural residents, local government officials, school students, general public and farmers.*

(16) *Encourage the Department of Public Instruction to supply funds and guidance for curriculum revisions and education programs to raise awareness and understanding of groundwater systems and problems. (Groundwater Staff and/or Committee)*

Current Status:

In 1985, the Health Department developed educational models and manuals for use by teachers in grades K-12. These are still in use today. In 1997, the Health Department and UW-Extension established a Water Education Resource Center in the Marathon County Public Library Headquarters-Wausau. The Center provides water test kits, teacher manuals, watershed/hazardous waste models, groundwater models, and a myriad of water-related publications. In 2000, the community-based groundwater education project affiliated with the National Groundwater Guardian Program. The City of Wausau, Marathon County Health Department and three school districts have established a partnership to provide groundwater awareness throughout the County. Currently, this educational effort

is financially supported with a $1,600 annual allocation through a special Administrative Fund.

Recommendation:

Continue the support of the Water Education Resource Center with targeted outreach to civic organizations, youth groups, rural residents, local government officials, school students, the general public and farmers. Furthermore, maintain financial support to keep the Center current as well as to promote this source of information to interested groups and individuals.

Responsible Department:

Marathon County Health Department

C. 1988 Recommendation:

(8) *Snow from snow removal operations in communities located along the Wisconsin River is to be disposed of adjacent to appropriate surface water per DNR policy. The impact of the many pollutants contained in urban snow is less significant on appropriate receiving streams due to their flow and assimilative capacity than it would be if accumulated at snow storage sites and allowed to seep into groundwater. Municipalities should also consider reducing the use of road salt whenever possible. (Municipal and County Highway Departments)*

Current Status:

Currently, the Wisconsin Department of Natural Resources is very active in educational efforts to inform communities, municipalities, and citizens about the potential pollutants associated with snow disposal activities. Although no formal regulations address snow piling, the DNR, through its policy of assisting communities, will monitor issues relative to snow piling as it pertains to sediment delivery, trash content, and other substances that sometimes mix with the snow to assure that environmental releases do not occur or impact groundwater and surface waters.

Recommendation:

No County action required.

Responsible Department:

Not applicable.

3. REGULATORY AND LEGISLATIVE ISSUES

A. 1988 Recommendation:

(2) *Authority for Wisconsin Administrative Rule NR812, which regulates the construction and design of wells, should be transferred to County government. Rationale: The DNR*

does not have resources to administer the program. Anticipated Revenue: a $40 application - $9,000 per year. (Zoning)

Current Status:

With collaboration of Marathon County Environmental Health and Zoning Departments, the possibility to assume responsibility for limited delegation of the well code NR812 from the DNR was pursued. Upon evaluation, the County's administration of NR812 (or part of) was deemed too expensive for the residents and politically difficult to implement. Therefore, the effort to pursue the transfer of NR812 responsibilities was terminated.

Recommendation:

No action taken.

Responsible Department:

Not applicable.

B. 1988 Recommendation:

(4) *Marathon County municipal water supplies are to be protected by well protection ordinances such as the model developed by the Marathon County Planning Department for the Town of Rib Mountain Sanitary District. The Marathon County Board of Supervisors and municipal governments should advocate passage of well protection ordinances wherever feasible. This effort should include 3-10 test wells and water samples per site to help define the recharge area. (Health Department, Planning, Zoning, Local Government, UWEX) Cost partially funded by municipality.*

Current Status:

To date only eight of the 15 municipalities that operate municipal water supply systems in the County have adopted Wellhead Protection. It would be advantageous for the County to encourage and assist the remaining municipalities to establish Wellhead Protection ordinances for the purpose of protecting their groundwater resources.

Additionally, since April 1992 all newly developed municipal water supplies must develop a "Wellhead Protection Program" for that system. A component of the Program is an ordinance to protect the wellhead.

The "*Wellhead Protection Overlay District (Zoning Code 17.59)*" was adopted as part of the General Code of Ordinances for Marathon County Chapter 17 Zoning Code. Its purpose is to institute land use regulations to protect the municipal water supplies, and to promote the public health, safety and general welfare of the residents of Marathon County. This ordinance has not been applied to any wellhead to date.

Recommendation:

Maintain program efforts that provide communities with municipal water systems, with zoning and ordinance strategies that protect wellhead recharge.

Responsible Department:

Marathon County Zoning Department

C. 1988 Recommendation:

(13a) *The County Board of Supervisors, at the recommendation of the Groundwater Advisory Committee, should consider developing codes to establish state enabling legislation to permit local government to develop restrictive land use zoning districts within the at-risk area of any existing or abandoned landfill. (Groundwater Committee and Staff)*

Current Status:

No action at state or local level has been successful in establishing legislation to restrictively zone landfill districts. The only restrictive use pertinent to active or inactive landfills is relative to placement of wells which must be 1200 feet or greater away from such landfills. Any wells seeking closer placement must receive a variance from the DNR.

Recommendation:

None pursued.

Responsible Department:

Not applicable.

D. 1988 Recommendation:

(13b) *The County Board of Supervisors, at the recommendation of the Groundwater Advisory Committee, should consider developing codes to require permits and proper reclamation of all nonmetallic mining operations in the County. Revenue should approximate cost. (Note: requires zoning adoption of Reclamation Ordinance.)*

Current Status:

The Zoning Department monitors the development and reclamation of all non-metallic mining operations in Marathon County. A complete description of the regulation is located in Chapter 21 of the Marathon County Code of Ordinances.

Recommendation:

Maintain Zoning Program Implementation

Responsible Department:

Marathon County Zoning Department

E. 1988 Recommendation:

(13c) *The County Board of Supervisors, at the recommendation of the Groundwater Advisory Committee, should consider developing codes to transfer the responsibility for the regulation of private septic and holding tank disposal under administrative rule NR113 from the Department of Natural Resources to Marathon County. This would require the creation of a ½ time position in the County Zoning office, possibly combined with ½ time position listed under 13B. (Zoning)*

Current Status:

No action has been taken on this recommendation to date. According to Zoning Department personnel, a half time position would still be needed if the WDNR transferred the above responsibilities to Marathon County. Additionally, the Zoning Department provides annual training and educational programs to plumbers, septic haulers, pumpers, and soil testers relative to COMM83 and department protocol. Finally, educational information is supplied to "farmer exempt" participants to minimize water resource impacts as well as health impacts.

Recommendation:

Continue educational programming. The ½ person will not be pursued without increased WDNR interest.

Responsible Department:

Marathon County Zoning Department

F. 1988 Recommendation:

(13d) *The County Board of Supervisors, at the recommendation of the Groundwater Advisory Committee, should consider developing codes to support the inventory, permitting, monitoring and abandonment of all underground storage tanks in the County. Prohibit installation of new private underground gasoline storage tanks in critical groundwater recharge areas. (Health Dept., County and Local Boards, DILHR, DNR)*

Current Status:

Through COMM10, administered by the Wisconsin Department of Commerce, all above ground and underground tanks, in-use and out-of-service, must be registered with out-of-service tanks requiring removal. The only exception to this registration is 1) above ground tanks ≤110 gallons, 2) farm and residential above-ground tanks ≤1100 gallons, and 3) heating fuel tanks for consumptive use. COMM10 also regulates installation, abandonment protocol and certification requirements. Finally, the Department of Commerce maintains an Internet accessible database of information relative to tank and registration for the public.

Recommendation:

No action required.

Responsible Department:

Not applicable.

G. 1988 Recommendation:

(13e) *The County Board of Supervisors, at the recommendation of the Groundwater Advisory Committee, should consider developing codes to use state inventories and regulations of salt storage areas to determine if any problems exist and if additional County action is necessary. (DOT, DNR, Planning, Health)*

Current Status:

The DNR and DOT require salt storage areas to be covered to minimize off site runoff and chloride migration. Furthermore, salt storage facilities must maintain specific distances from nearby wells.

Recommendation:

No action required.

Responsible Department:

Not applicable.

4. "GIS AND SMART GROWTH SUPPORT" (DATABASES AND MONITORING) ISSUES

A. 1988 Recommendation:

(5) *Marathon County and its local units of government should continue to request assistance from Wisconsin Geologic and Natural History Survey (WGNHS) and contribute funds to support surveys of surficial geology in the County. Those areas with known groundwater contamination problems or high sensitivity should be identified on a priority basis to assist groundwater management professionals. Partially funded by municipality. (WGNHS)*

Current Status:

Work with the Wisconsin Geological and Natural History Survey (WGNHS) continues to be "as needed." Currently, no collaboration between WGNHS and Marathon County is active. However, the Department of Natural Resources though its "Integrated Basin Plan" will be initiating research with the UW-Stevens Point Groundwater Task Group for evaluation of attenuation areas and identification of nitrate susceptibility areas in Marathon County. This work may involve updating work previously completed by WGNHS.

Recommendation:

No action required.

Responsible Department:

Not applicable.

B. 1988 Recommendation:

(6) *Records of contaminated wells should continue to be kept by the County Health Department. Documentation of contaminated wells would be based upon specifications found in NR140.1 sub chapter 2 of the State Wisconsin Administrative Code. (Health)*

(7) *Efforts should continue to locate and obtain well log information in all areas of the County so that groundwater management professionals are able to use the available surficial geology information to best advantage. (Health, DNR, Planning)*

(19a) *Support the development of a coordinated data management system between all involved offices needed to carry out above recommendations. This data management system would include hydrogeology collected as part of the NR 812 regulation and transferred from DNR to County Government.*

(19b) *This data management system would include records of contaminated wells.*

(19c) *This data management system would include creation of a database of water samples for well recharge protection zones.*

(19d) *This data management system would include a well testing log.*

(19e) *This data management system would include a well numbering system as part of the larger DNR system.*

(19f) This data management system would include any and all other information that may be valuable for groundwater protection, continual tracking of contaminated sources, cross correlation, etc.

Current Status:

Through the Department of Natural Resources and Department of Commerce efforts Internet accessible database information relative to landfills, storage tanks, well logs, leaking underground tanks, spills list, Environmental Repair Site, waste haulers, etc., is readily available. At this time, the County will continue to utilize the existing DNR databases and integrate them with Geographic Information System (GIS) efforts.

Recommendation:

Database information should be integrated with the GIS work and with the comprehensive planning efforts of the County.

Responsible Department:

Marathon County Planning Department

C. 1988 Recommendation:

(3a) *An inventory of all irrigated agriculture sites in Marathon County needs to be conducted in order to monitor any pesticide or fertilizer contamination. This inventory should include sampling of soils and water on irrigated lands. (Planning, DNR)*

Current Status:

No inventory of agricultural irrigated sites has been planned or initiated to date.

Currently, the Wisconsin Department of Agriculture, Trade and Consumer Protection administers Administrative Code DATCP29 that regulates pesticide use. The code addresses certification protocol of chemical handling and record keeping for both Restricted and General Use pesticides.

Recommendation:

No action is required.

Responsible Department:

Not applicable.

D. 1988 Recommendation:

(12) *Continue to identify failing septic systems in the areas of the County with high septic system failure rates or large numbers of obsolete systems, (i.e., critical areas) that are identified as high priority areas. (Health Department, Zoning)*

Current Status:

This program is ongoing. Zoning Department personnel continue to identify failing septic systems within Marathon County and enforce regulations that require these systems to be updated or replaced.

Recommendation:

Continue with current level of effort.

Responsible Department:

Marathon County Zoning Department

E. 1988 Recommendation:

(14) *Continue monitoring private wells around priority abandoned landfills. (Health)*

Current Status:

As of 1992, the project has identified 119 abandoned landfills and industrial dump sites. In 2000, a landfill database was constructed using DNR and Health Department data which enables all abandoned and operational landfills to be mapped using GIS. No private well monitoring is being planned and initiated by the County. However, the County does provide ongoing monitoring of both the active and abandoned landfills located at the County Landfill in Ringle.

The Department of Natural Resources will soon be initiating an assessment of closed landfills to determine if monitoring needs exist for the surrounding areas. It is anticipated that the DNR will include the County in the assessment effort and that information will be available on the Internet databases.

Recommendation:

No action, but continue WDNR program contact.

Responsible Department:

Marathon County Health Department

F. 1988 Recommendation:

(17) *The County Health Department shall continue their State Dept. of Health approved laboratory to test private water supplies and investigate drinking water problems within Marathon County.*

Current Status:

Since 1976, the Health Department lab has processed more than 4,500 private water supply samples per year. Follow ups are performed by environmental health division staff. The County Health Department Lab is certified by the Department of Agriculture, Trade and Consumer Protection (DATCP) for bacteriological testing and the WDNR for nitrate analysis. The Health Department Lab should continue to test private water supplies and investigate drinking water problems within Marathon County.

Recommendation:

Continue effort.

Responsible Department:

Marathon County Health Department

5. AGRICULTURAL ISSUES

A. 1988 Recommendation:

(11) *Objectives for the control of groundwater and surface water contamination used in the Upper Big Eau Pleine Priority Watershed Plan, should also be considered for all other watersheds in Marathon County. (Land Conservation, DNR)*

Current Status:

In 1992, watersheds were selected and funded through the Department of Natural Resources as part of the Priority Watershed Program. This program helps interested landowners protect and preserve area lakes and rivers by providing technical assistance and cost-share grants for agricultural Best Management Practices (BMPs). At that time there were three ongoing projects that the Land Conservation Department was working on: Upper Big Eau Pleine, Lower Big Eau Pleine and the Upper Yellow. Since then the Upper Big Eau Pleine has been completed and the Lower Rib River and Springbrook Creek have been added. It is estimated that the Lower Big Eau Pleine will be completed in 2002 and the Upper Yellow River in 2004. The Lower Rib River is scheduled to be complete in 2009. During 2001, the Land Conservation Department will complete a Soil and Water Resource Management Plan for the County. The Plan will identify both urban and rural resource concerns relative to soil erosion and water quality along with strategies to protect or minimize impacts.

Recommendation:

Complete Soil and Water Resource Protection Management Plan by the end of 2001. Although the large watershed approach may not be a continued strategy to prioritize activities, develop work practices to implement Best Management Practices in the County.

Responsible Department:

Marathon County Land Conservation Department

6. ORGANIZATIONAL ISSUES

A. 1988 Recommendation:

(10a) *The Marathon County Board of Supervisors should establish a permanent Committee on groundwater and hazardous materials. This Committee will address groundwater issues in the County and coordinate interdepartmental groundwater programs as well as monitor progress and economic impacts of the Plan recommendations. The Marathon County Groundwater Management Plan should be updated and revised periodically to facilitate implementation of groundwater protection recommendations and maintain inventory functions.*

Current Status:

In 1990, the Marathon County Board of Supervisors established a Groundwater Management Committee to address groundwater issues in the County. A Groundwater Technical Advisory Committee (TAC) made up of County staff was also created at this time. In 2000, the Groundwater Management Committee and its TAC were abolished and replaced with the Environmental Resources Committee. In June 2000, a TAC was created for the Environmental Resources Committee composed of County staff. The Environmental Resources Committee and its TAC are responsible for overseeing all aspects of the County's natural resources, including groundwater.

Recommendation:

The Marathon County Board of Supervisors should continue to support the protection of the County's groundwater supply through the efforts of the Environmental Resources Committee and its Environmental Resources TAC. This Committee should continue to address groundwater issues in the County and coordinate interdepartmental groundwater programs as well as monitor progress and economic impacts of the Plan recommendations. The Marathon County Groundwater Protection Guide should be updated and revised periodically to facilitate implementation of groundwater protection recommendations and maintain inventory functions.

Responsible Department:

The Marathon County Planning Department would continue its leadership role to coordinate and facilitate activity and discussion through the Environmental Resources Committee. The Technical Advisory Committee will serve as an advisory group to the Environmental Resources Committee to coordinate activity.

PART II
GROUNDWATER PROTECTION GUIDE FOR MARATHON COUNTY

INTRODUCTION AND ABSTRACT

THE NEED FOR GROUNDWATER PROTECTION

Groundwater is the major source of all water consumption in Marathon County. All public and private water supplies and most of the domestic, industrial, and agricultural supplies rely on groundwater. Annually, our County utilizes more than eleven billion gallons of groundwater to grow crops, wash clothes, and operate industries. Our lifestyles and way of life depends upon protecting and conserving both the quality and quantity of our groundwater resources.

Through local, state and federal efforts, this groundwater protection guide provides an overview of this valuable natural resource. By understanding the physical environment in which we find the groundwater, as well as the contamination sources that threaten its quality, we can develop programs and policies to protect this valuable resource.

Groundwater contamination can occur in any location at any time. Both rural and urban areas can be affected. In some ways, groundwater contamination can be viewed as an avoidable environmental tragedy, which results in the needless expenditure of millions of dollars. Luckily, most groundwater problems that have previously occurred in Marathon County have been minor contamination incidents but the threat to the groundwater could have been far worse. For example, if the pollution was caused by toxic chemicals that could not be discerned by taste or smell, nobody may have recognized the potential health threat that flowed from their faucet.

Like most people everywhere, the residents of these areas simply took their drinking water for granted and did not recognize the vulnerability of their groundwater resources. Nor were they aware that perhaps their very own actions contributed to the problem. In fact, nearly all groundwater pollution occurs by the hand of man, caused by his own actions and by his lack of understanding of groundwater principles.

Groundwater, once polluted may take decades or even centuries to be flushed of contaminants. Meanwhile, those people who drink contaminated water may, over time, suffer from a variety of health problems including malignant tumors, kidney and urinary tract disorders, leukemia or birth defects. The health costs associated with a major, long-term contamination incident can be staggering.

The need for clean groundwater is not only a health issue; it is also an economic issue. Where groundwater becomes polluted, property values drop and land may become virtually unsellable. People may relocate to new groundwater resources, perhaps to a new city or county. Business and industry may look elsewhere for expansion, or relocate their existing facilities, taking valuable jobs with them. Land once contaminated may be abandoned as a "brownfield," affecting its value and shifting the responsibility of the cleanup to the public.

This demonstrates that the cost of dealing with groundwater contamination can be great. Consequently, the only cost effective groundwater protection measures are preventive, and prevention requires advanced planning.

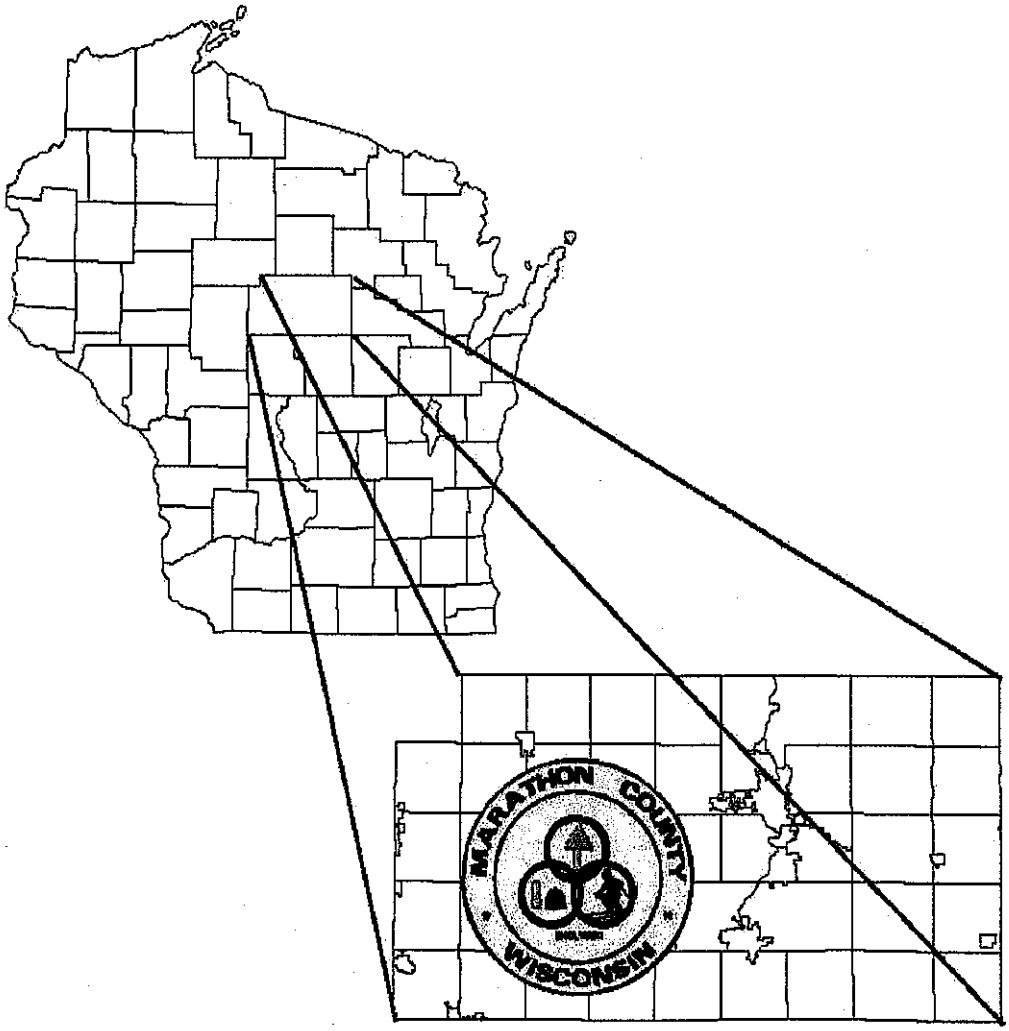
The frequency of contamination incidents in Marathon County underscores a need to take a closer look at our groundwater resources. What are the causes of these incidents? How could they have been prevented? What actions are necessary to avoid future problems?

It is the view of the Marathon County Environmental Resources Committee that elected leaders and the general public should focus on preventive actions to protect groundwater, and not wait to react to contamination after it has already occurred. This preventive approach, if implemented will cost some money now, but may save taxpayers large amounts in the future.

DESCRIPTION OF PHYSICAL RESOURCES OF MARATHON COUNTY

Marathon County is located near the geographic center of Wisconsin (see Fig. 1). At 1,009,041 acres, it is the largest county and the only county in Wisconsin with more than one million acres. The land area is larger than the state of Rhode Island. A wide range of soils, geology, land uses, and a 2000 population of 125,834 make Marathon County an area of complex environmental interactions.

Figure 1



The following sections summarize data available on Marathon County's physical resources and land uses:

Rib Mountain, located just west of the Wausau Urban area, is the fourth highest point in the state at 1,920 feet above sea level. It is also the highest elevation in the county. The lowest elevation, at the point where the Wisconsin River flows out of the county, is about 1,100 feet. A majority of the county ranges in elevation from 1,200 to 1,450 feet with a local elevation difference of less than 100 feet. The greatest local elevation difference in the county, about 750 feet, can be found

between the top of Rib Mountain and a nearby outwash terrace in the Wisconsin River Valley.[1] Land in the southeastern part of the county is often flat enough for large scale center pivot irrigation. The gently rolling land in the western part of the county is generally used for dairy farming.

1. GEOLOGY

A. Precambrian and Pleistocene

Marathon County is situated near the southern margin of the exposed Precambrian Shield. The bedrock geology is predominately Precambrian igneous and metamorphic rocks with a few scattered outliers of Paleozoic sandstone that overlie the Precambrian rocks.

Eastern Marathon County is underlain by the Wolf River Batholith. Small outliers of Paleozoic sandstone are exposed in southeastern Marathon County. Glacial deposits in the county include material deposited from three different ice sheets. Alluvial fill along the Wisconsin and Rib Rivers provides the major aquifers and sand and gravel deposits in the area.

The far northern and western parts of the county are broad, nearly level to sloping ground moraines. The central part, except for the Wisconsin River Valley, is a mixed area of ground moraines and uplands underlain by bedrock at a depth of two to 20 feet. This area is nearly level to steep. The steeper areas generally are adjacent to major drainageways. The Wisconsin River Valley is composed of nearly level to very steep outwash terraces and nearly level and gently sloping flood plains. The southeastern part of the county consists mainly of nearly level to steep outwash plains and stream terraces and undulating to very hilly moraines and drumlins.

