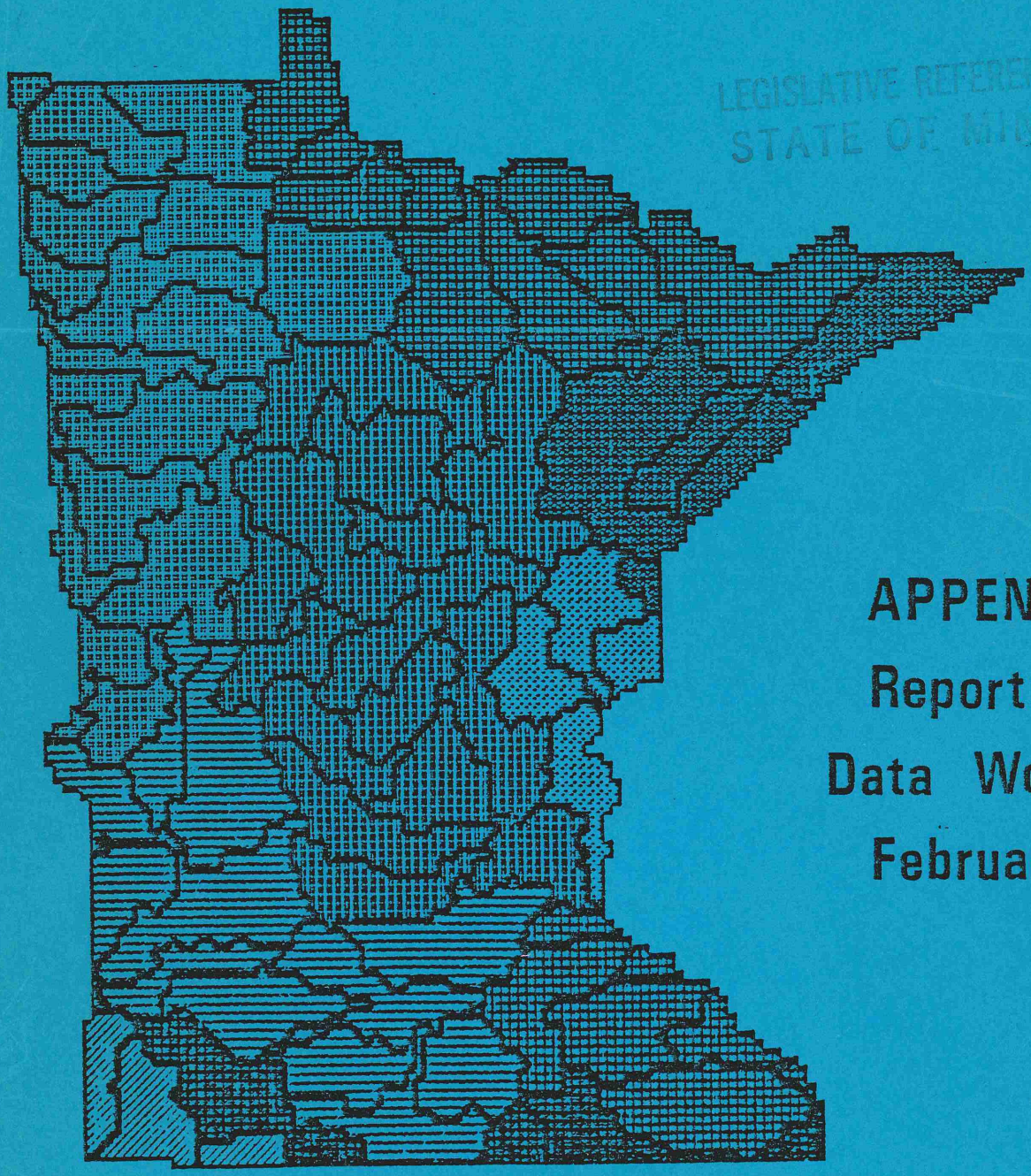
Toward Efficient Allocation and Management:



APPENDIX C: Report of the Data Work Group February 1979

A REPORT OF THE MINNESOTA
WATER PLANNING BOARD
TO
THE LEGISLATIVE COMMISSION
ON MINNESOTA RESOURCES
AND
GOVERNOR ALBERT H. QUIE

ACKNOWLEDGEMENTS

The "Final Report of the Data Work Group" represents the efforts of individuals who were members of the Data Work Group. The development and extensive review of this report was also facilitated by the cooperation of representatives from many other agencies including the Departments of Agriculture, Natural Resources and Health; the Energy, Pollution Control, and State Planning Agencies; the Minnesota Geological Survey and the Regional Development Commissions. The entire report has been reviewed and approved by the Technical Committee of the Water Planning Board.

Members of the Work Group included:

Bruce Olsen, MGS - Chairman
Richard Holtzman, MGS
Bob Tyler, MEA
Ron Visness, MEA
Mary Louise Dudding, SPA
Les Maki, SPA
Al Robinette, SPA
Tom Peterson, 6E RDC
George Orning, DNR
Eric Madsen, DNR
Dennis Quan, DNR
Linda Bruemmer, MDH
Bob Pope, PCA
Jack Ditmore, WPB
Bonnie Skelton, DOA
Steve Levy, DOA

The recommendations presented are those of the Work Group, and are not necessarily identical to those adopted by the Water Planning Board. This report provides documentation of the rationale and development of the water resources information and data section of the framework plan.

Primary funding for this project was provided by the Legislative Commission on Minnesota Resources, with additional assistance provided by U.S. Water Resources Council Title III Water Resources Planning Grants.

TABLE OF CONTENTS

SUMMARY AND RECOMMENDATIONS

Summary. In the fall of 1976, efforts were begun to develop a water information system within the Framework Water and Related Resources Plan as funded by the Legislative Commission on Minnesota Resources. The initial work program assignment to the Minnesota Energy Agency was for the design and implementation of a useable water information system, starting with an evaluation of whether or not techniques used in the development of its Regional Energy Information System could be used in a water information system.

The original concept of the water information system was to develop a centralized data base. This approach does not appear to be the most practical because the differences in existing data types, formats, uses of the data, complexity of file structures, and the sheer volume of data would cause any centralized data base to be extremely costly to develop and maintain. The most workable water information system will consist of having the individual sources coordinate their data collection and filing programs to eliminate any duplication of effort and to access these individual data bases through a centralized user service bureau. The concept of coordinated data bases versus a centralized data base would concentrate on improving access to individual data files rather than attempting to create a huge centralized data base regardless of the present data retrieval abilities of the sources. Also, the current trend in computer technology development is oriented towards distributive data processing in which sources would use "in house" mini-computers to process their own data and to interact with other data sources through a centralized computer system.

The Technical Committee of the Water Planning Board established the Data Work Group to coordinate the input of all agencies in the development of a water information system. The major emphasis of the Data Work Group effort has been to inventory individual water-related data sources and to develop the framework of a system for retrieving water resources information.

The objective of this report is to summarize the activities of the Data Work Group of the Water Planning Board and to delineate actions which must be taken in order to insure the continued success of a coordinated water management information system.

After assessing the accomplishments and problems encountered in setting up the System for Water Information Management (SWIM), the Data Work Group has defined statements of need and design. In addition, the Data Work Group has outlined policy and service functions for SWIM, its operational structure, and proposed FY 80 work program. Meanwhile, the Energy Agency has worked to organize and automate the data bases at some of the agencies, and has noted that, realistically, some agencies will never automate their data files.

SWIM has evolved into an incremental development process similar to that which the Minnesota Land Management Information System (MLMIS) has undergone over a ten-year period. Future growth of SWIM will be in response to use and not the result of any initial grand design. It is assumed that the development period will not be as long as that of MLMIS because of the experience gained from setting up that system.

