SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION NEWSLETTER
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INITIAL GROUNDWATER MANAGEMENT STUDIES COMPLETED

Two major groundwater management studies have now been completed for the Southeastern Wisconsin Region: a regional groundwater resources inventory and analysis and the development of a regional groundwater aquifer simulation model. These two work efforts represent the first two of the three elements of the planned regional water supply planning program for the Southeastern Wisconsin Region, considering both surface and groundwater systems.

Groundwater Resources Inventory and Analysis Report Completed

For the past several years, the Southeastern Wisconsin Regional Planning Commission has been working cooperatively with the Wisconsin Geological and Natural History Survey (WGNHS) and the Wisconsin Department of Natural Resources (WDNR) on a regional groundwater resource inventory and analysis program. The primary purpose of this effort has been the development of hydrogeologic data that can be used to support the preparation of a regional groundwater modeling program and to provide information useful for land use and related planning efforts. The groundwater-related inventories developed under this effort are documented in SEWRPC Technical Report No. 37, *Groundwater Resources of Southeastern Wisconsin*, June 2002. Copies of this report are available at the Commission offices and the report is on the Commission web site at www.sewrpc.org under the Data and Publications page.

Groundwater resource inventory information was compiled to document the Region's hydrogeology. Such data can be used for a variety of groundwater management purposes. Information developed included soils information and related mapping in the Region and their ability to attenuate contaminants before they reach the groundwater system

(see Map 1), the glacial and bedrock geology (see Map 2), and the aquifers of the Region (see Figure 1). Data and related mapping were also developed on groundwater quality and potential sources of contamination.

A unique system was used by the WGNHS to categorize areas of the Region with regard to the potential vulnerability to groundwater contamination. That system was based upon a number of factors, including: the characteristics of the soils, of the unsaturated zone materials below the soil layer, and of the aquifer, including its depth below the land surface. The groundwater resources report includes mapping to illustrate the contamination potential of the shallow aquifer in the Region, as estimated using the evaluation system developed.

Groundwater Model Development Completed

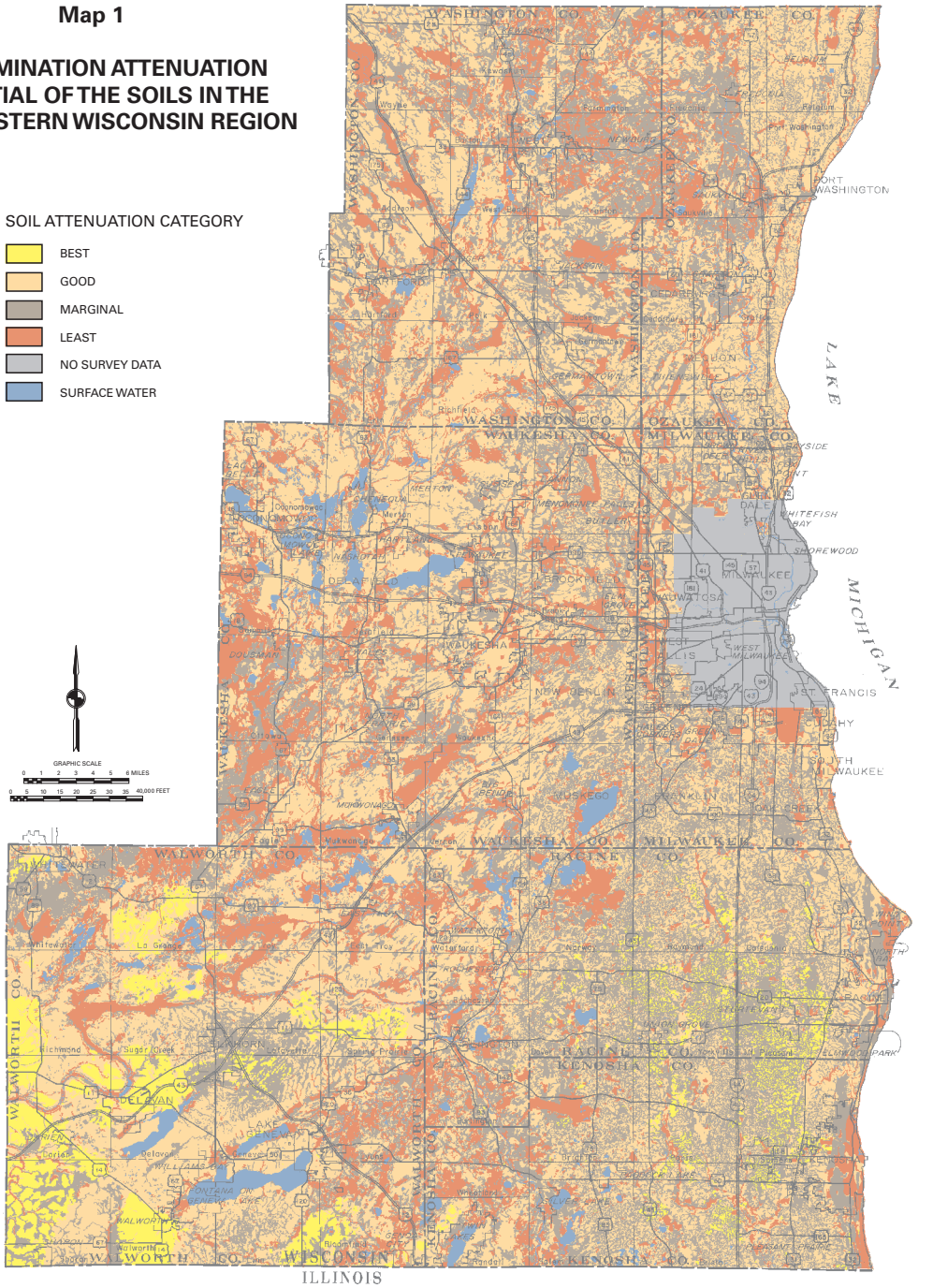
As the groundwater inventory and analysis project proceeded, the need to address the deeper aquifer system together with the shallow aquifer in an integrated data development and modeling program was raised. A regional groundwater aquifer simulation model was proposed to be developed to meet this need. The proposed modeling program is described in a document titled *Regional Aquifer Performance Simulation Modeling Program Prospectus* prepared jointly by the Commission, the WGNHS, and the U.S. Geological Survey (USGS). This prospectus was prepared under the guidance of the Commission's Technical Advisory Committee on Groundwater Resources, whose membership includes both groundwater users and individuals with technical expertise in this field.