B. Hydrogeologic Characteristics of Geology

Fractured igneous and metamorphic Precambrian rock yields sufficient water to be used as a water source by many rural residents in Marathon County. Wells drawing from fractures in these rocks typically provide sufficient water for domestic use and small farm use, yielding one to 15 gallons per minute.

In the south and southwestern parts of the County, the sandstone is a dependable, moderately productive source of groundwater with yields ranging from one to 75 gallons per minute.

Pleistocene sediment yields groundwater in sufficient quantities to be used for water supplies by many municipalities. Melt-water-stream sediment that was deposited during glacial phases prior to the late Wisconsin and subsequently buried, is an important source of water for many small communities in western Marathon County. Abbotsford, Athens, Colby, Edgar, Marshfield, Spencer, and Stratford obtain most of their water from buried sand and gravel deposits. Wells constructed in this material typically produce from 20 to 400 gallons per minute.

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[1] United States Department of Agriculture and Soil Conservation Service, "Soil Survey of Marathon County, Wisconsin." September 1989.

The silty and clayey deposits of the Marathon and Lincoln Formation, which represent the majority of the west half of the County are poor sources of water, typically yielding two gallons per minute.

By far, the most productive glacial deposit is the late Wisconsin melt-water-stream sediment found in the Wisconsin River Valley where Wausau and the surrounding communities reside. This deposit can yield at rates nearly 450 gallons per minute.

2. SOILS

The soils of Marathon County are primarily derived from the weathering of glacial drift, outwash and bedrock. A few soils have formed in glaciolacustrine deposits, alluvial deposits, or organic material. Most soils in the county are suitable for agriculture, with the exceptions of the very steep areas and the poorly drained soils.

The soils of Marathon County are grouped into general soil associations with each association having a unique landscape definition as well as distinctive patterns of soils, relief, and drainage.

Groundwater characteristics relative to the various soil associations, are influenced by the porosity of the soil profiles, textures of soil materials, and depth of the soil. These unique soil characteristics play a functional role in both quality and quantity of groundwater resources. For example, along the Wisconsin River, Rib River, and Eau Claire River, the Mahtomedi-Fordum-Sturgeon Association is the dominant soil pattern. This association because of its coarse texture soil type has a high infiltration rate, and high permeability rate because of its large pore space nature. Along these major river corridors high volume yield wells are found to service the communities of Marathon, Brokaw, Wausau, Schofield, Weston, Rothschild and Mosinee. However, because of high infiltration and permeability rates of coarse soil types, the groundwater is vulnerable because area soils have low attenuation potentials. Attenuation potential of a soil indicates the natural capability of a soil to reduce the impact of a contaminant by nature of its filtering potential. (Map 1)

Groundwater is also influenced by the landscape characteristics of the associations. Flatter areas produce less runoff and subsequently higher recharge rates. The presence of wetlands to filter runoff prior to recharges into surface and groundwater impacts the quality of groundwater. Sandy soils with high infiltration rates increase recharge rates.

The following are brief summary descriptions of the ten (10) soil associations of Marathon County. (Map 2) In understanding the nature of each soil association relative to origin, landscape, slopes, land cover, textures, land use, and geology, a better understanding of the groundwater recharge capability, runoff potential, discharge nature, quality, quantity, and attenuation potential can be assessed.

A. Areas Dominated by Soils Underlain by Heavy Glacial Till

1. Magnor-Cable Association

Located along the northern edge of Marathon County, this association represents about 10% of the county's surface area. The landscape is level to gently rolling with dominant soil types being somewhat poorly drained. Agriculture is a major land use in this region and uncropped land is primarily woodland.

2. Loyal-Withee-Marshfield Association

Located along the west end of Marathon County in the glacial till pedeplain, this association comprises about 15% of the county's area. With average 2-4% slopes and low permeability soils, the area represents the dominant livestock/cropping region of the county.

B. Areas Dominated by Soils Underlain by Sandy or Loamy Glacial Till, Residues, and Bedrock

1. Kennan-Hatley Association

Consists of soils on ground, terminal, and recessional moraines. This association lies parallel, alongside the Plover River in the eastern edge of the County. The soils are coarse in nature mixed with cropland and woodland. The landscape is severely rolling in nature with surface boulders and stones.

2. Marathon-Mylrea-Moberg Association

Consists of soils on upland and ground moraines and are generally well drained and underlain by "rotten granite." Large non-metallic mining operations are present.

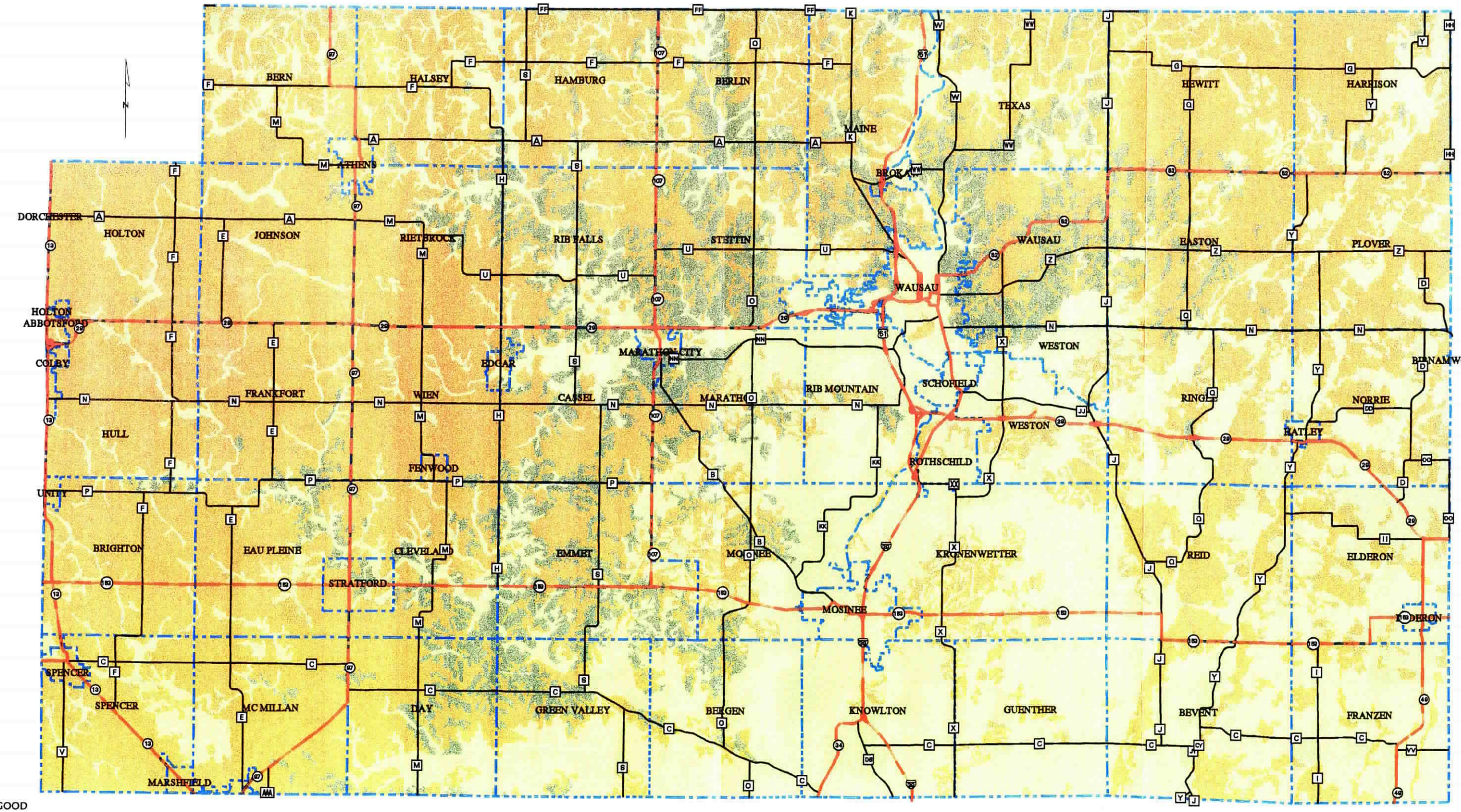
3. Fenwood-Rietbrock-Rozellville Association

Consists of soils on ground moraines and on uplands underlain by igneous and metamorphic bedrock. This soil association represents 22% of the county's surface area. Bedrock in this association is often less than 5 feet from the surface. Within this area, the presence of ginseng production is significant.

4. Mosinee-Meadland-Dancy Association

Located primarily in the south-central part of the County, this association consists of soils on ground moraines and uplands underlain by igneous and metamorphic bedrock. The landscape is generally flatter than the Fenwood-Rietbrock-Rozellville association and groundwater supplies are closer to the surface.

ABILITY OF SOILS TO ATTENTUATE CONTAMINATES



GOOD
LEAST
MARGINAL

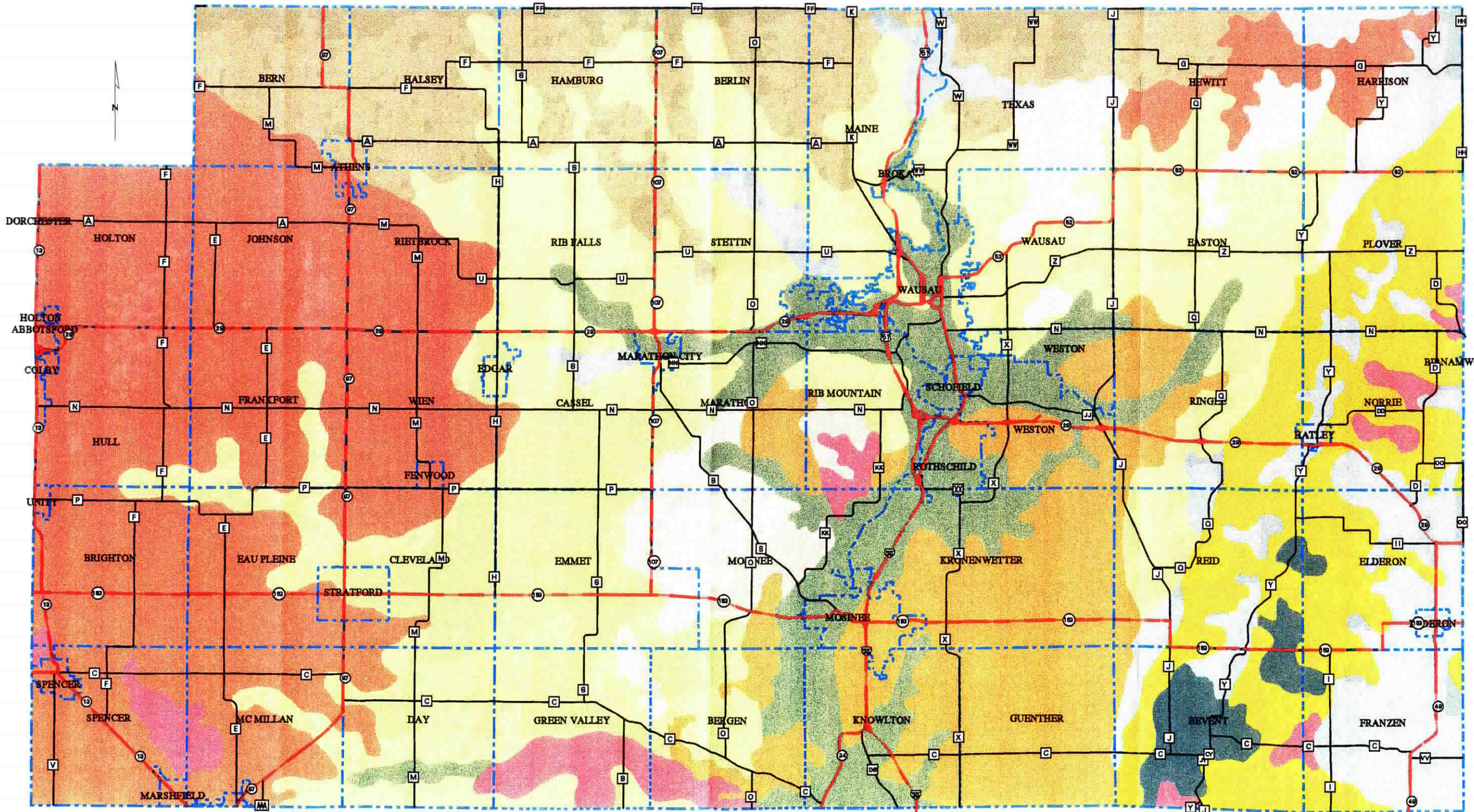
MARATHON COUNTY, WISCONSIN

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

Source: U.S. Department of Agriculture
Soil Conservation Service
The Research Division of the College of Agricultural and Life Sciences
University of Wisconsin

MAP#1

GENERAL SOIL MAP



- Magnor-Cable
- Loyal-Withee-Marshfield
- Kennan-Hatley
- Marathon-Mylrea-Moberg
- Fenwood-Rietbrock-Rozellville
- Mosinee-Meadland-Dancy
- Mahtomedi-Fordum-Sturgeon
- Chetek-Rosholt-Oesterle
- Mahtomedi-Graycalm-Meehan
- Cathro-Seelyeville

MARATHON COUNTY, WISCONSIN

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

Source: U.S. Department of Agriculture
Natural Resources Conservation Service
The Research Division of the College of Agricultural and Life Sciences
University of Wisconsin

MAP#2

C. Areas Dominated by Soils Underlain by Silty, Loamy, or Sandy Alluvial, Lacustrine, or Outwash Deposits

1. Mahtomedi-Fordum-Sturgeon Association

The area comprises the highly populated Wisconsin River Corridor characterized by deep alluvial deposits, high yielding well sources and low attenuation soils.

2. Chetek-Rosholt-Oesterle Association

Consists of soils on outwash plains and stream terraces.

3. Mahtomedi-Graycalm-Meehan Association

Consists of soils on outwash plains, stream terraces, and in glacial lake basins. This soil association is restricted to the immediate areas of the County surrounding the glacial lakes of Big Bass Lake, Mission Lake, and Pike Lake. Soils are coarse in nature with poor filtering capability.

D. Areas Dominated by Organic Soils

1. Cathro-Seelyville Association

The areas and their soils are nearly level and poorly drained and are located in surface depressions, ground moraines, outwash plains, and glacial lake plains. Areas such as the Nine-Mile Recreational Area and the Mead Wildlife Area are representative of this association type.

3. GROUNDWATER CONCEPTS

Before examining specific groundwater characteristics in Marathon County, it is first necessary to understand some basic terminology and hydro-geologic concepts. Figure 2, entitled "The Water Cycle" depicts the entire hydrologic cycle including both natural and man-induced elements. These elements will be discussed in this and later chapters.

Groundwater originates as rain or snow. As precipitation falls on the earth's surface, some evaporates, some runs off over the land into lakes and streams, and some soaks into the ground. A portion of water that enters the soil is utilized by plants. The remainder percolates downward into the groundwater resource where it will recharge streams, spring-feed lakes, or be drawn up via wells for human use.

Groundwater is found in saturated rock and soil formations. These formations may be ***consolidated*** bedrock such as limestone or sandstone, or they may be ***unconsolidated*** deposits of sand, gravel or silt. Water is stored in the spaces within the rock or soil. The relative volume of these spaces is known as ***porosity.***

Permeability refers to the size and interconnection of the spaces and describes the rate water will flow vertically through the material. ***Infiltration rate*** indicates the rate at which rainwater

and snow melt will enter into the soil surface. Soils with low infiltration rates will produce more surface runoff thereby, decreasing the recharge. ***Aquifers*** are the layers of strata that contain useable amounts of water. Unconfined aquifers occur where unsaturated porous material overlies the saturated materials. Where this occurs, the upper surface of the saturated zone is called the ***water table*** (Figure 2). The water table generally follows the contour of overlying terrain and can be roughly mapped by examining well depths in these contoured areas.

Aquifers may also be bounded at the top and bottom by impermeable layers, called ***confining beds***. These beds are typically of clay or shale, but in Marathon County are composed of granite or other impermeable rock.

The regional flow of groundwater generally is similar to the surface topography. Groundwater usually enters the aquifer in upland areas and flows toward low points in the drainage basin. Sometimes it reaches the surface in the form of springs or artesian wells or seeps into swamps or rivers and lakes. These are called ***discharge areas***.

Attenuation potential of a soil relates to the capability of a soil to reduce the intensity of a potential contaminant prior to introduction into a groundwater resource. Attenuation potential is a function of soil depth, texture and permeability rate.

4. GROUNDWATER FEATURES

A. Depth to Water (Map 3)

Depth to the water table generally ranges from zero to 20 feet in the outwash and glacial lake deposits, from 50 to 100 feet in pitted outwash, and as much as 170 feet in the end moraines. Depth to water in the area of ground moraines generally ranges from 20 to 30 feet.

B. Movement (Map 4)

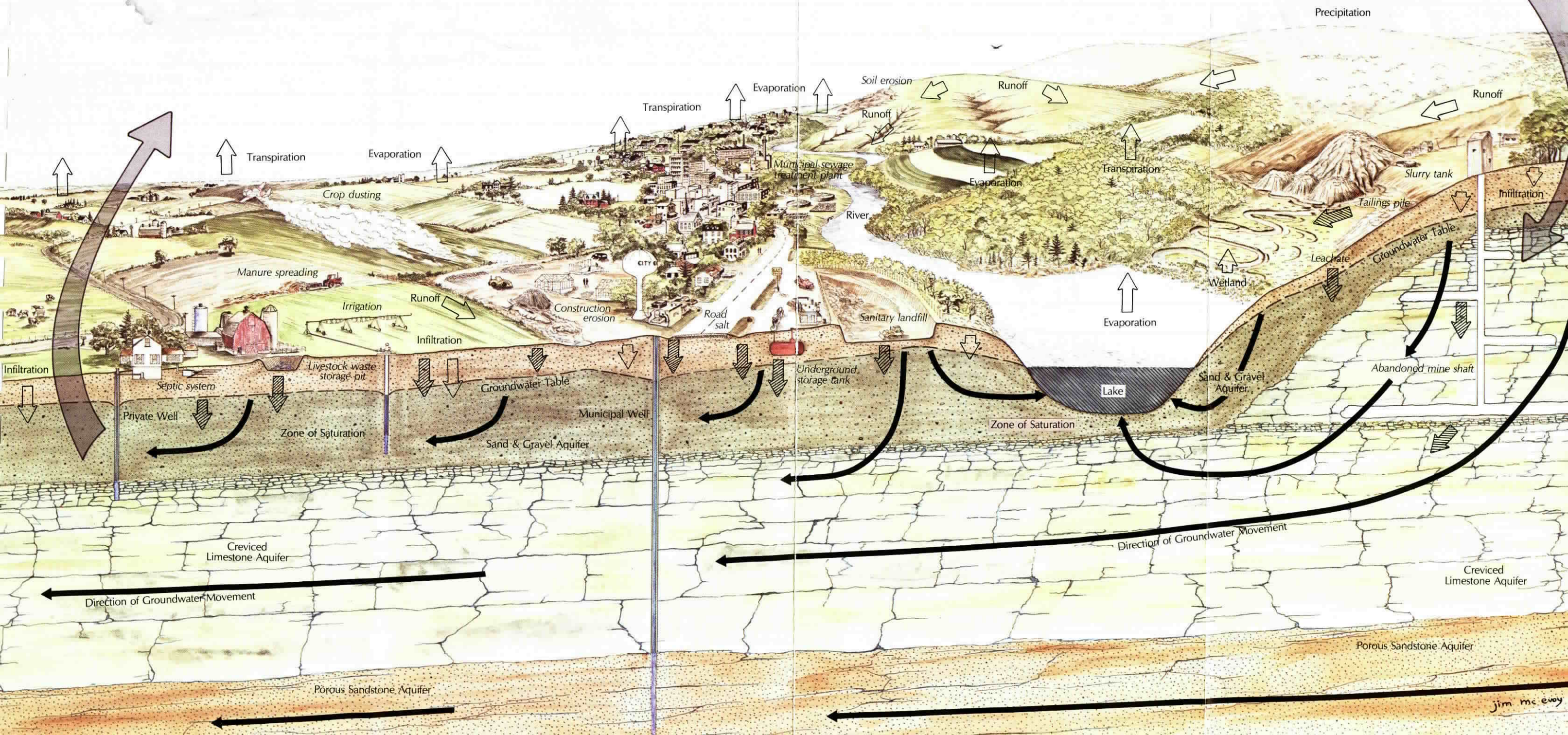
The general pattern of groundwater movement is determined by the shape and slope of the water table, which is the upper surface of the saturated zone. The direction of groundwater movement, which generally is at right angles to the contours, is shown by arrows. In Marathon County, this movement typically is from the sides of the basin toward the streams and from north to south. Locally, groundwater moves toward discharge areas - springs, streams, lakes, and wetlands. Lakes and marshes lacking surface inflows and outflow locally interrupt the natural gradient of the water table. Groundwater often moves through the lakes, entering on one side and leaving on the other. Deep regional movement may occur below the shallow zone of local movement. In Marathon County, the water movement usually is toward the Wisconsin River, except for the extreme southeast corner which drains into the Wolf River.

Groundwater and Land Use in the Water Cycle

Direction of Groundwater Movement

Human induced impacts on groundwater

Natural processes



Prepared by the Wisconsin Department of Natural Resources.

Publ. WR-104 91

Groundwater and Land Use in the Water Cycle

Water might be called our most recycled resource. Consider, for example, that the water you bathed in this morning may have contained the same water molecules that washed over a South Pacific coral reef millions of years ago. The distribution of the earth's total supply of water changes in time and space, but the amount has remained basically constant. Distribution of water changes according to a phenomenon known as the hydrologic cycle, kept in motion by solar energy and gravity.

Pick a bursting cloud as the start of the cycle. Its rain falls to earth. Some flows downhill as runoff (to a stream, lake, eventually the ocean); some evaporates; some is taken up by plants. The rest trickles down through unsaturated subsurface soil and rock formations, traveling through pore spaces and open cracks. This water eventually reaches the top of the saturated layer which is called the water table. The water contained in the saturated layer below the water table is called groundwater.

Groundwater seeps from upland to lowland areas, eventually discharging in low places where the water table intersects the land surface in streams, lakes, wetlands. Solar energy will cause evaporation from these surface waters.

In Wisconsin, an average of 30 to 32 inches of precipitation per year falls on the state. Most precipitation (75%) evaporates or transpires through plants and never reaches surface or groundwaters. The fate of the six to 10 inches per year that doesn't evaporate immediately or get used by plants, depends on local topography, soil, land use and vegetation. Ideally, these would retard runoff and let water soak into the ground, but conditions vary. In gently rolling Dane County, for example, for every one inch of water that runs off the land to a stream or lake, two inches seep down to the water table. But in the sandy plains of Portage County, nine inches are able to seep into the ground for each inch running of the land.

This is what makes groundwater. It doesn't come from Canada or Lake Superior in some mysterious underground stream.

All groundwater moves continually toward an area of discharge. But rates of movement vary greatly.

The reason for this variability is a matter of geology. The size of the cracks in the rocks, the size of the pores between soil and rock particles and whether the pores are connected, all contribute to the rate of movement to, through and out of the saturated zone.

For example, water generally moves more quickly into, through and out of coarse sand as compared with other materials, sometimes as much as several feet per day. Openings between the grains are large and interconnected, resulting in high permeability. Very fine-grained material like clay has many pores where water can be stored, but the pores are small so moving water through or out is difficult. Such formations are relatively impermeable; movement here may be only a few inches a year. Permeability in limestone rock, on the other hand, depends not on pore spaces but on the size, frequency and distribution of fractures and cracks.

Groundwater flow systems

Groundwater moves through the water cycle as part of a dynamic flow system, from recharge areas where infiltration occurs to discharge areas (streams, lakes, springs and many wetlands). It may move downgradient following the configuration of the water table, or in deeper confined layers of rock or soil under artesian pressure. In Wisconsin, the natural movement is always from upland recharge areas to lowland discharge areas. Because groundwater naturally moves to and discharges into lowland areas, it is a significant factor in the development of our lakes, streams and wetlands.