The purpose of the System for Water Information Management is to link together the users of water data with those agencies and institutions that collect, store and use the data. Along with fulfilling its primary role in the development and implementation of the Framework Water and Related Land Resources Plan, SWIM should be able to address the needs of individual state agencies, local governments, other public or private groups doing water-related research, and citizens.

SWIM has not centralized all water resource information into a single data base because such an approach seems to be economically impractical. Rather, SWIM will serve as a mechanism to tie together existing and future information systems within the state and elsewhere in order to coordinate and simplify user access.

While considerable strides have been made in coordinating the development of SWIM, the task is by no means complete: (1) Although several prototype automated data bases have been developed, much actual data entry remains to be accomplished before they will have comprehensive usage abilities; (2) Additional units of government maintain data bases that either should be accessed or made more accessible; (3) A thorough evaluation of data needs and quality is needed.

Recommendations.

(1) The Data Work Group recommends that the original centralized data base concept be abandoned in favor of using individual data bases which are coordinated and accessed through a centralized user service bureau. This latter approach is more practical to implement and is consistent with current computer technology development.

(2) The Data Work Group recommends that the Water Planning Board continue its support for development of SWIM. The benefits of SWIM as a management tool for agencies and as an analytical aid for planners enhances the various state agencies' ability to carry out their mandated functions.

(3) The Data Work Group of the Water Planning Board recommends that, for the successful continued operation of SWIM, a permanent User's Committee should be established, This group would set policy and provide technical advice to the Water Planning Board and SWIM staff, irrespective of the final administrative location of the information system.

(4) It is proposed that the operational framework for SWIM consist of the User's Committee, a small core SWIM staff to operate a service bureau, and individual agency data bases with their own personnel and a link to the Water Planning Board through the SWIM coordinator.

(5) It is recommended that the SWIM coordinator follow the work program and priorities during FY 80 as defined in this report. Tentative longer range priorities for the future of SWIM have also been outlined. The important elements of SWIM involve policy and service functions, provision of limited technical assistance to agencies and assessment of priorities for information systems development.

(6) Since some of the multiple data bases which comprise SWIM are managed by SYSTEM 2000 at the University of Minnesota, it is recommended that the Water Planning Board systems coordinator request to serve on the University's Long Range Planning Committee for the University Computer Center.

(7) River mile indexing, data quality, georeference, and parametric standards should be established to provide uniformity to SWIM output. Further, it is recommended that the data base delineating watershed boundaries be adopted for official state use.

PART I -- INTRODUCTION

Among the "Goals and Objectives for Minnesota" put forward by the Commission on Minnesota's Future in January, 1979, was the establishment of an information and data management system. The Commission noted: "The State of Minnesota needs a comprehensive data management system including the collection, interpretation, and extensive dissemination of data." Even more specifically, in 1972, a groundwater quality subcommittee of the Environmental Quality Council's Citizens Advisory Committee found that, "...experiences with groundwater contamination attributed to unwise land-use and conflicts of groundwater supply between industrial and private consumption have pointed to a need for a groundwater information system for Minnesota."

Development of water management information systems serves to address the needs of (1) individual state agencies, (2) local governments, (3) citizens, and (4) other private or public groups doing water-related research. A system for water information management can provide state agencies with information for use in regulatory activities, management, and planning; local governments with information for use in shoreland and flood plain management; individuals with information to meet personal needs and for becoming involved in environmental issues; and environmental groups and industry with data for use in research or planning.

Based on the preceding justification of need and potential value, the feasibility of developing a water management information system for Minnesota was assessed by the Minnesota Energy Agency (MEA) during Phase I (i.e., FY 77) of the Framework Water and Related Land Resources Plan development process. The Legislative Commission on Minnesota Resources (LCMR) approved $3,500 for an evaluation of whether the same techniques that were used in the development of the MEA's Regional Energy Information System (REIS) could be used in the development of a water management information system. The initial evaluation identified 11 major data sources which could be automated, as well as water information presented in numerous studies and reports. The MEA concluded that it would be possible to construct a water management information system utilizing these data resources.