Following informational meetings, support for the prospectus and for funding the program as proposed in the prospectus was received from water utilities in the Region that use groundwater as a source of supply and from the WGNHS, the USGS, and the Wisconsin Department of Natural Resources. Work on the regional aquifer performance simulation modeling program was completed this year. The work was carried out cooperatively by the WGNHS, the USGS, and the Commission under the guidance of the Commission Technical Advisory Committee on Groundwater Resources (see page 4).

The three-dimensional regional groundwater model was developed to represent the aquifer system in Southeastern Wisconsin (model nearfield area), as shown in Figure 2. Because the deep aquifer underlying the seven-county Southeastern Wisconsin planning region extends well beyond that area, the analysis also considered a much larger farfield

Map 1

CONTAMINATION ATTENUATION POTENTIAL OF THE SOILS IN THE SOUTHEASTERN WISCONSIN REGION



Source: University of Wisconsin-Extension, Wisconsin Geological and Natural History Survey, and SEWRPC.

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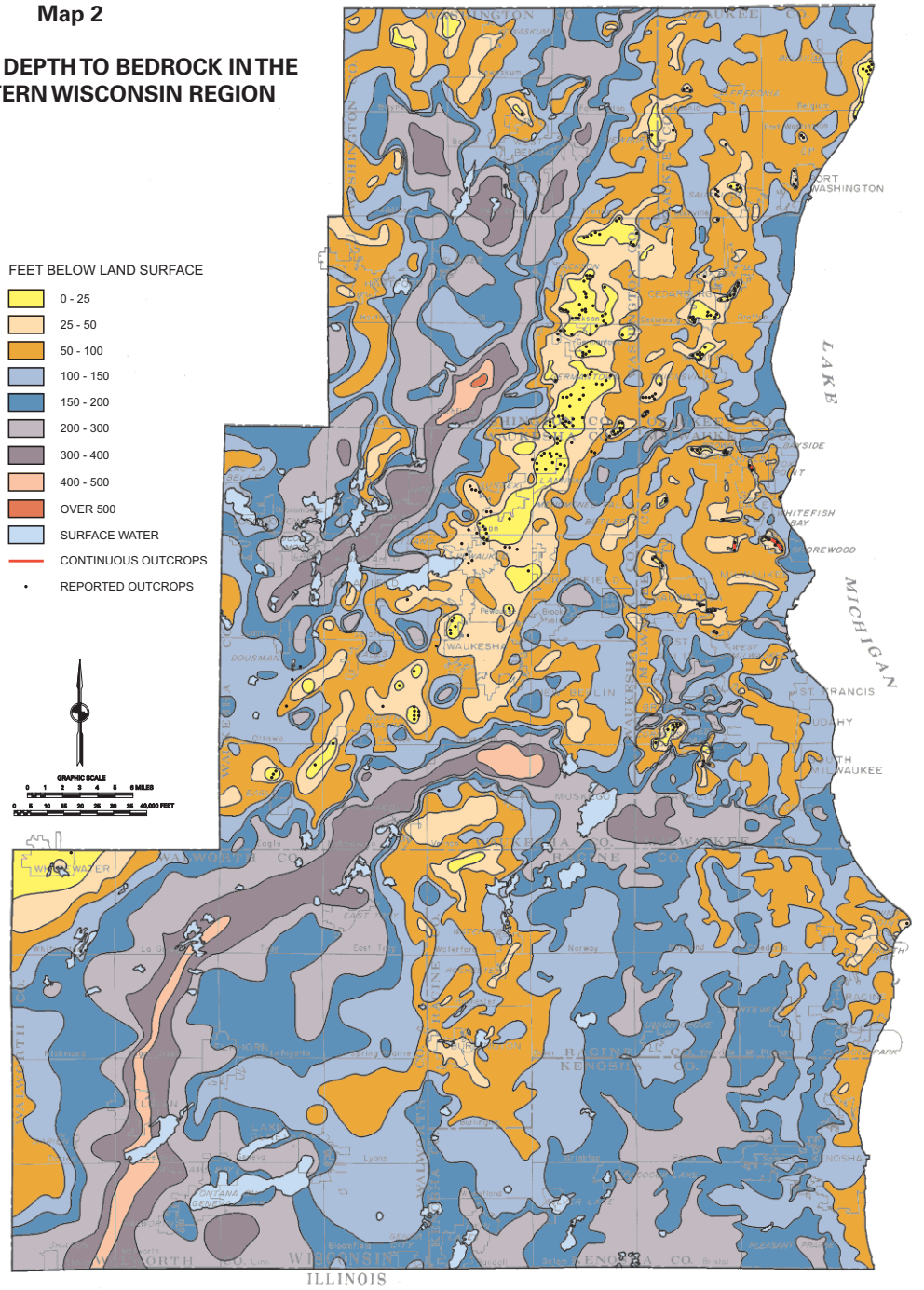
Constance Wilson ..... Utility Manager, Burlington Water Utility