Did you ever wonder why some streams continue to flow during dry periods, or during winter even though there is no rainfall? The answer is that winter stream flow is largely groundwater discharge (called baseflow), which is relatively warm (about 50° F). Streams, and most lakes and wetlands, are constantly replenished during the winter by groundwater in the uplands surrounding that stream, wetland or lake. The water table steadily lowers during the winter discharge period, and it isn't until the following spring thaw that water can once again infiltrate the soil to recharge the groundwater and thus cause the water table to rise.

Groundwater in Wisconsin doesn't move hundreds of miles. Most precipitation which recharges groundwater moves only a few miles from the point of recharge to the point of discharge. In the vast majority of cases, it stays within the same surface runoff watershed.

Aquifers of Wisconsin

An underground rock or soil formation that can store and transmit water efficiently is called an aquifer. In a few areas of northern Wisconsin, clay soils overlay granite or some similar hard nonporous rock. This geology makes it unsuitable for storing and transmitting water efficiently or economically and as a result, substantial well water supplies aren't available.

Wisconsin is favored with thick sequences of permeable deposits across most of the state. These layers of soil and rock formations comprise the four principal aquifers of the state: the sand and gravel aquifer, the eastern dolomite aquifer, the sandstone and dolomite aquifer and the crystalline bedrock aquifer.

Sand and gravel aquifer

The sand and gravel aquifer is the surface material that covers most of the state, except for parts of southwest Wisconsin which weren't glaciated. It is made up mostly of sand and gravel deposited from glacial ice or in river floodplains. The deposits are unconsolidated so they are often called soil, even though they are different from agricultural soil and are more than 300-feet thick in some places. The groundwater occurs and moves in the void spaces (pores) among the grains of sand and gravel.

The glaciers themselves were formed by the continuous accumulation of snow and played an interesting role in Wisconsin's groundwater geology. The snow turned into ice, which reached a maximum thickness of almost two miles. The ice sheet spread over Canada, and part of it flowed in a general southerly direction toward Wisconsin and neighboring states.

The ice sheet transported a great amount of rock debris called "drift."

As the ice melted, the drift was reworked by the running water. Large amounts of sand and gravel were deposited to form "outwash plains"; pits were formed in the outwash where buried blocks of ice melted and many of these are now occupied by lakes. The sand and gravel aquifer was deposited within the past million years.

The sand and gravel outwash plains now form some of our best aquifers in Wisconsin. Many of the irrigated agricultural lands in central, southern and northwestern Wisconsin use the glacial outwash aquifer. Many other glacial deposits are also useful aquifers, but in some places, large glacial lakes were formed which accumulated thick deposits of clay. These old lake beds of clay don't yield or transmit water.

Because the top of the sand and gravel aquifer is also the land surface for most of Wisconsin, it is highly susceptible to human-induced and some natural pollutants.

Eastern dolomite limestone aquifer

The eastern dolomite aquifer occurs in eastern Wisconsin from Door County to the Wisconsin-Illinois border. It consists of the Niagara dolomite formation underlain by the Maquoketa shale formation. These formations were deposited 400 to 425 million years ago. Dolomite is a brittle rock that is similar to limestone and contains groundwater in interconnected cracks. As a result, the yield of water from a well depends upon the number of fractures the well intercepts. Closely spaced wells, therefore, can vary greatly in the amount of water that can be pumped.

Where this fractured dolomite bedrock occurs at or near the land surface, the groundwater in shallow portions of the eastern dolomite aquifer can easily become contaminated. In those areas (such as parts of Door, Dodge and Waukesha counties), there is little soil to filter pollutants carried or leached by precipitation. Little or no filtration takes place once the water reaches large fractures in the dolomite. This has resulted in some special groundwater quality problems and should prompt special care to prevent pollution.

The Maquoketa shale layer beneath the dolomite is a rock formation formed from clay that doesn't transmit water easily. Therefore, it is important not as a major water source, but as a barrier between the eastern dolomite aquifer and the sandstone and dolomite aquifer below.

Sandstone and dolomite aquifer

The sandstone and dolomite aquifer consists of layers of sandstone and dolomite bedrock units that vary greatly in their water yielding properties. In these types of rock, groundwater occurs in fractures. In sandstone it also occurs in pore spaces between loosely cemented sand grains. These units occur over the entire state, except in the north central portion where these formations aren't present. In eastern Wisconsin, this aquifer lies below the eastern dolomite aquifer. In other areas, it lies beneath the sand and gravel aquifer. These rock units gently dip to the east, south and west away from the north central portion of the state, becoming much thicker and extending to greater depths below the land's surface.

The rock units that make up the sandstone and dolomite aquifer were deposited between 425 and 600 million years ago. The sandstone and dolomite aquifer is the principal bedrock aquifer for the southern and western portions of the state. In addition, in eastern Wisconsin, most users of substantial quantities of groundwater, such as cities and industries, tap this deep aquifer to obtain a sufficient amount of water.

Crystalline bedrock aquifer

The crystalline bedrock aquifer consists of a variety of rock types formed during a geologic time called the Precambrian Era. The Precambrian Era lasted from the time the earth cooled, more than 4,000 million years ago, until about 600 million years ago, when the rocks that comprise the sandstone and dolomite aquifer began to be formed. During this vast period of 3,400 million years, sediments, some of which were rich in iron and which now form iron ores, were deposited in ancient oceans; volcanoes spewed forth ash and lava; mountains were built and destroyed; and the rocks of the upper crust were intruded by molten rocks of deep-seated origin. The rocks that remain today have a granite-type crystalline structure. These are the "basement" rocks which underlie the entire state. In the north central region, they are the only rocks which occur beneath the sand and gravel aquifer.

The cracks and fractures that store and transmit water in these very dense rocks are spaced many feet apart. The amount of water available to a well can vary within a single homesite. To obtain water a well must intersect some of these cracks.

Many wells in the crystalline bedrock aquifer have provided good quality water. However, most of these wells don't penetrate deeply into the rock. Water samples from mineral exploration holes near Crandon and deep iron mines near Hurley have yielded brackish water near or exceeding mineral concentrations in sea water.

Reprinted in part from "Groundwater—Wisconsin's buried treasure," Supplement to Wisconsin Natural Resources Magazine.

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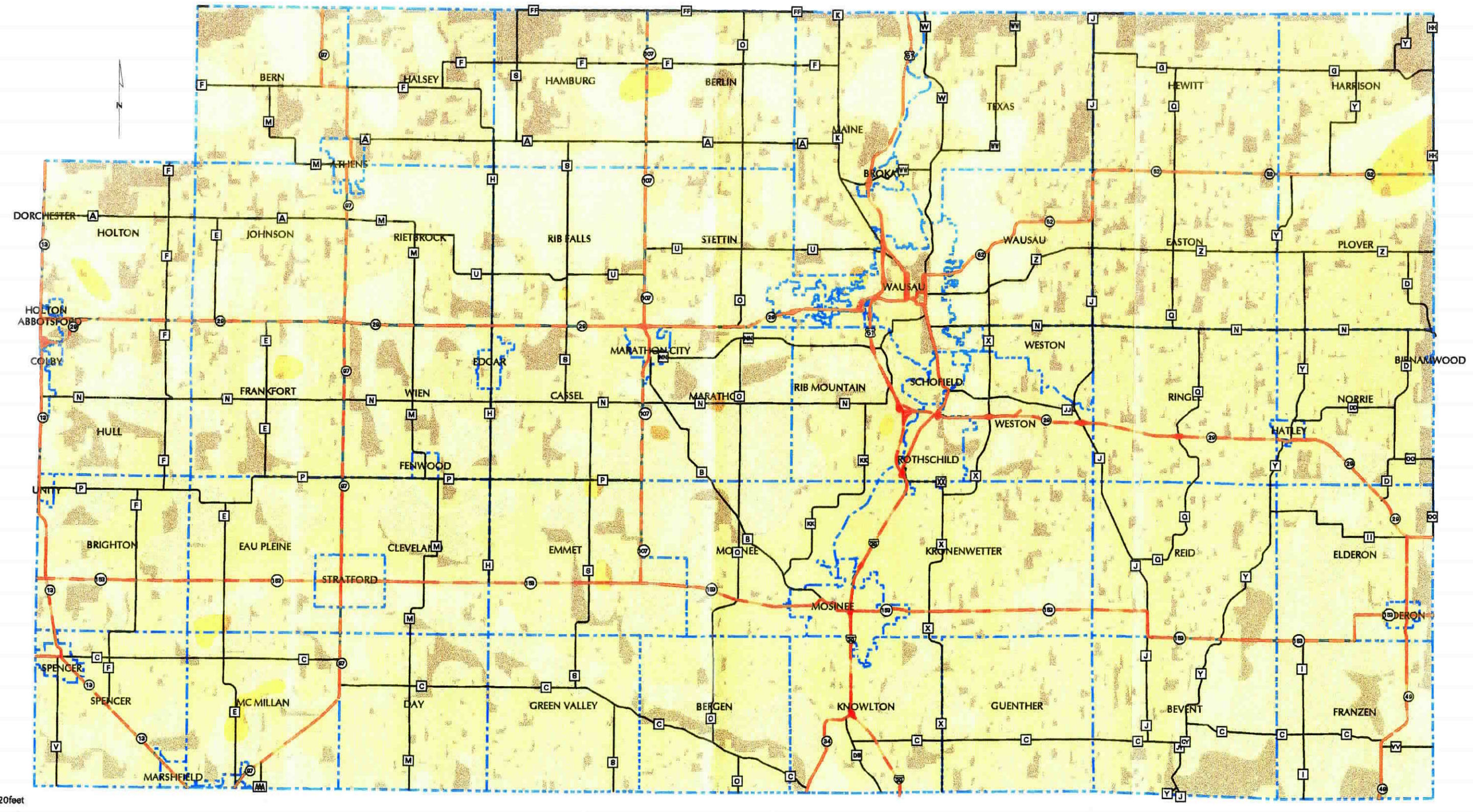
DEPTH TO GROUNDWATER



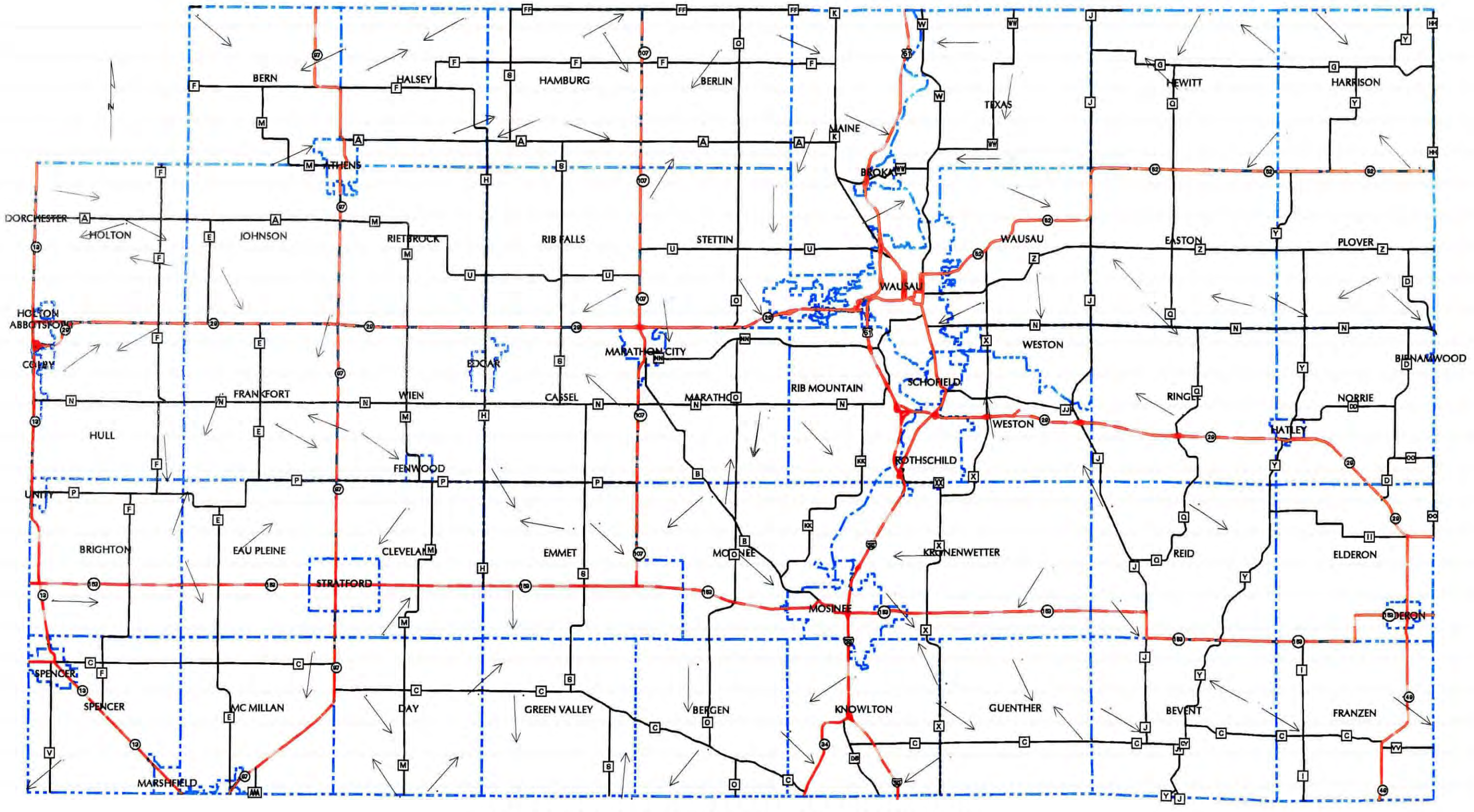
MARATHON COUNTY, WISCONSIN

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

Source: "Irrigable Lands Inventory — phase 1 Groundwater and Related Information", I.D. Lippelt and R.G. Hennings, MP -81-1, WGNHS 1981.

MAP#3

GROUNDWATER MOVEMENT TRENDS



MARATHON COUNTY, WISCONSIN

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

MAP#4

C. Recharge

Groundwater recharge is that portion of precipitation that percolates down to the water table. As shown in Table 1, only a small portion of total precipitation is actually recharged into an aquifer. The figures in Table 1 show a county-wide average of 5" per year. In actuality, recharge varies greatly. For example, only 2-3" of precipitation is recharged in western Marathon County where nonporous clay soils limit percolation. On sandy, porous soils near Mosinee, however, recharge may reach 10" or more, resulting in almost no runoff at all. In wetland areas of the County recharge is rejected and almost all precipitation becomes surface runoff.

It is important to note that changing the land use/land cover can have a large impact upon the recharge capacity of an area. For example, as more impervious surfaces such as roads, roofs, parking lots, etc., are created, the precipitation is not able to infiltrate the ground and recharge the groundwater. Additionally, any land use that accelerates the runoff of water from the earth's surface negatively impacts recharge and potentially increases flooding concerns.

Table 1 below shows the average long-term water budget for the Central Wisconsin River Basin.

Table 1

	Inches per year	Cubic Feet per second	Millions of gallons per day
Water gain:			
Precipitation----------	30.9	11,500	7,430
Water loss:			
Runoff * ----------	5.9	2,435	1,420
Recharge * ----------	5.0	2,065	1,200
Evapotranspiration----------	19.7	7,000	4,740
Groundwater underflow------	0.3	100	70
Total----------	30.9	11,500	7,430

*County Average: Read Part C entitled "Recharge" for explanation.

Source: Modified from Duvaul and Green "Water Resources of Wisconsin - Central Wisconsin River Basin," 1971.

D. Discharge

Natural groundwater discharge occurs at streams, marshes, lakes, and springs, or as underflow leaving the basin. The continued flow of perennial streams during long dry periods is natural discharge from the groundwater reservoir.

Natural groundwater discharges from the Central Wisconsin sand plain, the Antigo area, and the eastern Marathon County moraine area ranges from 0.5 to 1.0 cubic feet per second (cfs) per square mile. Discharge from the ground moraine area ranges from 0.0 to 0.2 cfs per square mile.

Some parts of the Wisconsin River groundwater basin are actually losing groundwater due to discharge into other basins. An example of this is where the Wisconsin River basin merges with the Wolf and Fox River basins in eastern Marathon County. Here, the groundwater divide is actually seven miles west of the surface water divide. Precipitation that is not carried into Wisconsin River tributaries is recharged into the Wolf River groundwater basin. The total loss of water by eastward underflow is estimated to be at least 30 billion gallons per year.

E. Availability (Map 5)

The highest well yields are from areas underlain by thick, permeable deposits of saturated sand and gravel. Yields ranging from 500 to more than 1,000 gpm (gallons per minute) may be expected from wells in permeable deposits less than 50 feet thick that induce recharge from nearby large streams. The cities of Wausau, Brokaw, and Rothschild all have wells that produce more than 1,000 gpm because the wells induce recharge from the nearby Wisconsin River.

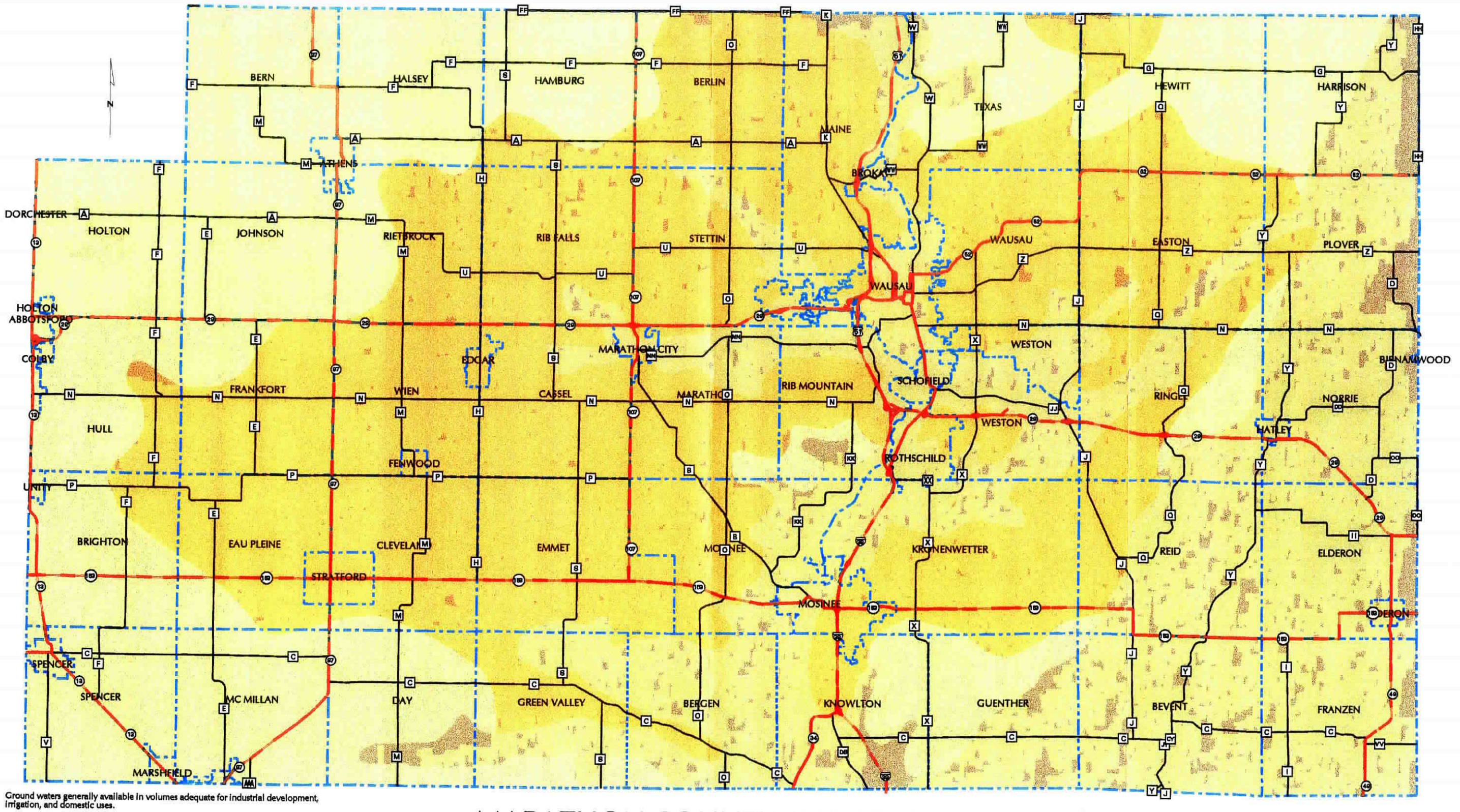
Yields between 50 and 500 gpm may be expected in the area of end moraines, in most of the area of outwash and alluvium in the eastern part of the County, and along the periphery of the high-yield Wisconsin River area.

Yields less than 50 gpm may be expected in areas covered by thin ground moraine.

Exceptions to the yields described above occur where localized geologic conditions differ from the general conditions.

Availability of groundwater is variable in Marathon County. In general, groundwater is in good supply in the Plover River watershed and eastward. Also, abundant water supplies are available along the Wisconsin River Valley and the lower reaches of its major tributaries. The central part of the county, with the exception of areas adjacent to major bodies of water, has limited groundwater availability due to the bedrock being so near the earth's surface. In the western and northern part of the county, groundwater is more plentiful, but areas of shortage do occur where bedrock is near the surface. Some wells in parts of western and southwestern Marathon County yields less than five gpm and may be inadequate for domestic use.

GENERALIZED GROUNDWATER AVAILABILITY



Ground waters generally available in volumes adequate for industrial development, irrigation, and domestic uses.

Ground waters generally available in volumes large enough for domestic uses and scattered urban development. Islands of water shortage occur where bedrock is close to surface.

Ground waters in general short supply where dense bedrock is close to surface. Islands of more ample water reserves do occur in the area where granite is weathered to rather deep depths or scattered deposits of sand and gravel occur.

MARATHON COUNTY, WISCONSIN

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

Source: "Irrigable Lands Inventory — phase 1 Groundwater and Related Information", I.D. Lippelt and R.G. Hennings, MP -81-1, WGNHS 1981.

MAP#5

WATER USE AND LAND USE TRENDS

1. LAND USE

Prior to settlement, Marathon County's vegetative cover consisted primarily of hardwoods which covered nearly the entire county. Logging cleared much of the area and farming soon followed. According to the 1997 Census of Agriculture, Marathon County had 515,888 acres in farmland.

Table 2 summarizes the estimated land use cover of Marathon County in 1990.

Table 2.
1990 Estimated Land Use Cover in Marathon County

Land Use	Acres
RURAL:	
Cropland	336,629.2
Forest Land	330,653.7
Other Agriculture (pasture, fallow, barren, unknown)	104,789.9
Water	21,405.7
Transportation	19,908.0
Rural Residential	16,676.8
Quarries	2,340.5
Specialty Crop	2,111.0
Rural Commercial	586.1
Recreational	390.4
Public/Quasi-Public	297.0
Urbanized Area	173,252.7
Total Land Use Cover	1,009,041.0

Local land use activities can greatly influence groundwater quality and quantity. This close relationship between land use and groundwater means that local government, in exercising the traditionally local function of managing land use, can play a significant role in protecting this valuable resource.

Land uses and the pollution sources that they may generate vary widely in their potential to contaminate the groundwater. Local governments can effectively protect groundwater quality through control of land use activities. Many land use control techniques are important to local groundwater quality protection programs. Such techniques can include prohibiting uses that have the potential to cause serious contamination, permitting other uses only under certain conditions, limiting density of development, and regulating locations within which various uses are permitted.

2. WATER USE IN MARATHON COUNTY

Nearly all water used for human consumption in Marathon County comes from groundwater sources. Surface water is used primarily for economic activities such as paper making, live stock watering, and irrigation for farm fields. Table 3 indicates water usage in the County for the year 1995.

Most residents of Marathon County obtain their drinking water from public water supply sources. In the rural areas residents rely on private wells for their water supply. Figure 3 & 4 lists municipal and other than municipal water supplies in Marathon County. Marathon County has a year 2000 population of 125,834 persons (US Census Bureau, 2000). Based on this 2000 population estimate, approximately 63% (sixty-three percent) of Marathon County's population (about 79,759 persons) obtain its drinking water from public sources. The remaining 37% (thirty-seven percent) use private wells for their water supply.