In Phase II of the Framework Plan development process (FY 78-79), the Minnesota Energy Agency proposed the design and implementation of a useable water management information system. The Water Resources Council concurred with this proposal and forwarded it to the Legislative Commission on Minnesota Resources as an element of the Phase II work program. The LCMR approved funds for the project ($100,000) through the MEA, but required that the newly created Water Planning Board coordinate work programs and reports and that the water management information system be developed consistent and compatible with the Minnesota Land Management Information System (MLMIS).

The original intent of the MEA was to develop a centralized, statewide data base containing information on both surface and ground water. The data base was to be keyed to a georeference structure and would have been compatible with the land-use data housed on the MLMIS. To assess the feasibility of this approach, the MEA initiated a review of the structure of data resources inventoried in Phase I to determine if there was sufficient uniformity to combine all these data into a single structure. While a degree of similarity was found to exist in georeference terminology, the differences in formats, data types, uses of the data, complexity of file structures, and the sheer volume of data suggested that the incorporation of all water information into a single data base is impractical. However, the georeference uniformity did point to the practicality of common access to the data even though it might be stored in separate data bases.

At approximately the same time, the MEA was reaching this conclusion, the newly formed Water Planning Board was organizing itself to direct the preparation of the Framework Water and Related Land Resources Plan, including its water management information system component. The Board settled on a structure involving a Technical Committee (composed of representatives of agencies cooperating in the planning effort) and three major Work Groups, one of which was responsible for guiding the work on development of the water management information system (i.e., the Data Work Group).

The Data Work Group was divided as to the relative importance of organizing the existing water data sources into individual automated data bases versus the conduct of a needs analysis concurrent with actual data base organization. The former view was operationally oriented, while the latter represented more of a planning perspective. Based on the conclusion that until the existing data collection systems are organized and coordinated it will be difficult to present planners and policy-makers with accurate data, it was determined that the focus of the information system development effort would be on organization of prototypes of automated systems which are fully coordinated. Initial efforts were to be focused on aiding the Departments of Health and Natural Resources, with close communication with other agencies (including the Minnesota Geological Survey) in developing automated data bases.

In addition, the Data Work Group expanded on the initial water information system work program with the development of a demonstration project reflecting the uses of water information for planning and

management decision-making. Using the four counties of Region Six East for demonstration purposes, land use, geologic, hydrologic, soil, water use, and economic data were employed to indicate how their interrelationships could affect the development of agricultural irrigation in the area. (Region 6E expressed an interest in the potential impact of irrigation development and contributed staff to collecting necessary background data.)

To complete the demonstration project, an irrigation sub-group of the Data Work Group was formed. This sub-group coordinated numerous agencies' personnel and the computer resources of the Minnesota Land Management Information System with the automated data bases being developed through the MEA and individual agencies in order to determine appropriate methods for portraying raw and interpreted data for use in decision-making relative to further irrigation development. The irrigation study demonstrates many of the capabilities of a water information system, while helping to define some of the problems associated with coordinating automated data bases and supplying this information to users. The methodology developed by this should be useable in all regions of the state.

The Data Work Group also took on the responsibility of developing an automated water data sources catalogue. This catalogue is an important adjunct to the information system because it allows users to identify sources of information and how they may be accessed where coordinated, automated data bases have not been developed. In 1975, a water data catalogue was prepared in printed form, but no responsibility for its update was established. The State Planning Agency and the Department of Natural Resources worked with both the Water Planning Board Management Work Group and the Data Work Group to accomplish the update. The catalogue was automated so that it can be easily modified and updated as new studies are completed or as new data programs are implemented.