Map 2

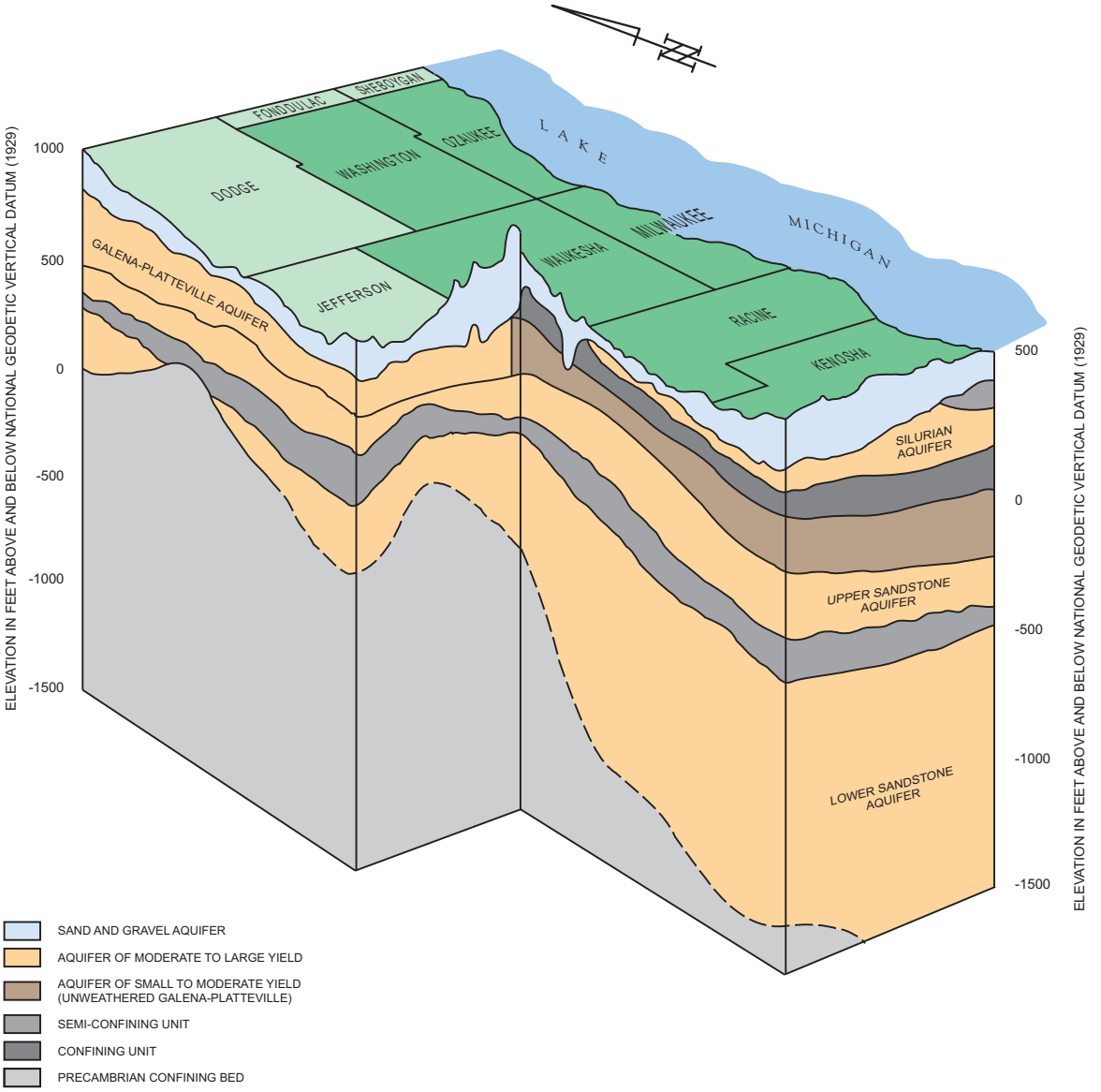
GENERALIZED DEPTH TO BEDROCK IN THE SOUTHEASTERN WISCONSIN REGION



Source: University of Wisconsin-Extension, Wisconsin Geological and Natural History Survey, and SEWRPC.