FIGURE 3.
MUNICIPAL PUBLIC WATER SUPPLIES IN MARATHON COUNTY

MUNICIPALITY NAME	PUBLIC WATER SYSTEM NAME	POPULATION SERVED
ABBOTSFORD	ABBOTSFORD WATERWORKS	1,930
ATHENS	ATHENS WATERWORKS	1,003
BROKAW	BROKAW WATERWORKS	186
COLBY	COLBY WATERWORKS	1,532
EDGAR	EDGAR WATERWORKS	1,318
HATLEY	HATLEY WATERWORKS	385
KRONENWETTER	KRONENWETTER SANITARY DISTRICT 2	2,010
MARATHON	MARATHON WATERWORKS	1,695
MOSINEE	MOSINEE WATERWORKS	4,054
RIB MOUNTAIN	RIB MOUNTAIN SANITARY DISTRICT 1	5,400
ROTHSCHILD	ROTHSCHILD WATERWORKS	5,400
SCHOFIELD	SCHOFIELD WATERWORKS	2,420
SPENCER	SPENCER WATERWORKS	1,861
STRATFORD	STRATFORD WATERWORKS	1,602
WAUSAU	WAUSAU WATERWORKS	38,777
WESTON	WESTON WATERWORKS	9,500

Source: Modified from United States Environmental Protection Agency "Envirofacts Warehouse" database as of 10 April 2000. 26 Jun. 2000. http://www.epa.gov/safewater/sdwis_st/state.htm

Table 3 - Total 1995 Withdrawal Water Use (In Millions of Gallons)
Marathon County
(Population: 122,000)

Public Supply	
Population served by ground water	60,000
Population served by surface water	0
Deliveries to Domestic	1,095
Deliveries to Commercial	730
Deliveries to Industrial	2,190
Deliveries to Thermoelectric	0
Total ground water withdrawals	**5,475**
Total surface water withdrawals	0
Commercial Water Use	
Total ground water Withdrawals	0
Total surface Water Withdrawals	0
Deliveries from public suppliers	**730**
Total withdrawals + deliveries	**730**
Domestic Water Use	
Self-supplied population	62,000
Public-supplied population	60
Total withdrawals, ground water	1,460
Deliveries from public suppliers	1,095
Total withdrawals + deliveries	**2,555**
Industrial Water Use	
Total ground water Withdrawals	365
Total surface Water Withdrawals	10,220
Deliveries from public suppliers	2,190
Total withdrawals + deliveries	**12,775**
Thermoelectric Power Water Use (All Fuel Types)	
Total ground water Withdrawals	365
Total surface Water Withdrawals	47,815
Deliveries from public suppliers	0
Total withdrawals + deliveries	**48,545**
Livestock Water Use & Irrigation Water Use	**No Data Available**

Source: Modified from United States Geological Survey (USGS) National Water-Use Database for the Year 1995. 01 Nov. 2000. http://water.usgs.gov/watuse/spread95.html

FIGURE 4.
NON-MUNICIPAL PUBLIC WATER SUPPLIES IN MARATHON COUNTY

MUNICIPALITY LOCATION	PUBLIC WATER SYSTEM NAME	POPULATION SERVED
MOSINEE	DEER TRAIL VILLAGE	110
MOSINEE	EDGEWOOD MOBILE HOME COURT 1 & 2	70 (EACH)
HARRISON	FORMER ANTIGO AIR FORCE STATION	25
SPENCER	KILTYS KOUNTRY KOURT	81
MARSHFIELD	RIEHLS COUNTRY ESTATES	35
MOSINEE	SUNSHINE ESTATES MOBILE HOME	145
STETTIN	WEST GATE ESTATES MOBILE HOMES	150

Sources: Modified from United States Environmental Protection Agency "Envirofacts Warehouse" database as of 10 April 2000. 26 Jun. 2000. http://www.epa.gov/safewater/sdwis_st/state.htm and information provided by the Marathon County Health Department.

Because the Wisconsin River in Marathon County is regulated by several dams on the main stream and the tributaries, the groundwater table may be locally affected by raising or lowering reservoir stage levels. Groundwater monitoring efforts must take into account these surface water influences. Several municipal water supplies also draw large quantities of water from aquifers influenced by the Wisconsin River because these aquifers are often the only ones capable of supplying the necessary quantities.

3. BACKGROUND GROUNDWATER QUALITY

The background quality of groundwater is generally good, although some minor local problems do exist. Iron concentrations sometimes exceed the amount recommended by the U.S. Public Health Service, but these concentrations are not a health hazard. Soft water is associated with the sand and gravel deposits; hard water is associated with sandstone and poorly permeable glacial deposits. Depth to groundwater varies considerably throughout the basin (from 0 feet to more than 170 feet), although in most areas of the basin, the water table is found within 50 feet of the surface.

There are also areas within Marathon County, both rural and urban, that have had their groundwater quality changed in some way due to contamination incidents that have previously occurred. The following are just a few examples of contamination incidents that have occurred in Marathon County over the past twenty years:

Problem:
In Spring, 1999, the WDNR detected contaminants in the water wells of the former Gorski Landfill in the Town of Mosinee. In July 2000, State officials reopened a 20-year-old investigation of the former landfill after discovering that potentially hazardous chemicals remained in the local water supply. The primary contaminants found were volatile organic compounds (VOCs) with the most prevalent of the compounds being trichloreoethylene (TCE). The DNR is currently conducting a more thorough investigation. Cost to Date: Undetermined.

Problem:
In 1998, as part of the Lower Big Rib River Watershed Project, 76 wells were sampled for nitrate with nearly 30% of the wells exceeding the Enforcement Standard (ES) of 10mg/L. Furthermore, water samples were analyzed for presence of Atrazine. A total of 10 samples

exceeded the PAL limit of 0.3 ppb and 23 samples had detectable levels. Cost to Date: Undetermined

Problem:
In January 1991, mercury was detected in groundwater samples taken at the Spickler Landfill property in Spencer. This property has been a National Priority List (NPL) Superfund Site since 1987. Previously, groundwater samples from monitoring wells showed exceedances of Maximum Contamination Levels (MCLS) for benzene, vinyl chloride, barium, copper, iron and manganese and groundwater contamination had not moved off the site. After the detection of the mercury at the site, eight private wells near the site were sampled. One well was found to exceed the Wisconsin Drinking Water Standard for manganese, one well exceeded for lead, one well exceeded for iron, and one well exceeded for copper. On June 3, 1992, the potentially responsible parties (PRP's) involved, BASF Wyandote, Weyerhauser, and Weinbrenner Shoe Company, completed the investigation and study under an Administrative Order on Consent (AOC). In June 1992, the PRP's were required to upgrade the existing landfill cap and install leachate collection and landfill gas flare systems. Design work was completed by the PRP's in December 1993. In September 1995, the PRP's completed Remedial Action (RA) construction. A five-year review was completed in September 2000. Long-term (30 years) monitoring of the site will continue to collect additional data and make sure contamination does not migrate off-site.[2] Cost to Date: Undetermined

Problem:
In 1986 work was completed on the Rib Mountain Sanitary District Sewer and Water facility. The project, which took more than ten years to plan and construct, was in response to long-term groundwater problems experienced in the Town. Cost to Date: $21.6 million. (In addition to the public expenditures, landowners paid between $600 and $4,000 each, to connect their homes to the system.)

Problem:
In May 1985, 95 wells in the Town of Stettin were found to be contaminated and unsafe for cooking and drinking. This problem later expanded to more wells and resulted in the 1986 annexation of more than 700 homes, 1,500 persons and $39 million in assessed property value to the City of Wausau. New municipal water lines were constructed in the area. Cost to Date: $1.75 million.

Problem:
In 1984, the Village of Rothschild constructed a new municipal well at a cost of $231,000. The well was closed before ever being used as well water samples were found to contain unsafe amounts of VOC's from dry cleaning fluids. To provide water for its residents, the Village of Rothschild purchased over $100,000 of water from the neighboring Town of Weston. In 1986, an air stripping tower was installed to remove the chemicals. Cost to Date: $600,000.

Problem:
In 1982, thirty-five residential homes located adjacent to a potato field near Mosinee were found to have unsafe levels of Aldicarb in their well water. The incident caused great anxiety among landowners, especially pregnant women and those with small children. It also resulted in some owners deepening their wells (at considerable expense) only to find increases in iron and manganese levels replacing the Aldicarb in the water. Experimental filters are now being used.

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[2] United States Environmental Protection Agency (EPA) Region 5 NPL Fact Sheet-Spickler Landfill. November 2000. EPA. http://www.epa.gov/R5Super/npl/wisconsin/WID980902969.htm

Other landowners chose not to increase well depth and are still experiencing high Aldicarb levels. At least 12 homes have applied for assistance from the Wisconsin Well Compensation Fund; decisions are pending legislative budget review. Aldicarb has been banned from this potato growing area. Cost to Date: Undetermined.

CONTAMINATION SOURCES AND ISSUES

1. THREATS TO GROUNDWATER

The greatest threats to groundwater resources are created by human activity. The duration, type and intensity of a number of human activities determine, to a large extent, the degree of risk that is posed to that groundwater supply.

Groundwater resources can be disrupted in two ways: by changing the usable quantity (lowering or raising the water table), or by changing the quality through the introduction of foreign substances.

A. Changes in Quantity

Information from the U.S. Geological Survey (USGS) indicates water use in Wisconsin has increased steadily since 1950. Groundwater use grew from 570 to 754 million gallons per day (Mgal/d) from 1985 to 1995. Despite a general abundance of groundwater in Wisconsin, there is growing concern about the overall availability of good quality groundwater for municipal, agricultural and domestic use and for adequate base flow to our lakes, streams and wetlands. Groundwater quantity problems have occurred naturally (droughts and crystalline bedrock aquifers with low yields) and from human activities (groundwater withdrawals and land use activities). The effects of groundwater withdrawals are well documented on a regional scale in the Lower Fox River Valley, southeastern Wisconsin and Dane County. There are substantial declines in groundwater levels in these areas. Localized effects from groundwater withdrawal are not as well documented as the regional effects. However, there have been a number of occurrences where individual groundwater users have over pumped an aquifer causing a temporary drawdown. This aquifer depletion can dry up shallower wells and sometimes require the drilling of new wells, or the deepening of existing ones. It can also drop lake levels and reduce stream flow. As water is drawn from deeper in an aquifer, the composition of that water may change, adding minerals or drawing in other undesirable materials. Currently, groundwater quantity studies are underway in Dane County, the Little Plover River Basin, the Lower Fox River Valley, and the Driftless Area.

Problems can also occur when water table levels are increased. Rising water tables caused by natural events such as floods and heavy precipitation, or by human activity such as dam building or levee construction can cause groundwater to come into contact with landfills, septic tanks or surface water and contaminate nearby wells. Landowners living along the shore of Silver Lake in Waushara County were forced to create a sanitary district because of similar problems created from a rising water table. The unusually high levels of surface water in the Great Lakes in 1986-1987 created similar groundwater problems for lakeshore residents, especially along the coast of Lake Michigan.

B. Changes in Quality

Groundwater quality problems are the most serious to be dealt with by individual property owners and/or local and county governments. Contamination of groundwater supplies can render individual and community wells unusable for long periods of time.

Common contaminants consist of bacteria, minerals, and organic or inorganic chemicals that are usually introduced to the groundwater at or near the ground surface. Although certain physical, chemical or biological processes may attenuate, or neutralize some contaminants

once those contaminants reach an aquifer they move with the groundwater flow and may persist for decades, or even centuries before they are broken down.

The consequences of groundwater contamination vary. In minor cases water supplies might develop a color or an odor. More acute cases would perhaps lead to a drinking ban and require temporary water supplies to be furnished to the individual or neighborhood with the problems. More severe pollution problems may require new long term groundwater sources to be located and costly infrastructures to be installed. Further, a community with major groundwater contamination may lose population and economic development potential.

Contaminants fall into three classifications. The first class consists of naturally occurring or man-made inorganic materials, minerals or metals. The second group is composed of microbial contaminants such as bacteria, viruses, and parasites. The third type of contaminant is derived from synthetic and organic chemicals such as gasoline, pesticides, nitrates and household chemicals. All three types can pose serious health problems to those who drink groundwater containing the materials.

Contaminated water used for human consumption can lead to a variety of health problems. Cancer, birth defects and neurological disorders were reported in areas where amounts of the chemicals benzene, vinyl chloride, arsenic and chromium were found. Nitrates in drinking water at levels above the national standards pose an immediate threat to young children and pregnant women. Excessive levels can result in a condition called "blue baby syndrome." If left untreated this condition can be fatal. A 1993 outbreak of cryptosporidiosis (a gastrointestinal disease caused by the protozoa Crytosporidium) in Milwaukee, Wisconsin, is the largest known outbreak of a waterborne disease in the United States to date. Residents of Milwaukee receive their drinking water from treating and disinfecting water from Lake Michigan. Due to an unusual combination of circumstances caused by a period of heavy rainfall and runoff, the treatment plant was ineffective, resulting in an increase in the turbidity of the treated water. There were an estimated 403,000 people infected, more than 4,000 people were hospitalized, and more than 50 deaths attributed to the disease.[3] Where the groundwater has been tainted with organic contaminants, outbreaks of disease also have been reported. In 1962-1963, 150 cases of hepatitis were reported in Lincoln County, Montana when it was discovered the groundwater had been contaminated by on site septic effluent from a non-functioning private system. The potential for groundwater contamination depends upon the degree of attenuation that takes place between the source of pollution and the aquifer. Factors such as geological materials, the distance a pollutant must travel through unsaturated materials, dilution and environmental conditions all determines how much attenuation occurs.

2. CONTAMINATION SOURCES

The sources of groundwater pollution are many and varied. In addition to some natural processes, many human activities can contribute to groundwater quality problems. Since people are agents of groundwater pollution, many of the sources and causes of groundwater pollution are found in and near population centers. Field investigations, and in some cases very detailed studies, may be necessary to determine where potential pollution problems exist.

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[3] EPA. "Water on Tap: A Consumer's Guide to the Nation's Drinking Water." July 1997. Blacksburg, Christiansburg, VPI Water Authority: EPA'a Water on Tap. 25 Jan 01. <http://.h2o4u.org/ontap/tapwhole.html>.

Many human activities that contribute to groundwater pollution are closely integrated into our economic and cultural way of life. Each resident of Wisconsin generates an average of 1,560 pounds of solid waste each year, or 4.27 pounds per day, including each person's household waste and share of commercial waste.[4] Clearly, we have based our culture and daily activities around the use of chemicals and potential pollutants.

While some of our activities involving contaminants may be of questionable use, others are necessary for lack of available alternatives. Practices such as disposal of municipal sewage sludge and application of agricultural fertilizer to increase crop yields are examples of such activities. Management strategies to reduce the impact of groundwater quality of such essential activities are likely to be aimed at modifying the practices rather than eliminating them. Because prevention is the key to groundwater protection, this section attempts to inventory and assess a broad array of activities that might be of concern.

Table 4 identifies potential groundwater pollution sources commonly found in Marathon County. These sources are arranged according to their place of origin, relative to the land surface. These contamination sources are grouped into six general categories: waste disposal activities, agricultural activities, forestry activities, materials storage and handling activities, earth disturbance activities, and commercial activities.

A. Waste Disposal Activities

1. Land Disposal of Solid Waste

Solid waste disposal is a leading source of groundwater pollution. Continuous or intermittent contact between refuse and water produces an undesirable liquid called leachate. Landfill leachate is defined as a grossly polluted liquid characterized by high concentrations of dissolved chemicals, high chemical and biological oxygen demand, and hardness. Leachate composition is extremely variable, determined by the composition of the refuse and the volume of water it contains. It may also contain substances leached out from hazardous materials legally or illegally discarded at the site.

The threat to groundwater from waste disposal sites depends on the nature of leachate, the availability of moisture in contact with refuse, the type of earth material through which the leachate passes, and the hydrology of the site. Because Wisconsin lies in a humid climatic zone, all waste disposal sites will produce leachate. Disposal site success depends on how leachate production and movement are prevented or minimized by engineering design, appropriate site location, or management practices.

While active landfill sites are closely monitored, there also exist more than 80 abandoned or improperly closed landfills in Marathon County (Map 6). In Wisconsin, there may be as many as 2,700 of these abandoned disposal sites. Many of these "dumps" operated with little or no technical supervision, have unknown wastes buried in them, and are located in areas considered unsuitable for solid waste disposal. The potential for groundwater contamination from these sites could be great. In Spring, 1999, the WDNR detected contaminants in the water wells of the former Gorski Landfill located in the Town of Mosinee. In July 2000, State officials reopened a 20-year-old investigation of the former landfill after discovering that potentially hazardous chemicals remained in the local water

[4] WDNR Wastewater Management Program:Recycling Home Page. 16 May 2000. WDNR. 27 Nov. 2000. <http://www.dnr.state.wi.us/>

supply. The primary contaminants found were volatile organic compounds (VOCs) with the most prevalent of the compounds being trichloreoethylene (TCE). The DNR is currently conducting a more thorough investigation. Residents living on and adjacent to the old landfill have been dealing with drinking water problems since the mid-1980's. At that time the Marathon County Health Department (MCHD) and WDNR tried to acquire state and federal aid to clean up the area. They even went as far as trying to get the property designated as a Superfund site. However, at that time the landfill did not meet the Superfund criteria. In order to help remedy the drinking water issue, the MCHD worked with affected homeowners to find alternative sources of water to be used for drinking, cooking and bathing. The city of Mosinee currently provides the water supply for most of the affected homes and special equipment has been installed in homes with the most contamination.

The Marathon County Solid Waste Department operates the only active public landfill in the county at the landfill site in the Town of Ringle. Here, the residents, businesses, and industries of the County are provided with an environmentally safe and cost effective integrated waste management system for nonhazardous solid waste. This system, composed of a landfill, recycling programs, composting, and waste-to-energy programs, also provides alternatives for complying with Wisconsin waste disposal regulations. Hazardous waste disposal is provided by the Marathon County Hazardous Waste Facility also operated by the County at an alternative site. Both of these facilities will be discussed in more detail later in the guide.

2. Salvage Yards and Junkyards

Junk and salvage yards handle hazardous materials from various automotive parts and accessories - including grease, oil, solvents, and battery acids. Like landfills, many junkyards are poorly located, with few provisions made for proper drainage and groundwater protection. As such, junkyards hold many of the same threats to groundwater resources as the landfills noted above.

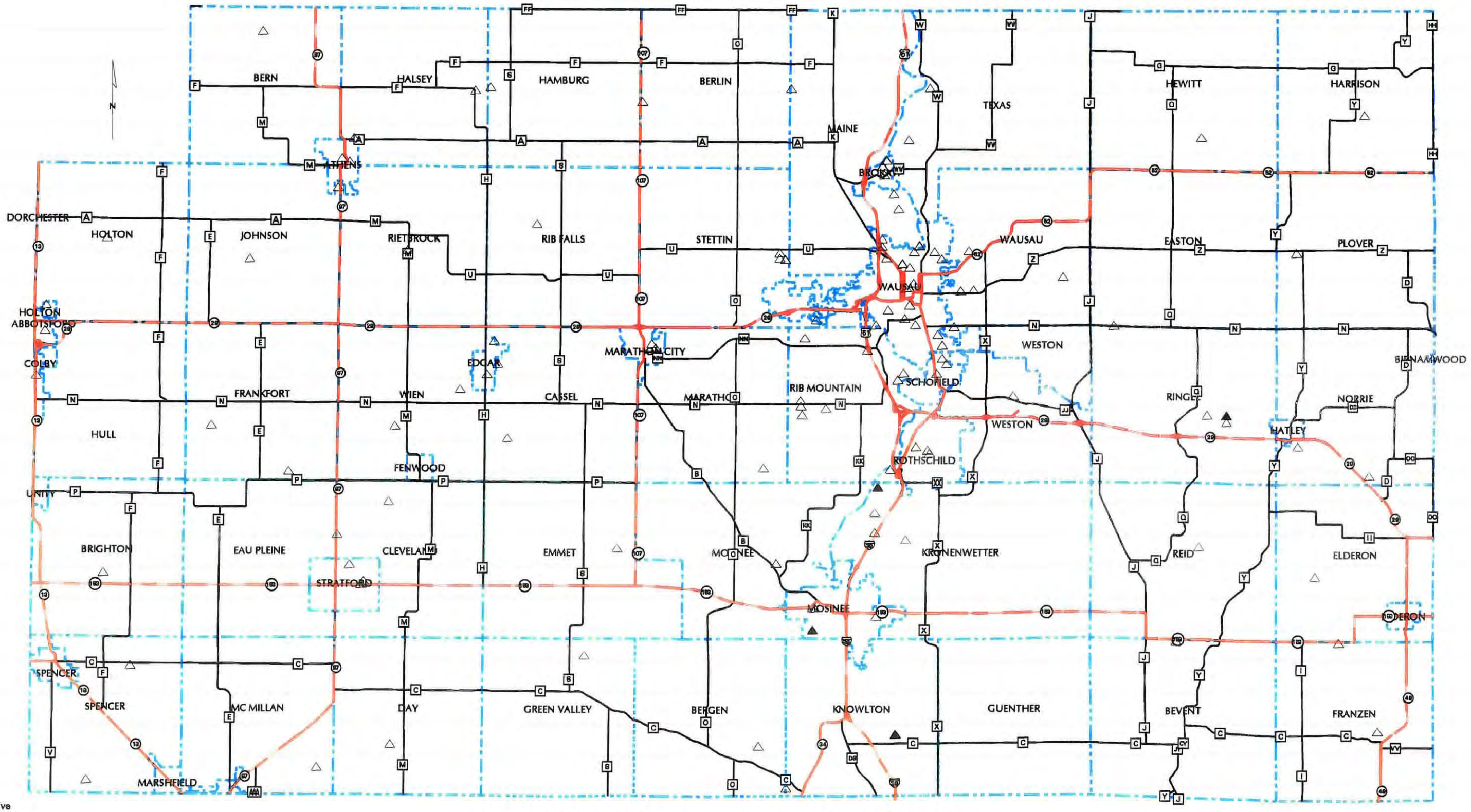
3. Municipal Wastewater Treatment

The disposal of municipal or industrial liquid wastes may be considered as a potential source of pollution for the county. Most communities collect both municipal and industrial wastes and treat them in sewage treatment plants before releasing the effluent. Typical waste from municipalities may include an increased biological oxygen demand (BOD) level, and increased levels of nitrates or other pollutants which could enter the groundwater supply.

4. Private Sewage Disposal Systems

Private wastewater systems are used to dispose of household wastes. A conventional private wastewater system consists of a septic tank and a soil absorption field. A septic tank is a water-tight tank placed underground. Household wastes are discharged from the house into the tank, where most solids, called sludge, fall to the bottom of the tank where they are partially digested by bacteria. In a properly operating system, the liquid waste, called septic tank effluent, flows from the septic tank to the soil absorption field where harmful bacteria are removed as they move through the soil. However, viruses and hazardous substances may not be eliminated. Pollutants of concern from septic system

LANDFILLS



MARATHON COUNTY, WISCONSIN

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

Sources: Registry of Waste Disposal Sites in Wisconsin.
WI DNR, 1999.

Marathon County Health Department

MAP#6

discharge are nitrates, bacteria, viruses, and hazardous materials. Even in properly functioning septic systems, most, if not all nitrates are discharged to the groundwater, particularly where the water table is close to the earth's surface.

If the soil has many large pores or if the soil is not deep enough, groundwater pollution is more likely to occur. Serious problems can occur when septic systems are illegally placed in sand and gravel deposits with a shallow water table in areas with creviced bedrock near the surface. In such cases, the effluent reaches the groundwater virtually untreated.

5. Sludge and Septic Application

Sludge is an organic, non-sterile by-product of treated wastewater. It is composed mostly of water (up to 99 percent of its weight) and organic matter. Both industrial and municipal sludge may contain hazardous chemicals and metals removed by the wastewater treatment process. Metals often found in sludge in variable concentrations include arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. The types and concentrations of metals found in sludge depend upon the source of the wastewater. Most of these metals come from industrial sources. Other constituents of sludge which may have an impact on the groundwater are nitrogen, chloride, and pathogenic bacteria and viruses.

Pollution from land application of municipal sludge depends upon the concentration of pollutants in the sludge, the application rate, the physical and chemical soil properties, the amount of precipitation, types of crops grown and the distance to the water table. Coarse-textured soils, a shallow water table, and high rates of precipitation favor groundwater pollution.

Septic tank pumpings, commonly referred to as septage, are a mixture of sludge, fatty materials, and wastewater. They may contain significant amounts of pathogenic organisms, nutrients, solvents, and oxygen-demanding material. Land spreading is the most frequently used septage disposal method.

B. Agricultural Activities

1. Livestock Waste

Dairy farming is the most common type of farm operation in Wisconsin. According to the Marathon County Land Conservation Department, in 1999 Marathon County had an estimated 63,000 dairy cows on an estimated 1,100 dairy farms, with most of these animals located on farms west of the Wisconsin River. In addition there are a number of beef and hog operations where livestock are fattened and then sold for slaughter.

Dairy cattle in Marathon County alone produce more than 2,000,000 gallons of manure per day and as such, the problem of safe storage and disposal of this manure is a concern. When allowed to run off from barnyards, feedlots, or farm fields, manure washes into rivers and streams, or infiltrates into the groundwater. The principal pollutants associated with this runoff are nitrogen, phosphorus, chloride, and bacteria. Concern also exists about the potential health effects of hormones, antibiotics, and chemical feed additives. In lesser incidents groundwater would become discolored, have an odor or an unusual taste. In extreme cases, such contamination would render a well unfit for human consumption.

Table 4.
Activities that May Create Groundwater Quality Problems in Marathon County

PLACE OF ORIGIN	WASTE - RELATED				NON - WASTE			
Place of Origin	Municipal	Industrial	Agricultural	Other	Municipal	Industrial	Agricultural	Other
At or near the land surface	Sludge and wastewater disposal		Feedlots (P)	Septage disposal (N)	Salt Piles	Above and on the ground storage of chemicals (P)		Highway deicing (L)
			Manure storage (P) & spreading (N)	Junkyards (P)		Stockpiles (P) Tailing piles (P) Spills (P)	Irrigation (N) Fertilizing (N) Pesticides (N) Silage (P)	Lawn fertilizing (N)
			Whey spreading (N)					
Below the land surface	Landfills		Manure Pits (P)	Septic systems (P)		Underground tanks (P)		Improperly constructed & abandoned wells (P)
	Wastewater Impoundments					Pipelines (L)		Over-pumping (Induced pollution) (P)
	Seepage cells							
	Sanitary sewers							

Animal feeding operations (AFOs) and confined animal feeding operations (CAFOs) can cause serious groundwater problems when manure is not properly managed. AFOs are defined by the Environmental Protection Agency (EPA) as agricultural enterprises where animals are kept and raised in confined situations. Only a small number of AFOs are considered CAFOs. CAFOs are facilities with 1000 or more confined animal units or facilities with 301-1000 confined animal units where waters of the United States pass through the facility or the operation discharges via a man-made device. According to the EPA, CAFOs are defined as point sources under the Clean Water Act (CWA). The CWA prohibits discharges from point sources, including CAFOs, unless these facilities are in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. Because of very high animal density, manure accumulation can easily run off into rivers, streams or into groundwater supplies. Besides organic materials, animal waste contains chlorides, nitrogen and phosphorus, among other pollutants. Leaching from waste lagoons may contaminate groundwater supplies and land application of manure may increase the levels of nitrates and pathogens in the groundwater supply. Wisconsin regulates AFOs and CAFOs by requiring these facilities to apply for a Wisconsin Pollutant Discharge Elimination System (WPDES) through the WDNR. The numbers of AFOs and CAFOs have increased over the years in Wisconsin. According to the WDNR, more than 50,000 active livestock operations exist today throughout the state. Of these, about 95 are required to have a WPDES. At present only

one farm facility within Marathon County, in the Town of Maine, is large enough to require a WPDES permit. However, within the next few years, the Marathon County Land Conservation Department predicts that the county may have as many as twenty. The EPA is also proposing to reduce the animal units per facility numbers requiring NPDES permits. Currently they are looking at reducing the 1000 animal units threshold to 700, 500 or as low as 300 animal unit facilities.

2. Manure Storage and Spreading

Livestock waste produced, stored and disposed of on dairy, beef, hog, sheep, and poultry farms are potential sources of groundwater pollution. In general, properly designed, located and managed livestock manure storage facilities have little potential for causing significant groundwater pollution. However, improperly designed and located or poorly managed facilities can cause significant problems. To prevent pollution of the County's surface and ground waters, Marathon County adopted the "*Marathon County Animal Waste & Manure Management Ordinance, August 1999*," to regulate the design, construction and application of manure from animal waste storage structures. An "Animal Waste Management Permit" is required from the Marathon County Land Conservation Department before a manure storage facility is constructed, installed, modified or abandoned. This ordinance also requires a nutrient management plan to be developed. All manure storage facilities in Marathon County under the ordinance shall meet or exceed the design and construction specifications stated in Standard 313 and 634 of the U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) Technical Guide. Prior to the issuing of an Animal Waste Storage Permit, an Animal Waste Storage Facility Plan must be submitted to the Marathon County Land Conservation Department for review. An Animal Waste Storage Facility Plan must consist of the following information:

1. number and type of animals for which storage facility will be required;

2. sketch of facility (including scale) and its location relative to buildings within 250 feet and homes within 500 feet;

3. structural details and dimensions, cross-sectional profiles, north arrow and building material specifications;

4. location of any wells within 300 feet;

5. log of soil test borings at proposed construction location, including information on soil textures within the boring profile, percent fines passing a #200 sieve, Plasticity Index (PI) of soil material used as liner, presence (if any) of bedrock and/or groundwater to a depth of at least 3 feet below the planned bottom of the storage facility;

6. time schedule for construction completion;

7. provisions for adequate drainage control of runoff around the storage facility to prevent pollution of surface and groundwater. If a navigable body of water is within 500 feet of the facility, the stream location must be shown along with verification that all DNR and County Zoning provisions have been satisfied; and

8. a Nutrient Management Plan, which shall be updated annually for the life of the storage facility, or 20 years, whichever is shorter.

All crop nutrient applications on Animal Waste Management permitted operations in Marathon County must be in accordance with the criteria outlined in Standard 590 of the USDA-NRCS Technical Guide. The following practices can result in pollution from land-spread livestock waste: 1) spreading livestock waste at rates that exceed crop nitrogen needs, 2) not crediting nitrogen from livestock waste when calculating crop fertility needs, 3) locating water wells where surface runoff can transport wastes to the well (polluted runoff may infiltrate along the well casing if it is not properly grouted), or 4) spreading of manure on frozen ground in the winter. These practices can cause an increase in sedimentation, eutrophication[5] or hypoxia (deficiency of oxygen) in surface waters and an increase in nitrate and pathogen levels in groundwater supplies.

3. Feed Storage Leachate

In livestock production systems such as dairy, large volumes of wet feed in the form of silage are stored in silos, bunkers, and bags to ferment. As the stored feed stabilizes and settles, the potential for leachate release is significant, especially if moisture levels of feed at the time of filling storage structures was greater than 68%. This leachate is a powerful pollutant if allowed to enter surface and ground water supplies. This leachate is very high in biological oxygen demand (BOD).

4. Cropland Farming

Cropland comprises nearly 280,000 acres in Marathon County. Of this cropland, nearly 6,000 acres is under irrigation. Cropping includes approximately 90,000 acres of corn, 165,000 acres of hay, 8,000 acres of soybeans, and 4,000 acres of vegetables.

Cropping practices that potentially impact groundwater are related to chemical applications, manure applications, and irrigation.

a. Fertilizer

Similar to livestock manure, the application of nitrogen-based fertilizer to land is common practice in Marathon County. Nitrogen fertilizers are converted in the soil to nitrate, which is highly stable and water soluble. However, the over-application of this fertilizer usually results in a portion of the fertilizer leaching through the soil and possibly reaching the water table. This excess nitrogen does not contribute to crop yields and may reduce the quality of nearby well water. In the Central Wisconsin River Basin, there are no significant natural sources of nitrate in the groundwater supply. Concentrations above the Wisconsin preventative action limit (PAL) of 2 mg/l can be attributed to pollutant sources. Nitrate can enter the groundwater supply from numerous sources, although agricultural land uses account for the majority of the nitrate loading and can impact large volumes of aquifers.[6]

Commercial fertilizers include a variety of types and concentrations of nitrogen, phosphorus, potassium, and trace elements, most of which are intended to improve plant growth and market value. While both nitrogen and phosphorus may contribute to eutrophication of

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[5] Eutrophication is defined by Merriam-Webster Dictionary as the process by which a body of water becomes enriched in dissolved nutrients (as phosphates) that stimulate the growth of aquatic plant life usually resulting in the depletion of dissolved oxygen.

[6] Kraft, George J., and Mechenich, David J. *Nitrate and Triazine Concentrations in the Groundwater of the Central Wisconsin River Basin.* January 29, 2001.

surface waters, the nitrogen component of fertilizer has generated the most concern about the groundwater.

b. Pesticides

Pesticides are widely used in Marathon County for insect and weed control. When properly applied, these chemicals are generally taken up by plants or broken down to harmless substances by soil organisms, sunlight, or chemical reactions. The greatest potential for pollution from field applied pesticides exists in irrigated sandy solum or thin soils over creviced bedrock. Sandy soils have rapid infiltration rates and the pesticide does not have sufficient time to break down before reaching the groundwater. Pesticides attached to sediments may infiltrate the open, connected joints in some bedrock and reach the water table. In either case, chemicals that do reach the water table can have significant impact on drinking water supplies.

The pollutants that may result from pesticide application fall into three broad categories: chlorinated hydrocarbons, organo-phosphates, and carbanate pesticides, the last being the most water soluble and therefore having the greatest contamination potential. Table 5 lists the most common chemicals used for agricultural purposes in Marathon County.

In past years, a serious pesticide contamination threat has occurred in Central Wisconsin where potatoes are grown. The insecticide Aldicarb, used to control a potato beetle, has appeared in well water supplies near potato fields. As potatoes are grown on sandy soil and are usually irrigated, the chemical quickly moves through the solum and reaches the water table.

Aldicarb is a potential carcinogen at high doses and may also affect the body's immunity system at lower levels. As a result of this contamination, when levels exceed advisories, bans on the use of the chemical have been imposed in a number of areas, including the Marathon County towns of Mosinee, Franzen, Elderon, and Reid. In addition to Aldicarb, research is also being conducted on possible dangers of several pesticides used for corn production and specialty crops.

Specialty crops such as ginseng are grown intensively in certain areas of Marathon County. Soils suitable for ginseng are usually well drained, making them highly susceptible to leaching of fertilizers and pesticides. Because of its high crop value and long rotation (3-5 years) pesticides are extensively used. In June 1999, a study of the *Impact of Ginseng Production on Groundwater Quality* was performed by the Environmental Task Force Program of the University of Wisconsin - Stevens Point. During this study soil types were identified and 27 wells were tested throughout Marathon County for 81 compounds. Six detectable contaminants were detected in four of the wells, with three of the four wells containing traces of Atrazine, which is not used for ginseng. The general consensus of this study, is that researchers could find no major effects on groundwater from pesticide application on ginseng fields.

Table 5. Agricultural Chemicals Used in Marathon County (November 2000)✳

Insecticides		
Ambush, Pounce (Permethrin)	Sevin (Carbaryl)	Lorsban (Chloropurifos)
Baythroid (Cyfluthrin)	Regent (Fipronil)	Malathion (Malathion)
D-Z-N Diazinon (Diazinon)	Warrior (Lambdacyhalothrin)	
Herbicides		
Accent (Nicosulfuron)	Atrazine (Atrazine)	Buctril (Bromoxynil)
Banvel (Dicamba)	Bladex (Cyanazine)	Prowl (Pendimethalin)
Beacon (Primisulfuron)	Fusilade (Fluazifop)	Harness, Surpass (Acetochlor)
Broadstrike, Hornet (Flumetsulam)	MCPA (MCPA)	Libery (Glufosinate)
Dual (Metolachlor)	Roundup (Glyphosate)	Lasso (Alachlor)
Eptam (EPTC)	Princep (Simazine)	Sensor or Lexone (Metribuzin)
Surflan (Oryzalin)	Distinct (Diflufenzopyr)	2,4-D amine or ester (2, 4-D)
	Pursuit (Imazethapyr)	
Fungicides		
Ridomil (Metalaxyl)	Dithane (Mancozeb)	Kocide (Copper hydroxide)
Rovral (Iprodione)	Alliete (Aluminum tris)	
Molluscicides		
Snail and Slug AG (Metaldehyde)	Deadline formulations (Metaldehyde)	Metaldehyde 7.5% Granules (Metaldehyde)
✳ Source: UWEX Field Crops and Farm Management Agent in Marathon County.		

c. Irrigation

Irrigation is generally found in areas of droughty soil, namely, soils that are excessively well drained, typically sandy, and overly coarse deposits with high permeability. These areas are highly susceptible to groundwater contamination. As previously mentioned, extensive contamination by the pesticide Aldicarb has occurred in areas of Wisconsin's Central Sand Plain, where there has been a rapid increase in the amount of irrigated farmland.

Irrigation can contribute to groundwater pollution in several ways. First, irrigated water may carry pollutants through the soil into the groundwater that are repumped and reapplied to

fields or that enters regional or local systems and leaves the site, posing hazards to others down-gradient. Second, the malfunction or lack of back siphoning valves may permit back flow to the well or chemicals applied through the irrigation system. Another major problem of agricultural irrigation is the quantity of water it uses; large withdrawals may adversely affect nearby shallow wells and cause other problems related to lowered groundwater levels.

Irrigated agriculture is becoming more common in the southeast, south central, and northeast sections of Marathon County. The highest concentrations of high capacity wells for irrigation are located in the towns of Franzen (15), Bevent (10), Reid (7), Elderon (6), and Harrison (5) (Map 7). A high capacity groundwater extraction system is defined as any well, or combination of wells on a single property, that has a maximum pumping capacity of 70 or more gallons per minute (Ch. 281.17 (1), Wisconsin Statutes). There are approximately 9,422 high capacity wells in Wisconsin. These wells are used primarily for municipal water supplies, agricultural and industrial purposes. There are several different types of high capacity wells depending both on the geology in which the well is constructed and the purpose for which the well will be used. Usually the types are divided by: confined or unconfined aquifer; soil, fractured bedrock or unfractured bedrock aquifer; non-potable, potable school, or sewage treatment plant water usage. Each of these separate high capacity well types have specific design requirements which are outlined in Table I, II, III and IV of Chapter NR 812.12, Wis. Adm. Code. Additional regulations exist for direct injection of fertilizers or pesticides into the ground. In such instances, farmers must install reduced pressure zone backflow preventer values onto their irrigation systems. High capacity wells must be approved by the WDNR's Bureau of Drinking Water and Groundwater. The Bureau of Drinking Water and Groundwater will only deny or limit a proposal for high capacity water usage if the operation of the high capacity well system on a property would have an adverse impact on water availability to a public utility well. The Department also has the authority to set specific design requirements to aid in minimizing the risk for groundwater contamination affecting the quality of the water that may be extracted by the well. The Department has the authority to rescind any approval if it determines that the applicant submitted an incomplete proposal, or if the system is not constructed and operated in accordance with all the conditions of the Department's approval.

C. Forestry Activities

Over one-third of Marathon County's land cover or 376,100 acres is forested according to a 1996 statewide inventory. The Marathon County Forestry Department manages over 28,000 acres of public forests in a multi-use manner incorporating recreational, wildlife enhancement, and timber production. The majority of forest land within Marathon County is privately owned. Forests play a vital role in purifying and maintaining clean water for streams, lakes, and groundwater. Although water quality impacts due to non-point source pollution represent a major source of pollutants, forestry practices contribute only a very small component of pollution. Furthermore, the types of pollutants attributed to forestry operations are sediment and nutrients which are usually limited to surface water discharge. By developing forestry management plans for both public and private lands that incorporate best management practices (BMPs) relative to chemical use, harvesting, access road construction, erosion control, etc., we can mitigate any negative water resource impacts as well as utilize these forests for their recreational, watershed, and timber production potential.

D. Materials Storage and Handling Activities

Many solids and liquids are placed on the ground for temporary storage. Past examples are stockpiles of raw materials, chemicals, products, and waste at industrial sites; piles of raw materials awaiting use and waste placed for temporary storage at construction sites; stockpiles of chemicals, manure, agricultural products and partially filled containers in agricultural areas; and stockpiles of salt for road deicing. Some of these materials are kept in the open, while others are kept in enclosures. Many of these materials or wastes are hazardous, or even toxic. If the stored materials or wastes contain water soluble products, they will leach out when exposed to rain and infiltrate into the ground, which may lead to groundwater pollution. Other than road salt used by municipalities, most storage of materials of this type is not currently regulated.

1. Chemical Storage Tanks

Storage and transmission of a wide variety of fuels and chemicals are inherent in many industrial and commercial uses. In addition, many home owners have found it more convenient and economical to buy large supplies of gasoline or home heating fuels and store them on their premises. In most cases, local fire regulations have required these chemicals to be stored in buried, underground tanks.

Special risks are involved when hazardous materials are stored in underground tanks. These tanks are dangerous because if they leak, potential contaminants lie closer to groundwater tables and below the biologically active soil layer where attenuation of contaminants would normally take place. Furthermore, leakage from such tanks may go unnoticed for long periods of time because the leaks cannot readily be seen.

The potential for tank leakage is great. In the past, underground gasoline and oil storage tanks were constructed of uncoated, single layer steel which would begin to corrode soon after installation. In Wisconsin, there may be thousands of such tanks still in use today. Fiberglass tanks were developed in the 1960's as an alternative to steel. Although corrosion problems are reduced, fiberglass tends to be more susceptible to breakage during installation and poor maintenance and natural climatic events such as earth contraction caused by freezing and thawing of the ground.

In addition to the tanks themselves, leaks can also develop in the connections and lines from the tank. This may occur from poor installation, corrosion or from abrasion caused by backfill surrounding the connections.

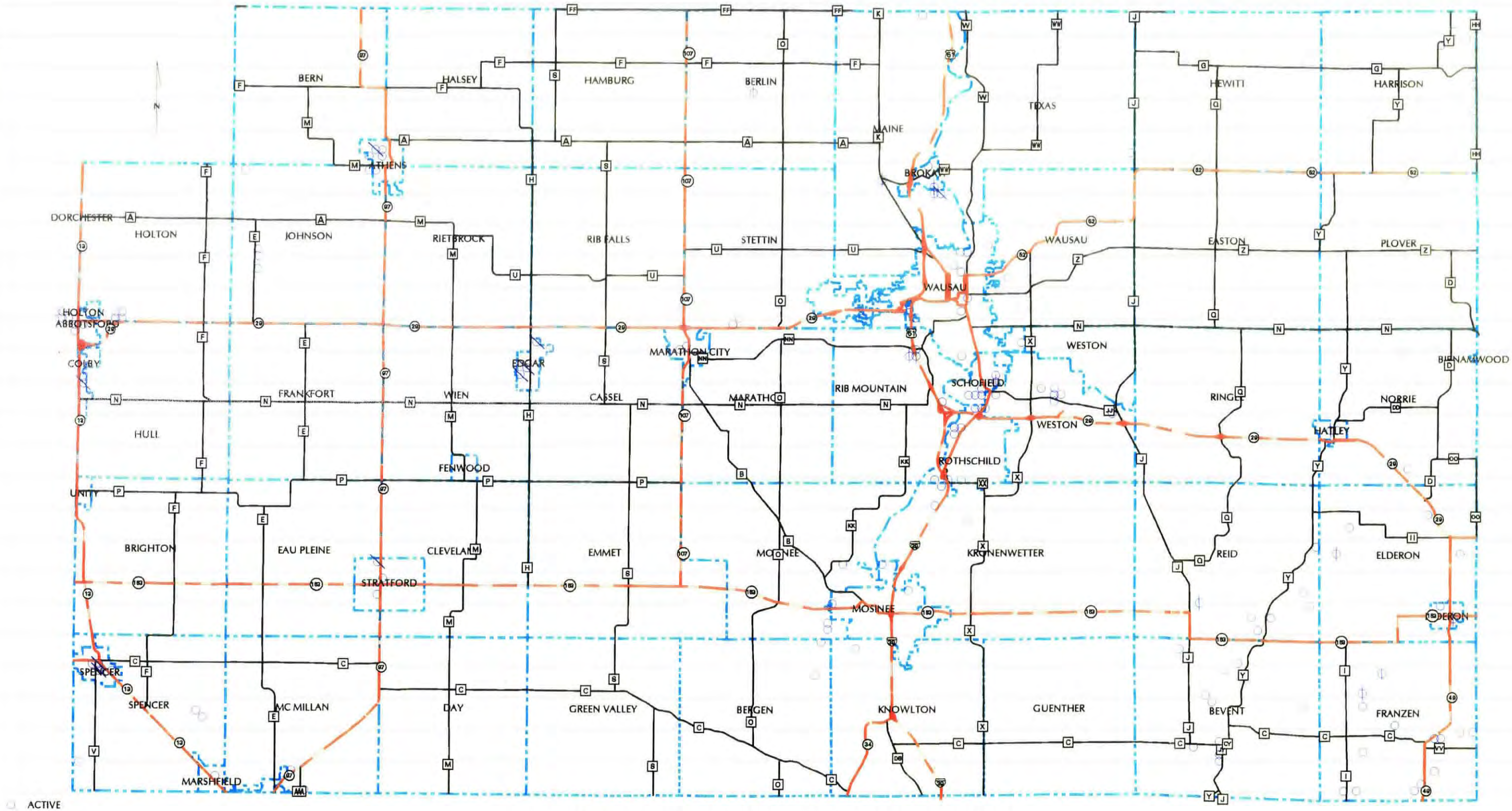
Studies conducted by the Environmental Protection Agency (EPA) and other public and private concerns reveal the following information:

1. The three primary causes of leaks from underground tanks are: 1) corrosion, 2) poor operation and maintenance practices.

2. The majority of tanks made of unprotected steel will begin to leak anywhere from two to 20 years from the date of installation.

3. Fiberglass tanks have a longer life span than steel tanks, but can easily be damaged during installation or maintenance. Almost all leaks from fiberglass tanks have been caused by breakage or separation of the fiberglass.

HIGH CAPACITY WELLS



ACTIVE
INACTIVE
ABANDONED

MARATHON COUNTY, WISCONSIN

Source: WI DNR

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

MAP#7

4. Improper installation can occur in many ways. Poor connections may loosen over time, anchoring and securing of the tank may break or loosen causing a tank shift. The use of inappropriate bedding or backfilling materials may exacerbate abrasion or corrosion.

5. Poor operating practices during pumping or filling of tanks can cause leaks. Many tank leakages have been attributed to puncture by dipsticks during inventory measurement.

6. Proper inventory control, including periodic leak testing is **essential** in the timely detection of leaking tanks.

Most incidents of leaking storage tanks are discovered in the service station industry, although more and more incidents are occurring from private or industrial tanks. The greatest problems are those underground tanks or gas stations, where the tanks have not been removed, replaced or properly abandoned. In some instances, gasoline remains inside until leaks form and the entire contents drain into the soil and rock layers. Sometimes leaks occur long after the business has left and the land use has changed. Entire residential neighborhoods have had their wells contaminated by abandoned tanks that were never properly removed.

The majority of chemical tanks are located in urban areas on main roads within a municipality. As a result, such tanks can be very close to public water well supplies and can place a large population in an "at-risk" situation for potential water contamination.