Figure 1

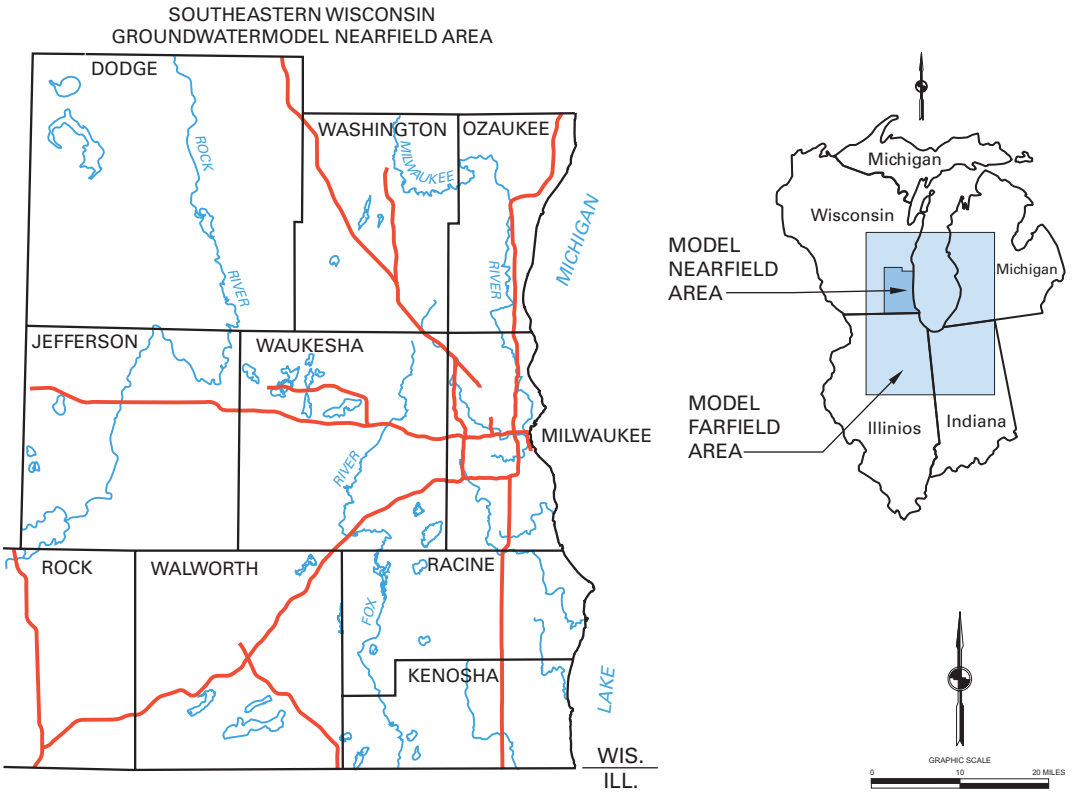
AQUIFER SYSTEMS IN SOUTHEASTERN WISCONSIN



Source: University of Wisconsin-Extension, Wisconsin Geological and Natural History Survey, and SEWRPC.

Figure 2

AREA OF SOUTHEASTERN WISCONSIN SIMULATED IN GROUNDWATER MODEL



Source: U.S. Geological Survey, University of Wisconsin-Extension, Wisconsin Geological and Natural History Survey, and SEWRPC.

area in order to properly establish boundary conditions for the planning region. The basic model grid spacing is about 2,500 feet and the model uses data averaged over about one-quarter of a square mile. This grid spacing, when coupled with 18 layers vertically, results in about 600,000 cells in the entire model. With this grid spacing, the model is well-suited to determine the effects of larger municipal wells, but not the individual effects of small wells serving individual or small groups of residents or commercial developments. For more localized applications, the model will form the framework for a

refined localized model which can be developed with the inclusion of data that will require additional fieldwork and data collection. In this sense the regional model is intended to provide a framework for more detailed and localized studies and models of specific sites.

The development of this model included rigorous steps of calibration and testing to insure it would meet extremely high accuracy standards and user expectations. Two scenarios were used to evaluate the accuracy of the model. The first, a predevelopment steady-state calibration, tested the model's ability to reproduce groundwater levels believed to have occurred in the late 1800s before extensive development took place in southeast Wisconsin. This steady-state simulation produced very good agreement between modeled and historic conditions. In the second scenario, the simulation tested the model's ability to reproduce today's conditions. These results were within 20 feet of actual data, considered to be an excellent outcome. Calibration in both scenarios also included comparisons of simulated baseflows in surface water features to measured baseflows.