As gasoline and other petroleum products leak into groundwater supplies, many potentially carcinogenic chemicals - benzene, toluene, xylene, phenols, dichloro and trichlorenthanes - may remain in the groundwater for years. Another potentially dangerous situation caused by leaking tanks is that of petroleum vapors or fumes rising which can enter basements, wells or sewers presenting potential fire and explosion hazards.

The most pressing concern, however, lies with those tanks already installed. Most of these tanks were installed by private parties, with no regulations to govern their installation, connection, or use of testing.

Wisconsin's regulatory program for petroleum storage tanks is presently divided between two agencies - the Department of Commerce and the WDNR. The Department of Commerce is responsible for:

1. Tank standards for both underground and aboveground tank systems

2. Wisconsin's tank registration database

3. Wisconsin's state fund for reimbursement of environmental cleanup costs, the Petroleum Environmental Cleanup Fund Act (PECFA) - COMM 47

4. Regulatory oversight of petroleum tank discharges to the environment that do not include high risk factors.

The Department of Natural Resources (DNR) is responsible for establishing investigation and remedial action requirements for contamination from sources in the NR 700 series of

environmental rules (Consultant qualifications, site investigations, interim and immediate actions, soil standards, selecting and implementing remedial actions, case closure and enforcement). The DNR also has regulatory oversight of LUST (Leaking Underground Storage Tanks) sites with high risk factors. These high risk factors include:

1. confirmed contamination in a water supply well above a NR 140 (Groundwater Standards) preventative action limit,

2. a confirmed free petroleum product with a thickness of .01 feet or more,

3. groundwater contamination above a NR 140 enforcement standard within 1000 feet of a well operated by a public utility,

4. groundwater contamination above a NR 140 enforcement standard within 100 feet of any other water supply well, and

5. groundwater contamination above a NR 140 enforcement standard in fractured bedrock.

The DNR also has jurisdiction over sites where risk factors have not been determined and sites where petroleum contamination is co-mingled with non-petroleum contamination. Currently, all Underground Storage Tanks (UST) and LUSTs are regulated by administrative rules COMM 10, COMM 47, NR 700 series, NR 100 series, NR 140, NR 141 and NR 149.[7]

2. Spills

There are approximately 1200 spills reported in Wisconsin each year (WDNR, 1998). During the years 1995-2000, more than 150 spills were reported to the Marathon County Office of Emergency Management. An undetermined number of additional spills and illegal dumpings go unreported. Spills that are not reported or properly cleaned up are the spills that will have the greatest impact to the environment and the County's groundwater supply. Petroleum products are the pollutants most commonly involved in spills. Spills can occur anywhere at any time; on commercial or industrial sites; on highways, airport runways, waterways, or railroads. Fortunately, many spills are small and can be cleaned up quickly before much of the substance reaches the groundwater.

The number of hazardous spills indicates that the existing preventive controls are not working to the degree necessary to protect groundwater. There is a high risk to adjacent wells for groundwater pollution if spills are not immediately and adequately cleaned up. If a spill is not cleaned up immediately and reaches the groundwater, the cost of remedial action (if available) can be very high. Since there is a lack of remedial technology, some spills cannot be cleaned up. Better management of all facilities and equipment used for storage of hazardous materials, careful transport of these materials, and immediate handling of spills by trained individuals can help minimize the risk of polluting groundwater.

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[7] Wisconsin Department of Natural Resources (WDNR) Wisconsin Tank Regulations - UST and LUST Home Page. 1 June 1998. Wisconsin Department of Natural Resources. 29 December 2000 <http://www.dnr.state.wi.us/>

3. Road Salt

Winter storms in Wisconsin require extensive snow plowing and road de-icing. Salt is the most commonly used substance to melt accumulated ice, however, many counties are experimenting with new anti-icing and deicing chemicals. As such, road salting, salt storage and snow disposal are all potential sources of groundwater contamination. In an average winter 12,500 tons of salt are spread on streets and highways throughout Marathon County or nearly 4 tons every winter for each mile of state, county or local road. As salt residues collect on roadsides, spring vegetation growth is impaired or killed completely. Salt percolates down through the soil and can enter nearby shallow wells, particularly at the bottom of steep grades that are heavily salted and where highway runoff is concentrated in a small collection area. In Wisconsin, chloride concentrations in direct highway runoff have been measured as high as 10,250 parts per million (ppm). The recommended maximum level of chloride in a potable water supply well is 250 ppm.[8]

Salt storage in uncovered piles also appears to be another contamination source especially when the floor of the storage area is composed of an unsealed material. Highway salt storage requirements are outlined in Chapter Trans 277 of the Wisconsin Administrative Code. The storage facility must be "designed, constructed and maintained to divert any runoff from the terrain surrounding the storage facility to prevent any contact between the runoff and highway salt at the storage facility." Recommended storage of salt is in an enclosed shelter with a sealed floor.

Snow Storage Areas - those places where snow cleared from streets and highways are dumped - are also rich with salt, resulting in salt saturated soil when the snow melts in the spring. The spring rain that melts these snow piles may also infiltrate salt into the water table.

4. Nuclear Wastes

Central and Eastern Wisconsin have previously been under consideration by the Department of Energy as a potential site for a depository for nuclear waste from the eastern part of the nation. To date, there are no nuclear waste facilities located in Marathon County. However, nuclear wastes are transported through the county in route to nuclear waste facilities. If an accident occurred in route, there is the potential for nuclear wastes to spill and impact the groundwater supply. If a nuclear waste facility is ever built within Marathon County, the facility will most likely have an impact upon the groundwater supplies of Marathon County. Further studies would then be needed to reveal what the threats may be and what precautions are necessary to protect the groundwater supply.

5. Household Hazardous Wastes

Most homes generate small quantities of potentially troublesome chemical wastes. These include drain cleaners, paint thinners, solvents, motor oil and battery acid.

Although individual amounts of these materials may be small, a community or county can collectively generate large supplies of chemicals. Since 1997, the Marathon County Hazardous Waste Facility has collected more than 132,529 pounds of hazardous material (Marathon County Health Department & Marathon County Solid Waste Department).

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[8] Honachefsky, William B., *Ecologically Based Municipal Land Use Planning*, Lewis Publishers, New York, 2000, 1.

Other sources of urban groundwater contamination include lawn care products such as pesticides and fertilizers. Similar to agricultural use, these products are used on public and private lawns and gardens, business and industrial headquarters and especially on recreational facilities such as playing fields and golf courses. Misuse can seriously contaminate local groundwater supplies.

E. Earth Disturbance Activities

Wherever subsurface drilling, excavating, or earth filling occurs in the immediate vicinity of the water table, the potential for contaminants to enter the groundwater increases.

1. Abandoned and Improperly Constructed Wells

Water wells, under certain conditions, can be conduits for groundwater pollution. Typical examples are wells with casings that have been corroded or ruptured, or wells in which the surface casing has not been adequately sealed to prevent drainage of pollutants from the land surface to the well. Unplugged abandoned wells also pose a major threat to groundwater because they permit water containing pollutants to migrate freely from one aquifer to another or from the land surface to an aquifer.

2. Aquifer Penetration

Aquifer penetration results from excavations that reach the saturated zone of a surficial or bedrock aquifer. In Marathon County this is usually caused by surface mining such as rock quarries, gravel and granite pits and any isolated deep mines. These excavations do not always create hazards, but do increase the risk to aquifers from adjacent or succeeding activities. In some cases, abandoned quarries become illegal dumping grounds for garbage, wreckage or hazardous wastes which then can seep into an exposed aquifer.

3. Mine Tailings and Fly Ash

Mining or quarrying operations often leave waste piles of overburden, refining wastes and tailings. In areas where coal or lead mining occurs mining wastes have led to the leaching of acids or minerals in surface and groundwater supplies. In the western states, uranium mining has lead to some incidents of contamination resulting from the leaching of radioactive materials into the water table.

Fly ash, the waste product of coal fired electric generating plants, is composed primarily of inert materials but may contain small quantities of heavy metals and other substances. Tests are currently under way to determine the effects of landfilling fly ash. Fly ash can be recycled and is currently sold to the concrete industry to be used as an additive to increase the strength of concrete.

4. Wetland Filling

Anytime development of agricultural, residential or industrial land involves filling in a wetland, the WDNR and Army Corp of Engineers require a permit to be obtained. Earthen fill must be clean (without contamination) so that the shallow water table does not become polluted.

5. Construction Site Areas

a. Non-metallic Mining

During quarrying operations for sand, gravel, and hard rock groundwater penetration is common. Activities and material handling/storage such as fuels and lubricants must be done to minimize groundwater impacts. Furthermore, these activities produce large spoil piles of topsoil and overburden that if allowed to leave the site could impact surface water through sediment delivery. Similarly, areas of disturbance greater than 5 acres in size for industrial development also produce spoil piles and discharges that can produce off-site delivery impacts to surface and groundwater resources.

F. Commercial Activities

1. High Capacity Wells for Bottling Water

Over the last ten years, the demand for bottled water has exploded into a 4.33 billion-dollar industry.[9] Wisconsin is well known for its pristine streams and rivers and bottled water companies have recently taken notice. Currently there are already about twenty commercial bottled water plants operating throughout the State. However, newly proposed plants, like the Perrier Bottling Plant in the Town of New Haven in Adams County, are now seeing opposition from local residents who fear that the plants will draw down the areas' groundwater tables, damage trout streams, and ultimately harm the environment.

Commercial water bottling plants, like Perrier, use high capacity wells to pump out large amounts of ground or surface water. The new Perrier plant is drawing opposition for just this reason. The proposed plant is expected to pump 500 gallons of water per minute, 24 hours a day, seven days a week.[10] One of the largest bottling plants already operating in Wisconsin, Nicolet Natural Artesian Water Co., pumps 200 gallons of water per minute. The WDNR is the permitting agency for high capacity wells and will have the ultimate say as to what the actual pumping levels will be.

A high capacity groundwater extraction system is defined as any well, or combination of wells on a single property, that has a maximum pumping capacity of 70 or more gallons per minute (Ch. 281.17 (1), Wisconsin Statutes). High capacity wells must be approved by the WDNR's Bureau of Drinking Water and Groundwater. The Bureau of Drinking Water and Groundwater will only deny or limit a proposal for high capacity water usage if the operation of the high capacity well system on a property would have an adverse impact on water availability to a public utility well. The Department also has the authority to set specific design requirements to aid in minimizing the risk for groundwater contamination affecting the quality of the water that may be extracted by the well. The Department has the authority to rescind any approval if it determines that the applicant submitted an incomplete proposal, or if the system is not constructed and operated in accordance with all the conditions of the Department's approval.

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[9] Reuters. "Perrier Seeks Water From Pristine Wisconsin Spring." 24 December 1999. Forests.org. 26 Jan 2001. <http://forests.org/archive/america/wiselwa.htm>.

[10] Zaleski, Rob. "Hope Bubbles Up in the Perrier Wars-The Little Town That Could." *The Capital Times* 7 Oct 2000. 26 Jan 2001 <http://captimes.com/news/local/2000/10/07/perrier_100700.html>.

The Perrier plant has been approved through the WDNR permit process to install high-capacity wells in two nearby springs, about eight miles northeast of Wisconsin Dells in Adams County.[11] Perrier has applied for a rezone of the proposed land from agricultural use to industrial use. However, due to a year long zoning moratorium imposed by the Town of New Haven board last March the Adams County Zoning Committee cannot act on the application until March of 2001.[12] Being a local issue, the Adams County Board will have the final say concerning the Perrier Plant and installation of the high capacity wells.

Currently there are no water bottling plants operating or proposed in Marathon County. However, if the bottled water market continues to be profitable, this may become an issue within the County as more companies look to Wisconsin and its abundant supply of pristine groundwater.

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[11] Zaleski, Rob. "Hope Bubbles Up in the Perrier Wars-The Little Town That Could." *The Capital Times* 7 Oct 2000. 26 Jan 2001 <http://captimes.com/news/local/2000/10/07/perrier_100700.html>.

[12] Wisconsin Stewardship Network Home Page. March 2000. Wisconsin Stewardship Network. 26 Jan 2001 <http://www.wsn.org/water/NewHaven.html>.

CURRENT DATABASES AND MONITORING

A. FEDERAL AGENCIES

B. STATE AGENCIES

1. Department of Natural Resources (WDNR)
   - WPDES Permits
   - Spills
   - Hazardous Waste Generators
   - Leaking Underground Storage Tank (LUST) Sites
   - Landfills

2. Wisconsin Geological Natural History Survey (WGNHS)

3. Department of Commerce
   - Storage Tanks

4. Department of Agriculture, Trade and Consumer Protection (DATCP)
   - Pesticide Use Inventory

5. Department of Transportation (DOT)
   - Hazardous Waste Haulers

C. MARATHON COUNTY

1. Health Department
   - Environmental Health Lab
   - Phase I Environmental Assessments

2. Land Conservation Department
   - Watershed Monitoring
   - Permitted Animal Waste Facilities

3. Zoning Department
   - Non-metallic Mining Activities
   - On-site Waste Systems
   - Shoreland Zoning
   - Floodplain Determination

4. Planning Department
   - NRCS Digital Soils
   - DNR Digital Wetlands
   - Parcels and Planimetric Basemap Layers
   - 208 Sewer Service Area Boundary Review/Amendments
   - Sewer Service Extension Review (Water Quality)
   - Comprehensive Planning
   - Land Use and Transportation Planning

5. Solid Waste Department

D. LOCAL GOVERNMENT (CITIES, VILLAGES AND TOWNS)

1. Municipal Wells
2. Comprehensive Planning
3. Land Use Planning
4. Zoning Authority

PREVENTATIVE ACTIONS

A community undertaking a groundwater protection program must be willing to make a long-term commitment to protecting its water resources. It must select the specific actions best suited to its situation and financial capability, and consider one or more of these actions to carry out the management approach decided upon.

Preventative actions can be classified into two categories, regulatory and non-regulatory.

1. NON-REGULATORY MEASURES

A. Educational Programs

Perhaps the best long term solution to preventing groundwater contamination is by educating the public at all age levels. School children from early ages onward need to be instructed in basic environmental subjects, including water resources and groundwater management. Citizens must be made aware of how certain actions can lead to degradation of our groundwater supplies and how to prevent such occurrences.

Having an educated citizenry, aware of actions that cause groundwater pollution, and its consequences are the best long-term protection of our groundwater resources. In 2000, Marathon County was designated as a Groundwater Guardian by The Groundwater Foundation, a non-profit organization dedicated to educating and motivating people to care for and about groundwater. To become a Groundwater Guardian, the Marathon County Safe Drinking Water Committee created a Result Oriented Activities (ROAs) Plan to address the county's groundwater protection concerns. ROAs fall into many categories including education, awareness, pollution prevention, public policy, conservation, and best management practices. To become a Groundwater Guardian the team completed the following ROAs:

- Worked to maintain a collection of water education resource materials which includes books, videos, groundwater models and teaching guides.
- Presented a workshop targeted toward teachers to encourage the presentation of water-related concepts in the classroom.
- Set up a booth at the Central Wisconsin Educators Convention to encourage educators to include groundwater-related issues in their curriculum.
- Set up a booth at the Wausau Area Builders Home Show to distribute information on drinking water issues.
- Introduced the Groundwater Guardian program, distributed information, and promoted the use of the Water Resources Collection through a display at the Wisconsin Valley Fair.[13]

Groundwater education programs are also currently being conducted in Marathon County by the County Health Department. In the past, educational programs have been conducted for elementary schools, youth and civic groups and the general public. Specialized educational and training programs in pesticide management are also being taught to area farmers by UW-Extension, as required by law. In 1997, the Health Department and UW-Extension established a Water Education Resource Center in the Marathon County Public Library Headquarters-Wausau. The Center provides water test kits, teacher manuals, watershed/hazardous waste models, groundwater models, and a myriad of water-related publications.

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[13] Groundwater Guardian Home Page. Jan 2000. The Groundwater Foundation. 26 Dec 2000 <http://www.groundwater.org>.

B. Well Testing

Well testing should be encouraged in all areas of the County, especially in areas where the potential for groundwater contamination is high.

Well testing can provide important data on the quality of water used from a particular well, or from a series of wells located in close proximity. If periodically tested, data can be examined to reveal changes in quality or the gradual introduction of foreign substances. With this information, further investigation can locate and ultimately eliminate the offending source of contamination before it becomes a major problem.

The Marathon County Health Department supports a very active Environmental Health Division and a certified laboratory providing water sample analysis. In 2000, the lab processed more than 6,100 water supply samples on 3,000 private wells (Marathon County Health Department).

One of the missions of the Environmental Health Division is to protect the integrity of the natural environment, reduce the potential for groundwater contamination affecting drinking water supplies, maintain the public's health and safety, ensure a nuisance free environment, and to provide environmental consultation services in the home and occupational setting.

The Health Department has four (4) objectives in their well testing program:

1. Water testing services for bacteria, nitrate, fluoride levels, and specific water chemistry components.

2. Recording test results and locations provides a drinking water database.

3. Consultation on specific well contamination problems and associated health effects.

4. The County Health Department entered into a performance contract with the Department of Natural Resources in 1991. The contract requires the collection of annual water samples, the sanitary inspections of all public water supply systems every five years, and the enforcement of well construction and drinking water quality standards.

C. Collection of Hazardous Waste and Chemicals

When household chemicals and wastes are disposed of in a proper manner it is unlikely they will reach the water table and cause contamination problems. However, many residents lack the technical knowledge and the proper facilities to dispose of their individual chemical wastes. It is therefore desirable to have a facility available to provide for the safe disposal of chemicals, which the entire community can utilize.

Marathon County has had the foresight to establish two programs which take in hazardous wastes.

In 1983 the Community Recycling Cooperative was formed in Wausau to collect and recycle materials that would otherwise be land filled or improperly disposed of. In 1990 the Recycling Law was passed in Wisconsin. Now, just about everyone in the state recycles-97 percent of the households in the state (WDNR, 2000). Items such as newspaper, cardboard, glass, plastic, aluminum and steel cans, have been collected and recycled. Today, the State of Wisconsin is recycling 25 percent of all the "junk" we use to throw away, saving valuable landfill space and

conserving natural resources (WDNR, 2000). Of particular interest to groundwater concerns is the collection of used motor oil and automotive batteries, both which cause major contamination problems.

In Wausau 18,471 gallons of used motor oil and 33,633 pounds of batteries (and battery acid) were collected in the years 1983-86. Additional recycling centers have since been created in Mosinee, Stratford and Spencer.

Recognizing a need to properly dispose of other hazardous household chemicals, Marathon County in 1985 established a "Clean Sweep" program for its residents. Once each year, individuals could bring their unused household chemicals to a collection point where they are sorted, then hauled to a special disposal facility. During the years 1985-1997, Clean Sweep collection sites in Marathon County collected 163,247 pounds of hazardous materials.

In 1987, the Marathon County Hazardous Waste Corporation was formed. A unique combination of representatives from private and governmental sectors, the Corporation opened a permanent hazardous waste collection facility in 1997. This facility is available to households, farmers and small businesses for the collection of household, agricultural and Very Small Quantity Generator (VSQG's) hazardous waste. Today, the Corporation boasts nearly 130 members with an additional 1000 member mailing list, representing a wide variety of environmental professionals from throughout the Midwest, including leaders from virtually every major business and industry in Marathon County.

Since the opening of the permanent collection facility more than 132,529 pounds of hazardous material have been collected. The ability to drop off hazardous waste on a year-round basis has resulted in a cleaner environment in and around Marathon County. The collection facility has recently begun accepting batteries for recycling and is establishing an annual roundup of obsolete home computers.

Marathon County is also an active participant in "Wisconsin's Agricultural Clean Sweep Program." Agricultural Clean Sweep collections provide a safe and convenient way for farmers and small business owners to dispose of unwanted pesticides. Both county and state funds pay for the program. According to Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP), Wisconsin's Agricultural Clean Sweep Program has collected nearly 1.5 million pounds of agricultural chemicals from nearly 9,000 farmers and businesses since 1990. This program continues to rank among the top pesticide collection programs in the nation. Only the states of Texas and Minnesota have collected more waste chemicals than Wisconsin. Marathon County has a permanent agricultural waste collection facility available to residents through the Marathon County Hazardous Waste Collection Facility.

D. Recycling Programs

Commercial, industrial, agricultural and residential recycling programs are currently in place throughout Marathon County to reduce waste in the County's landfill. Plastics, glass, cardboard, aluminum and paper are currently collected and sent to recycling facilities instead of taking up valuable space in the landfill.

E. Planning

Good, sound land use planning conducted by local and County government can be of great benefit in the long term protection of groundwater supplies. Carefully planned future

development can prevent construction on sensitive environmental areas, while site planning can lay out land use practices designed to enhance natural groundwater attenuation rather than alter it.

Some planning activities related to groundwater protection include:

* Plan Review.
* Site Planning.
* Writing appropriate development codes.
* Environmental planning for sensitive areas (recharge basins, wetlands, floodplains, etc.)

Marathon County municipalities need to give groundwater resources careful consideration when reviewing development proposals. Factors such as location, soil suitability, surrounding land use, environmental conditions and on-site conditions should be given more careful scrutiny before a building permit, re-zone or conditional use is granted. Most of this concern has developed in municipalities where groundwater problems have already occurred. While such incidents have called attention to the need for better land use controls, there are still a large number of municipalities that give little or no attention to the groundwater impacts of new development. In October 1999, Wisconsin's new "Smart Growth" Legislation was enacted which requires all municipalities (cities, villages, towns), counties and Regional Planning Commissions (RPC's) in the state to adopt a comprehensive plan by January 1, 2010 if they engage in programs or activities that affect land use. Few municipalities within Marathon County, the county included, currently have a comprehensive plan that meets these requirements. The County should encourage municipalities within Marathon County to complete a comprehensive plan for their community that 1) meets the requirements of Wisconsin's "Smart Growth Initiative" and 2) encourages future development to be placed where it will have the least impact to the county's groundwater supply. Marathon County is currently in the process of developing a county development plan that will meet these requirements.

F. Inventory of Potential Contaminants

To adequately protect groundwater supplies from chemical contamination, knowledge of the amount and locations of potential contaminants from known sources is essential. In order to do this, a complete inventory of these chemicals is required. An inventory should include a listing of the types of chemicals, usage, location amounts, and storage practices. From such an inventory advanced plans can be formulated to better prevent spills from occurring, and allow a quicker response to spill incidents that do occur.

In 1983, the Marathon County Office of Emergency Management conducted a detailed inventory of county businesses and industrial firms that utilize and store chemicals and other potential groundwater contaminants. This inventory revealed more than 60 businesses that routinely use and store bulk quantities of potential groundwater contaminating chemicals. These chemicals are used for a variety of purposes and consist of petroleum products, acids, alkalis, ammonia, dyes, radioactive materials, and agricultural chemicals. The Office of Emergency Management will periodically update this list. Not included in this inventory are retail gasoline service stations or private underground gasoline or home heating fuel tanks. However, Wisconsin Administrative Code COMM10 - Flammable and Combustible Liquids, requires the Department of Commerce's

Division of Environmental Regulatory Services-Bureau of Storage Tank Regulation to maintain an aboveground and underground storage tank database.

SARA Title III (Superfund Amendments and Reauthorization Act of 1986) also known as the Emergency Planning and Community Right-to-Know Act (EPCRA) was enacted in 1986 by Congress to initiate local emergency planning and preparedness for chemical accidents. The provisions of SARA/EPCRA provide for the following:

- ***Section 301 of SARA:*** ***Provides a 'Statutory Requirement' to create a Local Planning District***

In Wisconsin, counties are the Local Planning Districts, and must create a Local Emergency Planning Committee (LEPC) for that Planning District. The LEPC is a statutory committee of the Marathon County Board. The Emergency Management Office acts as the designated contact for the public and LEPC to receive information concerning substances on-site at a facility. The LEPC also reviews and approves off-site facility plans and performs other related administrative tasks related to the SARA Program.

- ***Sections 302/303 of SARA: Emergency Planning Notification/Plan Development***

These sections of SARA require that users or facilities that have on-site *Extremely Hazardous Substances* (EHS) in amounts at, or above limits established by the EPA, notify the local jurisdiction through the LEPC. These facilities are also required to develop an Off-Site Response Plan for these substances.