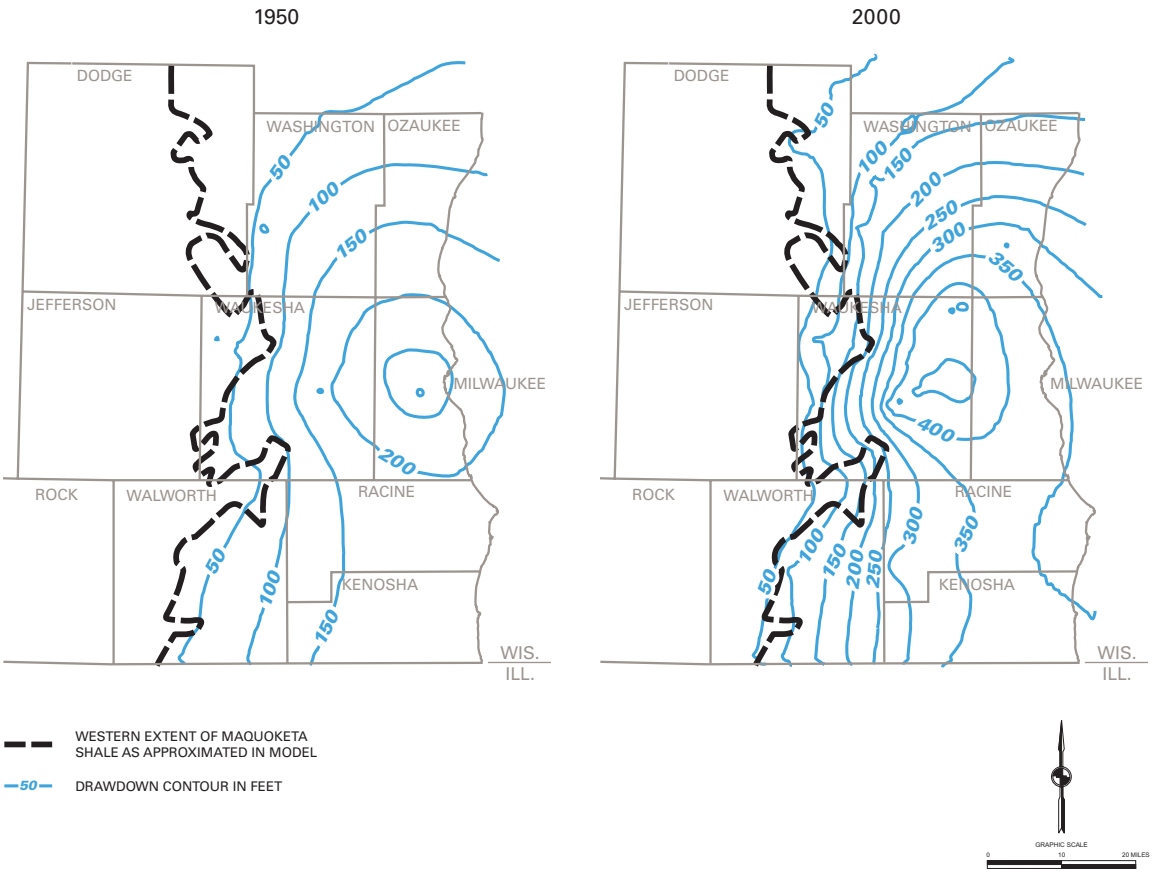
The model clearly shows how groundwater use relative to predevelopment conditions has affected water levels in Southeastern Wisconsin. Figure 3 illustrates that the cone of depression has shifted westerly and that pumping has significantly lowered water levels. As water use increases, this drawdown will continue to increase.

This new model defines the major aquifers and incorporates major surface water features. This allows the model to be used to simulate interactions between the deep and shallow aquifers and between groundwater and surface water systems. Thus, the model can be used to forecast water levels and groundwater flow under various water demand scenarios, as well as the impact of the groundwater system dynamics on critical surface water conditions, such as base or low flow in streams and wetlands.

There are several timely needs for the model. One is determining the zone of contribution, or area of land surface contributing water to a well, for each public water supply in the region. The WDNR established an objective to accomplish this by 2004. This model will enable the agency and resource managers to define wellhead protection zones for over 200 public wells. With this information in hand, water utility managers will be able to delineate critical recharge areas for protection from contamination and adverse land uses. The model is currently being used to delineate contributing areas for

Figure 3

SIMULATED DEEP DRAWDOWN RELATIVE TO PREDEVELOPMENT CONDITIONS: DEEP AQUIFER



Source: U.S. Geological Survey, University of Wisconsin-Extension, Wisconsin Geological and Natural History Survey, and SEWRPC.

all municipal wells in the seven-county SEWRPC Region. This effort was supported in part by the WDNR Source Water Protection program. For larger wells, the model was adequate for this purpose, but for many of the smaller capacity wells, it serves as the framework for more refined models of specific small areas around communities.

Other anticipated uses of the model include:

- Prediction of long- and short-range water levels in the aquifers,
- Quantification of the exchange of groundwater with Lake Michigan,
- Groundwater quality evaluations—as one tool to help understand the reasons for increases in radium and salinity in deep aquifer wells,
- Preliminary well siting evaluations,
- Water supply facility optimization analyses, and
- Evaluation of groundwater conservation and recharge strategies.

The groundwater modeling work is planned to be documented in a SEWRPC technical report planned to be published early in 2004. An announcement of the availability of that report will be made on the Commission web site.

What Are the Next Steps?

There are ongoing and planned activities relating to the new groundwater model. Currently, the model is being used for an analysis of the potential impacts on water levels resulting from new wells being developed by the Village of Eagle. This analysis is being done as a demonstration project to illustrate the model's use as a framework for a more refined analysis. Early in 2004, the Commission plans to schedule demonstration workshops in several locations throughout the region to explain the model development and demonstrate its uses. It is also planned to utilize the groundwater model as an important tool in the development of a regional water supply plan which is now in the study organization stage. The need for, scope, and schedule for that planning program will be reported in a subsequent SEWRPC *Newsletter*.

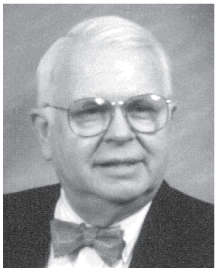
The involved agencies—USGS, WGNHS, WDNR, and SEWRPC—plan to continue to work cooperatively to maintain, and periodically update, the model so that it remains a viable tool for groundwater management activities.

PROFILE OF COMMISSION OFFICERS

The Commission has four officers: Thomas H. Buestrin, Ozaukee County, is serving a sixth consecutive term as the Commission's Chairman; William R. Drew, Milwaukee County, is serving a sixth consecutive term as Commission Vice-Chairman; Richard A. Hansen, Racine County, is serving a first term as Commission Secretary; and Duane H. Bluemke, Waukesha County, is serving a first term as Commission Treasurer.

Mr. Buestrin, who initially served on the Commission from 1970 to 1983, was reappointed to the Commission in 1990 and 1996 by former Governor Tommy G. Thompson, and in 2002 by former Governor Scott McCallum. Mr. Buestrin has long been active in industrial and commercial real estate development in the greater Milwaukee area. A current Director of Bank Mutual Corporation and of Mutual Savings Bank, both based in Milwaukee, and a former Director and Chairman of the Board of the Federal Home Loan Bank of Chicago, Mr. Buestrin has served on the boards of several other banking institutions over the past 17 years.

Mr. Drew was first appointed to the Commission in 1991 and reappointed in 1996 by Governor Thompson, and reappointed in 2002 by former Governor Scott McCallum. An attorney concentrating his practice in the areas of municipal and real estate-development law, Mr. Drew is currently the Executive Director of the Milwaukee County Research Park Corporation. Mr. Drew has also served as Director of the Milwaukee County Department of Administration, Commissioner of the City of Milwaukee Department of



Thomas H. Buestrin,
Chairman

William R. Drew
Vice-Chairman

Richard A. Hansen
Secretary

Duane H. Bluemke,
Treasurer

City Development, and was City of Milwaukee Alderman and former President of the City of Milwaukee Common Council.

Mr. Hansen was appointed to the Commission in 1999 by then Governor Thompson. A longtime member of the banking community, Mr. Hansen is currently President and Chief Executive Officer of Johnson International, Inc. Prior to his current position, he served as President and Chief Executive Officer of Firstar Madison. Mr. Hansen also served in that capacity for various Firstar branches in Minnesota and northwestern Wisconsin. He is a Director and past Chairman of the Board of Directors of the Bank Administration Institute, member of the Community Bank Council and member of the Board of the Puelicher Center for Banking Education at University Wisconsin Madison. He is Chairman of Future Wisconsin, Inc. and serves as Chair for several Racine area committees.

Mr. Bluemke was appointed to the Commission in 1992 and reappointed in 1998 by then Governor Thompson. Mr. Bluemke has long been involved in the health care field, providing cost control programs for health care facilities as President and founder of U.S. Counseling Services, Inc., and President of Gibraltar Consultants, Ltd., a hospital management consulting firm. He has been a lecturer on health care equipment maintenance cost reduction and prepared articles on the subject for various health care industry publications. Prior to his current endeavors, he worked in both the engineering and insurance fields in a variety of capacities. Mr. Bluemke is also active in real estate development in the Milwaukee area and serves on the Board of Directors of Lutheran Home for the Aging, Inc.

Each officer's term is set to expire on December 31, 2004.