- ***Section 304 of SARA:*** ***Emergency Notification of Release***

This section of SARA requires that facilities must immediately notify the local jurisdiction likely to be affected if there is a release into the environment of a listed hazardous substance that exceeds the reportable quantity for that substance.

- ***Section 311/312: Community Right-to-Know (Chemical Inventory Reporting)***

There are two community right-to-know reporting requirements within the *Emergency Planning and Community Right-to-Know Act.* They require facilities to submit either copies of their Material Safety Data Summary Sheets (MSDS's) or a list (Tier II forms) of chemicals to the LEPC. Reporting under Section 312 also requires a facility to submit an annual *Emergency and Hazardous Chemical Inventory Form* to the LEPC.

Marathon County has approximately 150 facilities subject to SARA Section 311 and Section 312 reporting requirements. These facilities meet or exceed the amounts of hazardous materials stored on-site as established by the EPA. They are required to annually submit local reports concerning the amounts of these products. Of these facilities subject to the reporting requirements, 48 are identified and subject to the Section 302 Planning Requirements. These facilities have Extremely Hazardous Substances on-site that meets or exceed the EPA's published *Threshold Planning Quantities* for these substances. All of these facilities are considered high-risk, and are required to have an individual *Off-Site Facility Plan* developed in the event there is a chemical release at the facility.

G. Cleanup of Hazardous Material Spills

Spills of hazardous materials can occur in a variety of ways. The most common occurrence takes place during chemical transport, such as after a train derailment or a traffic accident involving a tanker truck. It can also occur from excavation where a pipe is accidently uncovered and broken, or from severe weather toppling tanks or other containers.

When a spill is reported, the Marathon County Office of Emergency Management responds in cooperation with the Department of Natural Resources and the Environmental Protection Agency. Groundwater contamination can still be significantly reduced or prevented if clean up occurs before the materials reach the water table. Notification of spills should occur as soon as possible to minimize contamination threats.

Spill records/documentation are maintained by the Marathon County Office of Emergency Management by reports from the following sources:

1. If a Deputy was sent to the scene and/or an *Incident Report* was generated and filed.

2. An *Incident Report* was received from a Law Enforcement Agency other than the Marathon County Sheriff's Department.

3. Notification from the State Duty Officer.

4. An *Incident Report* that was generated through the Office of Emergency Management,

It is the spiller's responsibility to cleanup the spill. All Deputies, Law Enforcement Agencies and Fire Departments in Marathon County have been provided with copies of a *Spill Contractor List.* Responsible parties are also provided a copy of this list and advised to have the spill cleaned up. They can use one of the contractors on the list, or choose one of their own.

The Marathon County Office of Emergency Management completes a *Spill Report Form* from one of the above sources and forewords it to the following:

- Marathon County Health Department - for their review, and if appropriate, follow-up investigation.

- DNR Spill Coordinator, Western Regional Office. The DNR responsibility is based on Administrative Code NR 706 for investigative and cleanup activities on reported releases or spills.

- Local Regional Wisconsin Emergency Management (WEM) Office for their review.

For significant incidents, the State Duty Officer is also contacted and advised of the spill.

H. Professional Assistance

Protecting groundwater supplies for future use requires detailed knowledge of the resource itself. This knowledge can then be translated into positive measures such as educational programs, protective regulation, or preventative action.

The closest form of professional assistance for groundwater subjects can be found at the County level where there are specialists in planning, zoning, soil science, conservation, health and emergency management.

Another form of professional assistance widely available to local government is that offered through state and county University of Wisconsin Extension. With the assistance of a County Resource or Agriculture Agent, individuals and local units of government can call upon the expertise of Extension personnel for help in specialized groundwater areas.

The study of groundwater is of a highly technical nature, however, involving expertise in geology, hydrology, chemistry, physics, soil science and other related fields. Few local governments can afford to keep a hydrogeologist on their full-time staff. As a result, most specialized research involving groundwater is conducted by consulting firms or state agencies who employ hydrogeologists. These hydrogeologists can work cooperatively with local staff persons (Health Department, UW-Extension, Planning, Zoning, Solid Waste, Land Conservation) and the County Board to develop appropriate groundwater protection recommendations.

Another possible way for the County to closely follow and act on future groundwater situations is through a designated committee of the County Board that deals with environmental resources issues like groundwater. A committee that directly addresses all groundwater issues is likely to be more knowledgeable and responsive when certain situations require quick and effective action. In 1990, the Marathon County Board of Supervisors established a Groundwater Management Committee (GMC) to address groundwater issues in Marathon County. Before the creation of this committee, concerns of this type were referred to the Land Conservation Committee, the Forestry, Recreation, Zoning and Planning Committee or the Marathon County Health Board. In 2000, the GMC and its Technical Advisory Committee (TAC) were abolished and replaced with the Environmental Resources Committee. In June 2000, a TAC was created for the Environmental Resources Committee composed of County staff. The Environmental Resources Committee and its TAC are currently responsible for overseeing all aspects of the County's natural resources, including groundwater.

In 1986, Marathon County completed a contractual arrangement with the Wisconsin Geological and Natural History Survey (WGNHS) for detailed scientific aquifer research in the Wisconsin River Valley between Brokaw and Mosinee. The WGNHS has also assisted in identifying municipal well recharge areas for wells in Rib Mountain, Kronenwetter and the City of Mosinee.

Another source for detailed groundwater research and education is the Central Wisconsin Groundwater Center, a research facility of the University of Wisconsin Extension. Their offices are located on the University of Wisconsin-Stevens Point campus.

I. Soil and Water Conservation Planning

Priority planning should be developed in areas of the county with impacted water resources. In these priority areas, best management practices should be developed relative to storm water management, animal waste storage and nutrient management, cropping systems, and grazing to minimize runoff and infiltration of nutrients and chemicals into the county's groundwater supply.

J. Forestry Best Management Practices (BMPs)

Our forests play a vital role in purifying and maintaining clean water for lakes, rivers, streams and groundwater. The most practical and cost-effective method to assure that forestry operations do

not adversely affect Wisconsin's water quality is through the use of voluntary "best management practices" (BMPs).

Many of these BMPs are described in the WDNR Bureau of Forestry publication *Wisconsin's Forestry Best Management Practices for Water Quality Field Manual for Loggers, Landowners and Land Managers.*[14] This publication provides BMPs for a variety of forestry related topics like timber harvesting, wetlands, chemicals and forest roads. These BMPs are not mandated, however, the WDNR strongly encourage their use by all Wisconsin forest professionals, land managers and forest landowners. Many public and private Wisconsin landowners already use forestry BMPs to guide their current management activities. The WDNR requires that BMPs are used on all forest lands that they own and encourage counties to incorporate BMPs into county forest management plans (*Note - The Marathon County Forest ten-year comprehensive land use plan makes compliance with forestry BMP's mandatory on county forest lands).* Cooperating consultants are required to manage private lands in a manner that matches the standards the WDNR places on their own land. Managed Forest Law and Forest Stewardship management plans must also incorporate BMPs to control soil erosion that adversely affects water quality. Many pulp, paper and forest industry companies also have adopted BMPs as part of their corporate land management policies.

The BMPs listed in the WDNR publication cover a variety of forest related activities. It is important to remember that these BMPs are guidelines and can be modified for specific site conditions with guidance from a forester or other natural resources professional. However, the modifications made must have no impact on water quality or provide equal or greater water quality protection. Professional advice on BMPs and all forest management activities can be acquired from consulting or industrial foresters, WDNR foresters, fish managers and water quality staff, USDA-NRCS staff, County Land Conservation Department staff or County Forestry Department staff.

2. REGULATORY MEASURES

In addition to using non-regulatory means to protect groundwater resources, local and county government may find it desirable or even necessary to regulate activities that may jeopardize local groundwater resources. Local regulations controlling where various land uses can locate, specifying the type of activity permitted and the manner of carrying them out, and regulating the density of use can all play an important role in groundwater protection.

The authority to adopt regulations of this type has been granted by law in various ways to all three levels of government - state, county and local. For example, the state has reserved the authority to set groundwater quality standards. The County has been authorized to adopt ordinances that control well and sanitary codes, disposal of septage, and administer other related regulations. Both County and local government - cities, villages and towns - are all empowered to have and enforce zoning laws. However, only local government can enact groundwater protection ordinances.

As can be seen, coordination between the state, county and local government is important, therefore it is necessary that all units of government be aware of their responsibilities in groundwater protection. The following section discusses these regulatory measures.

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[14]Wisconsin Department of Natural Resources Bureau of Forestry. "Wisconsin's Forestry Best Management Practices For Water Quality Field Manual For Loggers, Landowners and Land Managers." March 1995.

A. Zoning

Zoning is a regulator of land use. By preventing incompatible land uses from locating adjacent to each other fewer conflicts are likely to occur. Likewise, by locating potential groundwater contaminators away from major groundwater consumers, the potential for large scale problems can also be avoided. An example of this would be to locate an industrial facility away from a residential subdivision, or locating a landfill away from a municipal well.

Zoning can also protect against development in vulnerable environmental areas such as in wetlands, or shallow soils, where a spill could move rapidly into the water table. Currently thirty-four of the County's forty-two towns and all of the County's fourteen villages and six cities have some form of land use zoning. The use of this type of zoning, however, is ultimately a local decision.

Marathon County currently administers floodplain and shoreland - wetland zoning, designed to prevent most development in these fragile environmental areas. These ordinances are mandated by the state legislature.

B. Subdivision Ordinance

The design, layout, location and density of new residential plats must be considered in the context of groundwater protection. Similar to land use zoning, improperly designed or located subdivisions can lead to groundwater problems in a number of ways. The most common problems found in subdivisions are lot density, runoff, unsuitable soils for on-site sewage disposal, and poor street or lot design.

A number of state, county and local agencies participate in the subdivision plat review process. The County Zoning Department administers a subdivision ordinance, effective in all unincorporated municipalities. In these locations, additional reviews are made by the Wisconsin Department of Administration's (DOA) Office of Land Information Systems (OLIS); the Marathon County Planning Department; and other departments where appropriate. On-site waste disposal suitability is determined by the Zoning Department.

In cities and villages, subdivision and plat review is a local responsibility. Again, the DOA-OLIS reviews the plat for the State. In certain situations, the Department of Transportation and the Department of Natural Resources may also comment on a proposed plat located adjacent to a highway or stream, etc. In addition, new non-point runoff rules have been proposed to regulate the grading associated with developments (NR 151, 152, 153, 154, 155, 120, 216 and 243 all contain non-point standards).

C. Wellhead Protection Ordinance

In 2000, approximately sixty-three percent (63%) of Marathon County residents (approximately 79,759 persons) were served by municipal well suppliers. (Map 8). Wellhead protection is a means by which a municipality can efficiently and actively protect its drinking water resource. Wellhead protection is preventative in nature, whereas many other environmental programs tend to be reactive. Recent efforts have been directed at new and innovative techniques for the protection of these wells and well fields.

Special ordinances, usually administered through a local zoning ordinance, provide special land use regulations for well recharge areas, the area in which precipitation is directly returned to a

public well. Usually, an ordinance of this type prohibits land uses which have the highest potential for groundwater contamination. Underground gasoline tanks, chemical type industrial uses and waste disposal sites are typical of the uses prohibited in a recharge area. If properly identified and implemented, well protection ordinances can provide an additional safeguard for municipal wells and all who use water from the well. Such an ordinance also protects the major investment a municipality makes in terms of well drilling, infrastructure, and operational costs.

Only local government has been authorized by state legislation to use these powers. The Towns of Rib Mountain and Texas, City of Mosinee and Village of Brokaw are examples of County municipalities with public water systems that have adopted a municipal well recharge area protection ordinance.

According to the WDNR, there are six primary activities used when developing a wellhead protection plan for a community. These six activities are:

1. Determine the scale of the planning area. Is the community/county protecting one well, all the wells in a municipality or all the municipal wells in the county?

2. Form a group composed of local planning and zoning officials, elected officials, interested citizens and water surveyors.

3. Delineate the land area that the community/county would like to protect.

4. Identify and locate the potential contaminant sources that exist within the wellhead protection area.

5. Assess the adequacy of existing groundwater protection programs as they relate to identified contamination sources.

6. Plan for the future. Develop local plans to establish zoning restrictions, ordinances, and other programs to minimize the chances for future contamination of the wellhead.

Developing an ordinance requires identification of the area to be protected. This is normally done by a hydrogeologist, engineer or other groundwater specialist. Depending on the situation, this process is usually the most costly and time consuming.

Once identified the ordinance text is prepared and adopted, as is the final map. A wellhead protection ordinance is generally defined as an overlay district, meaning the present zoning restrictions remain intact, but additional restrictions of the overlay district also apply. The WDNR is the lead state agency for developing and implementing the Wisconsin Wellhead Protection (WHP) Plan. The specific goal of this plan is to achieve groundwater pollution prevention in public water supply wellhead areas consistent with the state's overall goal of groundwater protection. A WHP Plan must be developed for any new municipal water supply well constructed after May 1, 1992. For municipal water supply wells built before this time participation is only voluntary; the WDNR promotes and encourages participation but does not require wellhead protection planning for existing wells. All WHP Plan's must be approved by the WDNR's Public Water Systems Section.[15]

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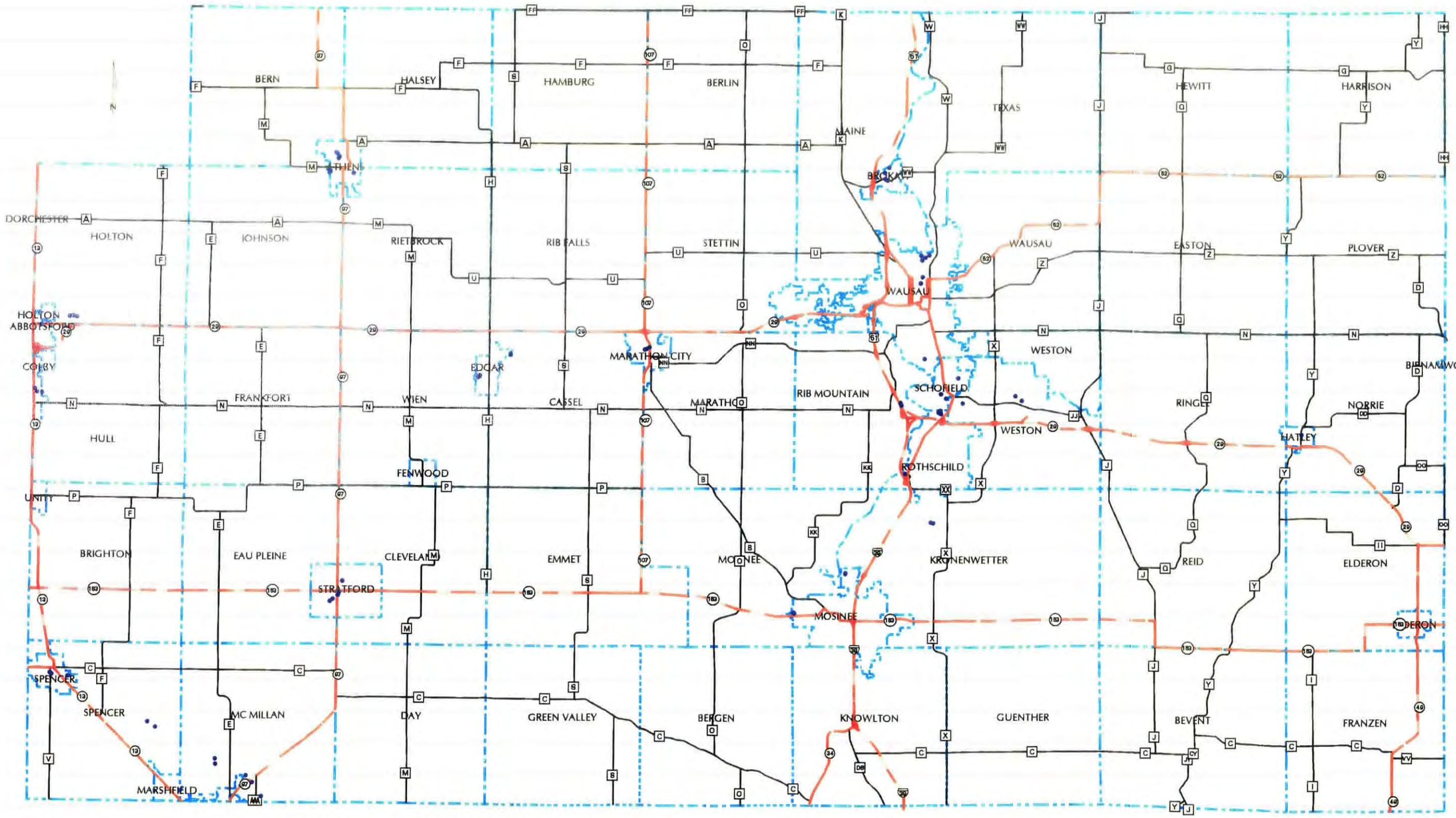
[15] Groundwater Coordinating Council Members, *Wisconsin Groundwater Coordinating Council Report to the Legislature*, August 2000.

MUNICIPAL WELLS



MARATHON COUNTY, WISCONSIN

Source: WI DNR

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

MAP#8

D. On-site Waste Disposal and Private Wells

Residents who live beyond the lines of a municipal water and sewer system or a sanitary district must provide their own water system and on-site waste disposal system.

Domestic on-site systems include septic tank and drain field, mound systems and holding tanks. As discussed in the previous section, improperly installed or maintained system can introduce bacteria, viruses and other hazardous substances into nearby groundwater.

The act of drilling a well may open up the aquifer to contaminants of a shallower or deeper layer. If well casings are not installed during the drilling process groundwater from various rock layers can be intermingled and water quality can deteriorate. This has occurred not only in improperly drilled wells, but in other kinds of excavation that exposed rock layers to each other, such as mine shafts and oil and natural gas wells.

Another threat to groundwater from wells, shafts and on-site sewage systems is caused by improper abandonment when their use has been completed. Holes left open after abandonments are vulnerable to contaminant-bearing rainwater or snow melts. They also pose a target for the intentional dumping of contaminants, whether through acts of ignorance or vandalism.

The intentional dumping of hazardous wastes into abandoned septic tanks has occurred, with the dumper assuming he has safely disposed of his chemicals. However, just as in underground petroleum tanks, septic tanks may corrode and leach its contents into groundwater, carrying with them any chemicals contained inside.

In Marathon County, there are estimated to be between 17,000 - 18,000 private on-site sewage disposal systems in use. In 2000, administrative rule COMM-83 replaced ILHR-83 in regulating the construction and installation of private on-site sewage disposal systems. These regulations, which are administered by the County Zoning Department are in effect throughout the County where a public sewer is not available. Due to COMM-83, there are currently nine different types of domestic on-site septic systems available for use in Marathon County.

- Holding Tank
- At-Grade Using Pressure Distribution
- In-Ground Soil Absorption
- Recirculating Sand Filter
- Split Bed Recirculating Sand Filter
- Mound
- Single Pass Sand Filter
- Drip-Line Effluent Dispersal
- Pressure Distribution

All, except for the holding tank, are considered as components or part of what is now known as a Private On-site Wastewater Treatment System (POWTS).

Systems which have failed must be replaced or restored to a functioning status. Such systems may be eligible for state grant monies to reduce the replacement costs.

There are an estimated 18,000 privately used wells in the County. Nearly all of these wells are used for human consumption of water, although a small number have been drilled solely for irrigation of crop land or for livestock watering.

For wells, Wisconsin Administrative Code NR 812 regulates the location, construction and operation of private wells. However, these rules are administered by the Wisconsin Department of Natural Resources, not Marathon County. A current concern is that the DNR does not have the personnel to adequately enforce this code and further personnel increases for this program are unlikely. Recognizing this, administrative rule NR 145 allows for counties to assume responsibility for well regulations if they choose. To date, Marathon County has not taken on this responsibility.

There are also rules which govern the abandonment of both wells and private on-site waste disposal systems. Abandonment normally occurs following the installation of public sewer and/or water supplies.

E. Solid Waste Disposal

The disposal of solid wastes in municipal and industrial landfills has become increasingly expensive and controversial. The growing realization that even well sited, well engineered, and well-operated landfills may eventually leak, and that suitable sites are difficult to find, have made this means of waste disposal increasingly unpopular. Communities across the country are examining alternative approaches to solid waste management. Nevertheless, in most communities, landfilling remains the only immediately available option for solid waste disposal. The thousands of existing landfills and dumps must be considered in groundwater protection programs.

The Wisconsin Solid Waste Management Program has been in existence for more than 30 years. The regulation of existing solid waste landfills and assistance to local governments in developing new environmentally safe landfills have been the major thrust behind Wisconsin's solid waste program. In the early 1970s all operating solid waste facilities were identified and licensed throughout the state. At this time there were approximately 2000 solid waste disposal sites in existence around the state. Most of these facilities were small town dumps. All solid waste facilities that were located too close to navigable surface waters, within a floodplain, wetland or critical habitat were ordered to close. At this time a change in operating procedures was also implemented for large landfills. Open, burning dumps were replaced by the sanitary landfills and enforcement began throughout the state. The remaining landfills, which posed the greatest threat to the environment due to their poor operations or hydrogeologic setting, were required at this time to begin monitoring the groundwater and surface water within and near the facility. By the mid to late 1970s groundwater data from those facilities was available and provided documentation that unlined landfills were causing significant groundwater quality impacts. As a result, many of these unlined solid waste facilities were required to close. These combined efforts, in conjunction with the completion of the U.S. Environmental Protection Agency (EPA) funded Open Dump Inventory in 1980, led to the closure of a majority of the 2000 land disposal sites which had previously existed in Wisconsin.

The Wisconsin Legislature in cooperation with WDNR passed a comprehensive groundwater law (1983 Wisconsin Act 410) in 1984. The law created Chapter 160 of the Wisconsin State Statutes and designated the WDNR responsible for establishing a list of substances which have been detected in or have reasonable probability of entering the groundwater via landfill leachate. The WDNR and the Wisconsin Department of Health and Social Services established Enforcement Standards (ESs) and Preventive Action Limits (PALs). The ESs is generally equivalent to Federal Maximum Contaminant Levels (MCLs) and cannot be violated beyond a set distance from a solid waste landfill (300 feet for those facilities existing prior to October 1, 1985 and 150 feet for those facilities constructed after October 1, 1985), or at their property boundary, whichever is the

greater distance. The PALs are more stringent trigger levels and range from 10% to 50% of the ES, and are based on the threat a particular contaminant poses to public health and the environment. The PALs are applicable at any location where groundwater is monitored, including directly beneath a landfill, whereas federal law only requires municipal solid waste landfills to meet the Federal MCLs at a maximum distance of 492 feet from their limits of filling or at their property boundaries. NR 140 Wisconsin Administration Code also requires the owner/operator of the landfill to "take whatever actions are necessary" to avoid exceeding the ESs and, since October 1, 1985, all new solid waste landfills in Wisconsin must be designed to meet the PALs. The WDNR licenses all active landfills that meet location, construction and operational standards. The WDNR periodically reviews these operations to ensure continued compliance with the law.

New disposal sites must be lined and equipped with a leachate collection system that channels leachate and runoff from the site into an impermeable holding area from which the liquid is removed for treatment. In 1996, Wisconsin revised its solid waste rules to require all municipal solid waste landfills to be designed with a composite liner (a geomembrane liner on top of a four-foot thick clay liner) and a composite final cover system. The revised rules which also included financial assurance standards that were originally set in the 1980's, currently exceed the Federal (Subtitle 'D') rules for municipal solid waste landfills. This helped to make Wisconsin the first state in the nation to receive approval of its solid waste program by the U.S. Environmental Protection Agency (EPA).

There are presently four landfills in Marathon County licensed under the WDNRs Waste Management Program (Table 6 and Map 6). The Marathon County Landfill, located in the Town of Ringle, is currently the only operational public solid waste facility in Marathon County. This facility is operated by the Marathon County Solid Waste Department and provides the residents and industry of this County with an environmentally safe and cost effective integrated waste management system for non-hazardous solid waste. The Solid Waste Department also provides recycling programs, composting, and waste-to-energy programs as well as promoting and providing solutions to household hazardous waste disposal. A minimal fee is charged for disposal of all materials at the landfill facility.