PROPER LOCATION OF CENTERS OF SECTIONS

Since it became operational in 1961, the Regional Planning Commission has engaged in the remonumentation of the U.S. Public Land Survey System within and adjacent to the seven-county Southeastern Wisconsin Region. This work has involved the cooperative

efforts of the Commission, the Wisconsin Department of Transportation, the seven counties concerned, and a number of cities, villages, and towns. A total of 11,040 section and one-quarter section corners, including centers of sections—or about 94 percent of all such corners in the Region—have been or are in the process of being located, remonumented, and placed on the State Plane Coordinate System through high order horizontal control surveys.

The resulting horizontal control survey network, and the procedures used in the creation of that network, have stood the test of almost 40 years. The network has been widely used in the conduct of land and engineering surveys throughout the Region; has provided the basis for the preparation of large-scale topographic maps meeting National Map Accuracy Standards together with companion cadastral maps; and has provided the basis for the creation of automated, parcel-based land and public works management information systems within the Region. No successful professional or legal challenges have been raised relative to the control survey network, or to the procedures used in the creation of that network, in almost 40 years.

Issue

Inexplicably, a professional debate still occurs from time to time over the correct procedure to be followed in locating the centers of sections. This debate was historically reflected in the literature, and particularly in papers and correspondence published in the Journal of the American Congress on Surveying and Mapping and in the Wisconsin Professional Surveyor, among other publications, and has been the subject of post-graduate research studies conducted at the University of Wisconsin.

The Commission carefully examined this issue in 1961. The examination included consultation with experienced and knowledgeable land surveyors and engineers practicing within the Region, and with staff of the then General Land Office of the U.S. Department of the Interior. Based upon that examination, a policy governing the procedure to be used in the location of the centers of sections was adopted, and that policy has been applied by the Commission in the conduct of all of the land survey work undertaken by the Commission since 1961. The policy adopted by the Commission, and the procedure specified in that policy, have been specifically concurred in by a number of County Surveyors holding office within the Region, including the County Surveyors of the Counties of Kenosha, Ozaukee, and Racine. Since the Commission provides County

Surveyors for Milwaukee, Walworth, and Waukesha Counties, the procedure has, of course, been concurred in by those County Surveyors as well.

Commission Policy
The Commission-adopted policy governing the procedures to be used in the location of the centers of sections specifies that:

- Where a section has never been subdivided, the center should be located at the intersection of straight lines connecting established opposite quarter corners. There are few such sections in the Region.

- Where a section has been previously subdivided, the center should be located on the basis of the available physical evidence of the location of the center of the section as that location was determined in the original subdivision of the section by surveyors authorized to make such subdivision.

Rationale for Commission Policy
The Commission adopted the foregoing policy after careful consideration for the following compelling reasons:

- The center of sections were not established by the Government Surveyors in the conduct of the original U.S. Public Land Surveys. The subdivision of the sections and the attendant location of the centers of the sections were left to County Surveyors and other private land surveyors engaged for this purpose. The subdivision work was to be conducted in accordance with applicable State law. That law has been changed from time to time, and the changes have important implications for the issue concerned. The law in effect at the time of the subdivision, and the instruments and methods used by the surveyors in the subdivision, have a bearing on the location in which the monuments or other physical evidence of the location of the centers of sections are found.

  From 1836—the date when the U.S. Public Land Surveys were completed in Southeastern Wisconsin—until 1853, the *Wisconsin Statutes* required that the centers of sections be located at the intersection of straight lines run between opposite quarter corners.

From 1853 to 1860 the *Wisconsin Statutes* required that the centers of sections be located at equal distances from the opposite quarter corners. The center of a section located in accordance with this method could be anywhere from several feet to several hundreds of feet from the center established by the intersection of straight lines connecting opposite quarter corners.

Then from 1860 to 1862, State law required the centers of sections to be located on a straight line run between the east and west quarter corners at a point equidistant from those corners; and from 1862 to 1867, the law was again changed, reverting to requiring the centers of sections to be located equidistant from the opposite quarter corners.

Finally, in 1867, the law was again changed to require surveyors in subdividing a section to be governed by the laws of the United States and the rules and regulations made in conformity thereto. This again required the centers of sections to be located at the intersection of straight lines run through the opposite quarter corners.

These changes in State law were made over the period of time in which the majority of the sections within Southeastern Wisconsin were subdivided. Therefore, it should be expected that many centers of sections were and, therefore, are properly located in accordance with the State law in effect at the time, but at substantial variance from a position at the intersection of straight lines through the opposite quarter corners. Within Southeastern Wisconsin, substantial monuments were often erected to mark the centers of the sections so located, particularly cut limestone monuments, many of which have survived to this day.

To apply the rule in effect today to locate a corner which was properly set in the subdivision of a section when another rule was in effect is illogical and contrary to good land surveying practice.

Long-established, sound professional practice, supported by numerous court decisions, requires the land surveyor in locating boundary lines to "follow in the footsteps of the original surveyor." The surveyor's function is not to set new corners—even to correct errors—but to locate and use corners marked by his predecessors. This principle requires that where a section has been subdivided, the center be located on the basis of available physical evidence, including monumentation, fence lines, hedge lines including such lines formed by trees, shrubs or field stone rows; and the traveled ways of public roads. Failure to follow this sound principle of practice can only create mischief by disturbing settled property rights and lead to fluid and unstable property boundaries and to disputes and litigation.

- To ignore existing physical evidence, including monumentation, and to rely on a theoretical location for the center of a section not only violates good surveying practice, but leads to the absurd situation where refined instrumentation introduced over time will result in constant shift in the location of not only the centers, but also in the locations of the related section and quarter section corners, some of which have been lost and restored. The individuals who devised and implemented the U.S. Public Land Survey system were too knowledgeable, experienced, and practical to fall into that trap. Considering all of the conditions existing at the time of the original subdivision of a section and attendant location of the center of the section including: the applicable law; the type of surveying instruments and methods in use; the value of the land; and the level of training and experience of the surveyors involved; it should be apparent that present day practices will almost always show discrepancies in the position of a corner located one-hundred years or more ago and the position of that corner as located under different rules and refined instrumentation and procedures. It is for precisely this reason that the rules governing the location of U.S. Public Land Survey corners have always required that the location of the original township, section, and quarter-section corners, as determined from available physical evidence, must stand as the true corners of the subdivisions which they are intended to represent. If this were not so, the continued refinement of instruments and methods would mean a continuing shift in the locations of the corners to try to meet recorded bearings, distances, and coordinates

with resulting chaos in the determination of property boundaries. Therefore, the Regional Planning Commission has followed that same rule in the location of the centers of sections.

LAND DIVISION CONTROL GUIDE AVAILABLE

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) has published an update to its land division control guide. The guide is one in a series of guides intended to promote good public planning and sound community development within the seven-county Southeastern Wisconsin Region. The new guide explains the fundamentals of good land subdivision practice, procedure, and design; and is designed to assist county and local units of government, land developers, engineers, and surveyors in achieving higher standards of land division and development throughout Southeastern Wisconsin. To that end, the guide includes a model land division control ordinance. The guide also includes a model agreement and a sample declaration of restrictions creating a homeowners association.

Land division regulations are one of the most important tools available to county and local governments to guide the conversion of undeveloped land into buildable lots. It is through such regulation that the public interest in land division is expressed and protected. The importance of land division regulation is illustrated by the high levels of land division activity that have taken place in the seven-county Region from 1960 through 2000. Over this 41-year period, an average of 3,337 residential lots have been created each year within the Region through subdivision plats. The platting activity has ranged from a low in 1982, when 481 lots were created, to a high in 1960, when 6,272 lots were created. In 2000, a total of 3,143 lots were created. The locations of these subdivision plats, their design, and the quality of the attendant improvements have had a major impact on environmental quality and on the cost of providing public facilities and services within the Region.

Land subdivision is far more than a means of describing, marketing, and taxing land; it is the first step in the process of building a community. Much of the form and character of a community is determined by the quality of its land divisions. Once land has been divided into blocks and lots, streets constructed, schools and parks created, and utilities installed, the development pattern is firmly established and is unlikely to change substantially. Residential, commercial, and industrial structures will be built on the sites created by the land division. After many decades of use, some of these structures may be razed to make way for new structures and thereby accommodate new uses. Yet, the street pattern established by the initial land division often remains in place. For generations the entire community, as well as the individuals who occupy a land division, will be influenced by the quality of its design and by the character of its improvements.

Land subdivision in Wisconsin is regulated by Chapter 236 of the Wisconsin Statutes. The Statutes are intended to ensure that clear and accurate property boundary line records are established and recorded when land is divided. Under the Statute, affected State agencies review proposed land divisions to ensure that development will not adversely affect water quality or adjacent State highways, and that access to navigable lakes, rivers, and streams will be provided.

Land division ordinances adopted by county and local units of government are often more detailed than, and serve to supplement, State requirements. Local land division ordinances should establish design and improvement standards for land development, including street layouts, widths, and grades; bicycle and pedestrian circulation; park and open space requirements; block configurations; lot sizes; and street, utility, stormwater management, and transit improvements. Recommended design and improvement standards are described and illustrated in the guide. The guide also includes a comparative evaluation of four subdivision design types in use today: a conventional curvilinear design, a cluster design, a neo-traditional or new urbanism design, and a coving design.

SEWRPC NOTES—continued

Land division control ordinances are an important means of implementing community comprehensive plans. A number of communities in Southeastern Wisconsin have adopted such plans, and many communities will update or adopt such plans in response to the comprehensive planning—often referred to as "Smart Growth"—requirements adopted by the Wisconsin Legislature in 1999. The integration of land division control with comprehensive planning will help to ensure that proposed land divisions will fit harmoniously into a community's existing and planned land use pattern, and that adequate provision is made for community and neighborhood facilities, including parks, schools, and shopping areas. The proper relationship between a community comprehensive plan and land division regulations is described in the guide.

Copies of the guide may be ordered by contacting the Commission offices at (262) 547-6721. The model land division ordinance is available on the Commission's web site at www.sewrpc.org/modelordinances.

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