Table 6.
Licensed Solid Waste Landfills in Marathon County
January 2001

Facility/Operation Name	Activity
Marathon County Landfill Area B	LF-Large
Mosinee Paper Corp. Landfill	Medium Monofill
Wisconsin Public Service Corp.-Weston Ash #3	LF- Medium Monofill
Wisconsin Public Service Corp.-Weston #3	Medium Monofill

Source: Modified from Wisconsin Department of Natural Resources "Waste Management Program-Licensed Solid Waste Landfills in Wisconsin" database as of 9 January 2001. 18 September 2000. <http://www.dnr.state.wi.us/org/aw/wm/solid/landfill/licensed.htm>. And information received from Wausau DNR Waste Management Staff.

Wisconsin's landfill siting process is considered one of the most successful in the country because it strikes a balance between the statewide need for environmentally sound waste disposal capacity and the legitimate concerns of local citizens and municipalities. The siting process requires that landfills meet stringent siting, design, construction, operating, monitoring,

performance, and financial responsibility requirements to maximize the protection of the environment and public health. The state statutes restrict local authority to regulate the siting of a solid waste disposal site. Only local regulations in effect for at least 15 months are recognized and these may be made inapplicable in an arbitration award granted by the State Waste Facility Siting Board. Solid waste management rules preempt local controls.

Junkyards were once regulated as solid waste facilities. However, due to the lack of documented pollution problems resulting from these activities, WDNR's authority to regulate junkyards was removed. The WDNR can investigate sites and respond to emergency cases involving imminent risks to health and environment. The WDNR also has a permit process that is currently used to regulate salvage yards. The Department of Transportation (DOT) also requires that salvage operations hold a salvage license. Though the WDNR and DOT have different purposes and goals when dealing with salvage operations, the two agencies have been meeting since the mid-1990's to see how they might assist each other with their goals. Previously the DOT did not require an applicant to provide proof of WDNR certification, however, some DOT investigators have already refused salvage licenses to applicants who were unable to show proof that WDNR requirements were met. Stormwater Discharge Permits will also soon be issued to salvage operations through the WDNR. According to the WDNR, scrap and salvage associations are being pro active in helping operators comply with these permits. These programs, called Cooperative Compliance Programs, establish industry-wide approaches, provide group training, foster information sharing, and promote best management practices that reduce or eliminate stormwater contamination associated with salvage operations.

F. Earth Disturbances

1. Non-Metallic Mining

The reclamation of surface excavations is the standard procedure for avoiding contamination problems. Backfilling and berming can prevent contamination from runoff. Security fencing may be necessary to prevent illegal dumping.

There currently are no deep shaft mines in operation in Marathon County. However, there are numerous open pit mines operating to quarry building stone, gravestones, sand and gravel, and "rotten granite." In some locations, these abandoned pits have become illegal dumpsites for junk, tires and other wastes.

In 1984 and 1985, a County Ad Hoc Committee set out to develop a reclamation ordinance designed to clean up existing sites and to regulate the development of new sites. After a series of reviews and meetings the ordinance was modified to remove some required cleanup activities from the text language. This modification in effect, crippled the ordinance to the point of eliminating most of the activities necessary to reclaim these pits. As a result, the ordinance was tabled and was not adopted by the County Board.

In April 1989, the Nonmetallic Mine Reclamation Ordinance was adopted by the Marathon County Board of Supervisors. As a result of the adoption of §295 WI Statutes and the promulgation of NR 135 (Nonmetallic Mining Reclamation), the County has modified the Marathon County Nonmetallic Mine Reclamation Ordinance. This document can be viewed online at the Marathon County website <http://www.co.marathon.wi.us>.

2. Wetland Filling

A wetland by definition is groundwater near or at the earths surface where water loving or water dependent plants are present. The filling of wetlands is regulated by the County Zoning Department, WDNR and Army Corp of Engineers to prevent the unauthorized placement of fill into wetlands, to protect the quality of wetlands and ultimately prevent groundwater contamination.

As of the writing of this Guide, the extent of the WDNR and Army Corp of Engineers jurisdiction over wetlands has come into question. On January 9, 2001, the United States Supreme Court, through a ruling in the case of the Solid Waste Agency of Northern Cook County (SWANCC) vs. US Army Corps of Engineers 99-1178, limited the Corp of Engineers' Clean Water Act jurisdiction to navigable waters and wetlands adjacent to navigable waters. This decision refutes the use of the Migratory Bird Rule used under authority of the Commerce Clause to establish jurisdiction over wetlands which are not adjacent to waters of the United States. The court held in its 5-4 decision that the U.S. Army Corps of Engineers had exceeded its statutory authority by asserting it had jurisdiction, under the Clean Water Act, over isolated wetlands used by migratory birds in the Illinois case. Because state wetland protection rules are based on Army Corps of Engineers authority to act under the federal Clean Water Act, Wisconsin wetland officials are now worried that taken broadly, the court decision could mean the state has lost its ability to protect millions of acres of wetlands. Wisconsin has 5.3 million acres left of the 10 million acres present before statehood (WDNR, 2001). According to the Wisconsin Wetland Inventory (WWI), Marathon County has 117,468 acres of wetland of which 89,956 acres (77%) are currently unprotected due to the Supreme Court decision. However, many of these wetlands may still be protected through County Shoreland and Wetland Zoning (§ 59.971 and NR 115). The Wisconsin Legislature is also currently trying to introduce legislation to further protect Wisconsin's remaining wetlands. Additionally, a proposed Wisconsin Administrative Rule (NR 350) would require mitigation of wetland filling by restoration of prior converted wetlands or creation of wetlands at a ratio of 1½:1.

3. Construction Site Erosion/Stormwater Management Ordinance

The WDNR currently regulates those earth disturbances greater than 5 acres in size require the creation and implementation of a Stormwater Management Plan and a Construction Site Erosion Plan to minimize discharge of contaminants and sediment into surface and ground waters. Efforts are underway to require management plans for disturbances of as little as 1 acre in size.

Currently, storm water discharge is primarily released to surface channels or surface waters. Additional regulation may be pursued to ensure that storm water is directed to recharge basins where groundwater tables can be replenished.

G. Land Conservation

The potential for groundwater contamination from agricultural activities can be great in several areas. These critical areas are animal wastes, irrigation, and farm chemical use.

The Marathon County Land Conservation Department (LCD) works extensively with farmers throughout the County to reduce soil erosion, surface and groundwater contamination, and to improve soil productivity.

In the area of manure management, UW-Extension provides information on alternative management practices and the LCD provides assistance in design of feedlots, barnyards and livestock holding areas. Such designs might include retaining walls, sediment basins and similar drainage features.

The LCD has five Priority Watershed Projects that have been completed or are in various stages of completion: 1) Upper Big Eau Pleine, 2) Lower Big Eau Pleine, 3) Upper Yellow River, 4) Spring Brook Creek and 5) Lower Big Rib River (Map 9). Priority watersheds are areas of land that drains to a common place that has been selected for special attention. The Priority Watersheds the LCD is studying are part of a larger state program commonly known as Wisconsin's Priority Watershed Program. The program is designed to help improve and protect water quality by providing assistance and cost sharing to landowners for the installation of conservation practices. The Priority Watershed Program was created in 1978 because Wisconsin's lakes, streams and groundwater supplies were being threatened by non-point source pollution. The program is open to all watershed residents and landowners. Financial assistance is also provided based on eligibility.

The Lower Big Rib River watershed differs from the previous watershed projects in that "critical sites" relative to barnyard runoff, cropland erosion, and pastured streambanks have been identified. Critical sites are those sites that contribute most significantly to the water quality problems within this watershed relative to specific source types. To achieve water quality goals for the project, these critical sites must install Best Management Practices or the WDNR will issue a "Notice of Discharge" that requires corrective actions be taken to reduce pollution sources.

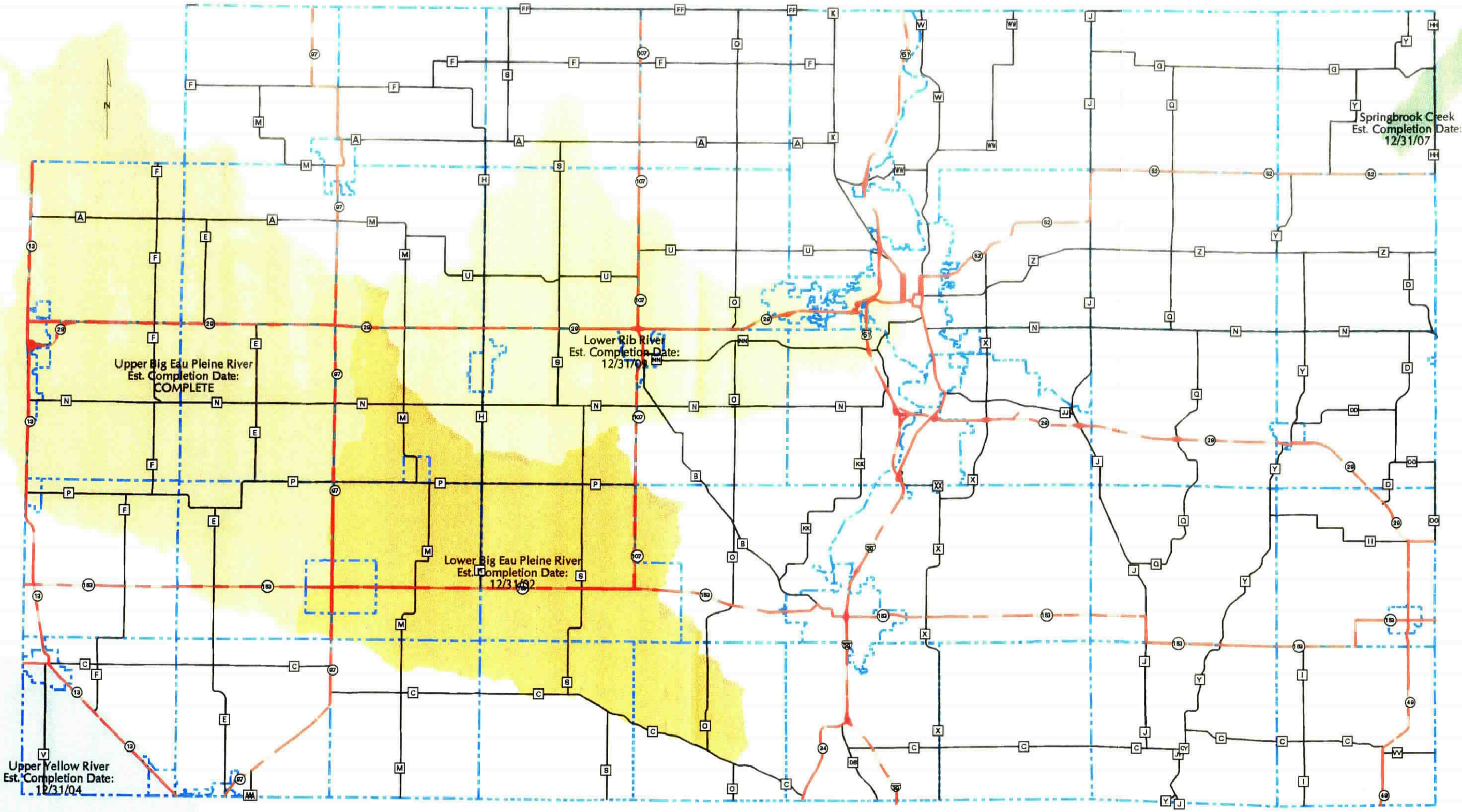
Earthen manure pits have been a cause for concern in the past. If improperly located, designed or excavated, manure can seep into the water table bringing with it nitrates and bacteria. The Land Conservation Department regulates these structures by the Animal Waste & Manure Management ordinance, which requires the issuance of a permit before any earthen manure pit can be constructed. The Animal Waste Ordinance also requires that all manure productions be utilized according to a Nutrient Management Plan developed by a Certified Crop Advisor.

In 2001, the Land Conservation Department will develop a Comprehensive Soil and Water Management Plan in which priorities and concerns relative to groundwater will be addressed. Strategies will be outlined that will implement protection and corrective practices toward safeguarding groundwater resources.

Currently large animal feeding operations (AFO's) (in excess of 1,000 animal units) are required to have a Wisconsin Pollutant Discharge Elimination System (WPDES) permit for controlling runoff from these confinement operations. In 1988, there were no feedlot operations in Marathon County large enough to require a discharge permit. Presently there is only one large AFO operating in Marathon County in the Town of Maine. It is expected within the next few years that there may be as many as twenty large AFOs operating throughout Marathon County. Smaller feedlots (with less than 1,000 animal units) currently do not require WPDES permits but are subject to investigation by DNR and Department of Agriculture, Trade and Consumer Protection (DATCP) field staff on a compliant basis. The Environmental Protection Agency (EPA) is working on a proposal to require smaller AFO's (in excess of 300, 500 and 700 animal units) to also be subject to the WPDES permit process.

Groundwater pollution stemming from irrigation or chemical use can often be avoided by carefully adjusting the form, method, rate and timing of application of fertilizers and pesticides to plant needs and soil attenuation capacity. Nitrate and pesticide levels are usually higher in surface

WATERSHED PROJECTS



MARATHON COUNTY, WISCONSIN

Source: WI DNR

MAP DEVELOPED BY:
MARATHON COUNTY PLANNING DEPARTMENT

MAP#9

runoff than in infiltrating water. Often pesticides sorb to soil particles and can be a more serious problem for surface water quality, however, this is not always the case, ie. Aldicarb. Techniques to control runoff may increase infiltration and, consequently, increase the leaching of agricultural chemicals to groundwater. Installing tile underdrains may be necessary if soils do not have adequate natural drainage. The collection and re-application of irrigation return flows is one means of recapturing nitrate for crop use, which, in turn, can reduce fertilizer costs and help reduce the infiltration of nitrates into underlying aquifers. For more information on groundwater protection and agricultural practices, refer to "Agricultural Best Management Report" by Gary Jackson, et al, U.W. - Extension or contact your UW - Extension field crop and farm management agent.

Finally, a plan to inventory the abandoned well sites may be developed. Unused wells often become direct conduits for entry of contaminants in groundwater as well as posing potential safety concerns.

CHARTING THE COURSE

Selecting a course of action to protect groundwater involves making choices. There is no formula available to guarantee that the choice a community makes will be right. An action that may work well for one local government may not be appropriate for another.

In addition to choosing between regulatory and non-regulatory actions local and county governments must also make other choices which include:

REMEDIAL VS. PREVENTIVE

A first consideration is to what degree actions will be remedial or preventive. Although the discovery of groundwater contamination in an area is often the triggering event for citizen concern calling for governmental action, local officials must weigh the costs and effectiveness of responding to the momentary crisis against the opportunities for preventing such problems in the first place. If the local program response is to develop "cleanup" programs for particular documented contamination sources, the program may well be unending. Any remedial efforts should be undertaken within a broader context of trying to prevent or limit reoccurrences of the problem.

ALL POLLUTION SOURCES VS. SELECTIVITY

A critical factor relates to the scope of the management initiatives. Should a groundwater protection program be targeted at all polluting sources or should it be selective? It is probable that many local programs will have a modest beginning. This is perfectly appropriate, and may reflect limited technical or financial resources, or the lack of immediate need for a more comprehensive program. In contrast, a more comprehensive effort may be essential when the nature of the groundwater problems demands action on a number of fronts. Thus one effort might be initially limited to an educational effort to get farmers to better store and manage their animal waste, while another might require additions using a broad array of tools and is aimed at multiple rural and urban sources of groundwater contamination. Whether the local program is single or multi-pronged, it is important that the sources addressed are the sources that need to be addressed to protect groundwater.

GENERAL FOCUS VS. SPECIAL MANAGEMENT AREAS

Another key consideration for local government is whether to deal with polluting sources generally, wherever they occur within the jurisdiction, or whether to focus on specific geographic areas for special management attention. One of the advantages of undertaking groundwater management at the local level, in conjunction with state programs, is to acknowledge local variability with regard to the geologic and socioeconomic settings. Areas are different, and may demand carefully tailored, area specific management approaches to successfully prevent or solve groundwater problems. Local governments therefore have an opportunity to bring their local expertise and experience to bear in ways that recognize the non-uniform character of their piece of Wisconsin. The area focus could take the form of a management plan for a defined area, perhaps on the basis of its natural vulnerability to pollution; or it could be targeted at all the areas within the jurisdiction that, for example, contribute groundwater inflow to public water supplies.

LONG-TERM VS SHORT-TERM ACTIONS

In choosing among actions to be taken, a fourth factor involves time. What actions are short-term in nature, both in terms of the time to implement them and of the duration of their effects? What actions should be integrated as short-term first steps with a long-term program? And which long-

term actions can be identified, but implemented in stages over periods of many years? A local management program could be broken down for operating and programming purposes using the time variable.

CONCLUSION

The Marathon County Environmental Resources Committee has begun the process of groundwater protection by outlining recommended actions to aid the County and its municipalities in the protection of Marathon County's precious groundwater supply. The next step is for citizens and their elected representatives to determine which of these recommendations are desirable and feasible in the protection of the groundwater resources we all rely upon.

PART III
OTHER SOURCES

Other Sources

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Wisconsin Department of Natural Resources (WDNR) Home Page, <http://www.dnr.state.wi.us/>.

Wisconsin State Statutes Home Page <http://www.legis.wi.us/>.

Contacts

Marathon County Departments

http://www.co.marathon.wi.us/

- **Forestry Department**
  212 River Drive
  Suite 2
  Wausau, WI 54403
  (715) 261-1580

- **Hazardous Waste Collection Facility**
  301 Alderson Street
  Schofield, WI 54476
  (715) 848-9060
  Email: hazwaste@mail.co.marathon.wi.us

- **Health Department**
  1200 Lakeview Drive
  Wausau, WI 54403
  (715) 848-9060

- **Land Conservation Department**
  210 River Drive
  Wausau, WI 54403
  (715) 261-6000

- **Planning Department**
  210 River Drive
  Wausau, WI 54403
  (715) 261-6040

- **Sheriff's Department-Office of Emergency Management**
  500 Forest Street
  Wausau, WI 54403
  (715) 847-5226

- **Solid Waste Department**
  R18500 East Highway 29
  Ringle, WI 54471
  (715) 446-3339

- **University of Wisconsin Extension-Marathon County**
  212 River Drive
  Suite 3
  Wausau, WI 54403
  (715) 261-1230

- **Zoning Department**
  210 River Drive
  Wausau, WI 54403
  (715) 261-6020

State of Wisconsin Agencies
http://www.wisconsin.gov/state/home

- **Department of Administration (DOA)**
  http://www.doa.state.wi.us/
  101 East Wilson Street, 10th Floor
  Madison, WI 53702
  (608) 266-1741

  - **Office of Land Information Services**
    http://www.doa.state.wi.us/olis/index.asp
    17 South Fairchild Street, 7th Floor
    Madison, WI 53703-3219
    (608) 267-2707

- **Department of Agriculture, Trade and Consumer Protection (DATCP)**
  http://datcp.state.wi.us/static/
  2811 Agriculture Drive
  P.O. Box 8911
  Madison, WI 53708-8911
  (608) 224-5012

- **Department of Commerce (DOC)**
  http://www.commerce.state.wi.us/
  201 W. Washington Avenue
  Madison, WI 53714
  (608) 266-7088

  - **Division of Environmental and Regulatory Services**
    P.O. Box 14427
    Madison, WI 53714-0427
    (608) 266-3723

    - **Bureau of Petroleum Environmental Cleanup Fund Administration**
    - **Bureau of Retail Petroleum Services**
    - **Bureau of Storage Tank Regulation**

- **Department of Natural Resources (DNR)**
  http://www.dnr.state.wi.us/
  - **Bureau of Waste Management**
    West Central Region Headquarters
    Department of Natural Resources
    P.O. Box 4001
    Eau Claire, WI 54702
    (715) 839-3700

- **Hazardous Waste (Notification, Reporting & Transportation Licenses)**
  Contact Sue Brumberg (715) 839-3734

- **Hazardous & Solid Wastes Requirements**
  Contact Richard Brown (715) 359-4843

- **Solid Waste Recycling**
  Contact Deb Pingel (715) 359-4531

- **Bureau of Drinking Water and Groundwater**

- **Bureau of Watershed Management**

  - **Dam Safety, Floodplain, Shoreland Section**
    Richard Wedepohl, Section Chief (608) 266-1926

  - **Great Lakes and Watershed Planning Section**
    Charles Ledin, Section Chief (608) 266-1956

  - **Runoff Management Program**
    Russ Rasmussen, Section Chief (608) 267-7651

  - **Water Quality Modeling Section**
    Greg Hill, Acting Section Chief (608) 267-9352

  - **Water Quality Standards Section**
    Jim Schmidt, Acting Section Chief (608) 267-7658

  - **Wisconsin Pollutant Discharge Elimination System (WPDES) Permit Program**

    - Animal Waste: Jeanne Calhoun (715) 284-1480
    - Landspreading Specialist: Jim Freidrich (715) 421-7807
    - WPDES Permit Coordinator: Holly Eaton (715) 839-1634

- **Wisconsin Geological & Natural History Survey (WGNHS)**
  http://www.uwex.edu/wgnhs/
  James M. Robertson, Director and State Geologist
  3817 Mineral Point Road, Madison, Wisconsin 53705-5100
  Map Sales (608) 263-7389 Information (608) 262-1705 Fax (608) 262-8086

Federal Agencies

- **Army Corp of Engineers**
  http://www.usace.army.mil/
  HQ US Army Corps of Engineers
  441 G. Street, NW
  Washington, DC 20314-1000
  (202) 761-0001

- **Federal Emergency Management Association (FEMA)**
  http://www.fema.gov/
  Region V Office
  536 South Clark St., 6th Floor
  Chicago, IL 60605
  (312) 408-5500

- **United States Department of Agriculture (USDA)**
  http://www.usda.gov/

  - **USDA-Natural Resources Conservation Services (NRCS)**
    http://www.nrcs.usda.gov/
    326 River Drive
    Wausau, WI 54403
    (715) 848-3586

  - **USDA-Wisconsin Farm Services Agency (FSA)**
    http://www.fsa.usda.gov/wi/

    Wisconsin State FSA Office
    6515 Watts Road
    Madison, WI 53719-2726
    (608) 276-8732, ext 100

    Marathon County FSA Office
    326 River Drive
    Wausau, WI 54403
    (715) 848-2330

- **United States Bureau of Census**
  http://www.census.gov/
  U.S. Census Bureau
  Washington DC 20233
  (301) 457-4608

- **United States Environmental Protection Agency (EPA)**
  http://www.epa.gov/

  EPA Region 5
  77 W. Jackson Blvd.
  Chicago, IL 60604
  Toll Free: 1-800-621-8431
  http://www.epa.gov/region5/

- **United States Geological Survey (USGS)**
  http://www.usgs.gov/

  Wisconsin USGS Office
  Warren Gebert
  8505 Research Way
  Middleton, WI 53562-3581

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Email: *dc_wi@usgs.gov*

Miscellaneous Contacts

- **University of Wisconsin-Stevens Point Environmental Task Force**
  http://www.uwsp.edu/cnr/etf/index.htm
  College of Natural Resources, University of Wisconsin-Stevens Point
  Stevens Point, WI 54481
  Toll free (877) 383-8378

- Central Wisconsin Groundwater Center
  http://www.uwsp.edu/cnr/gndwater/
  College of Natural Resources, University of Wisconsin-Stevens Point
  Stevens Point, WI 54481
  (715) 346-4270
  Email: *gndwater@uwsp.edu*

- The Groundwater Foundation - (Groundwater Guardian Program)
  http://www.groundwater.org/Guardian/ggindex.htm
  P.O. Box 22558
  Lincoln, NE 68542-2558
  Toll Free: 1-800-858-4844
  Email: *info@groundwater.org*