In summary, the Data Work Group has taken significant steps toward the implementation of systems for water information management since October, 1977, although much remains to be done. The most important decision of the Work Group -- and a variation from the original information system proposal of the Minnesota Energy Agency -- was to move from a centralized data base approach to support the development of separate, coordinated data bases. The Minnesota Energy Agency has worked with individual agencies during the FY 1978-79 biennium to develop these separate but compatible data bases. The results of this work are described in the following sections. Concurrently, the Data Work Group has provided guidance to these efforts and cooperated in the development of the Region 6E demonstration project (using the MLMIS) and in the development of the automated water data sources catalogue.

PART II - COMPUTER DATA BASES CURRENTLY AVAILABLE TO THE SYSTEM FOR WATER INFORMATION MANAGEMENT (SWIM).

As noted above, investigations by MEA and the Data Work Group quickly revealed that SWIM should not be organized as a single centralized data base. Because of the large quantity and complexity

of the data involved, such a system would be very costly to develop and maintain. An alternative recommended by the Data Work Group is to develop SWIM as a collection of compatible but distributed data bases, each maintained within an appropriate state agency. Information from several such data bases would then be combined through computer programs developed and maintained by a centralized service bureau similar to MLMIS.

At present, there are ten data bases containing water information useful to SWIM. Of these, six have been coordinated through the Water Planning Board Data Work Group and are designated as SWIM data bases. Each of these has relied upon LCMR funding for initial development or data loading.

SWIM Data Bases	Participating Agencies
Water Data Source Catalogue	DNR, SPA, MEA
DNR Watershed Data Base	DNR, SPA
MDH Well Log Data Base	MDH, MEA
DNR Water-Use Data Base	DNR, MEA
DNR Aquifer Data Base	DNR, MEA
MGS Subsurface Geology Data Base	MGS
DNR Surface Water Data Base (Proposed)	DNR
Other Data Bases	
DNR Permit Index and Mailing List	DNR, ISD
PCA Information Systems	PCA, ISD
USGS 1975 Water-Use Data Base	USGS
MDH Water-Quality Information System	MDH

Brief descriptions of the six SWIM data bases follow. Additional details will be documented in technical or working papers.

Water Data Source Catalogue

Jointly, DNR, MEA, and SPA have just completed an initial loading of the Water Data Source Catalogue, which is an update of a similar document published in 1975. Initially, it will be limited to state water program descriptions, but the ultimate goal is to include also federal, regional, and university water data information. Unlike the 1975 document, this catalogue is computerized. A machine processible approach will simplify updating and the dissemination of changes. Because of the increasing use of computers in the state government's water resources departments, the accessibility of such

a computerized catalogue is becoming increasingly practical and convenient.

Information about water related projects and programs was collected primarily by personal interviews. Additional information was obtained from the 1975 catalogue, internal DNR sources, and other literature sources. The catalogue contains: organization name, how water data is collected and used, geographic identifiers, history, detailed lists of parameters collected and their collection frequency, number of sites for water data collection, type of analysis used, a list of pertinent publications and, finally, the current and potential users of the data. At present 56 projects are included. This number may double or triple as federal, university, and regional projects are added.

The information obtained during interviews was recorded on forms designed for easy entry into a SYSTEM 2000 managed data base. Both data entry and retrieval can be accomplished using time-sharing terminals, or a detailed listing may be printed for distribution on a regular basis. New water data collection programs can be added to the catalogue easily. Revised listings including additions, changes, and corrections can then be distributed as needed.

Watershed Data Base

The watershed mapping project is being performed by personnel at the DNR Office of Water Planning in conjunction with MLMIS. All the watersheds in the State of Minnesota are being accurately delineated and coded in a form compatible with MLMIS. Watershed boundaries are marked on U.S. Geological Survey topographic maps and then coded by 40-acre parcels for entry into the data base. (Some heavily urbanized areas in the metro region are coded by 2 1/2-acre parcels using data supplies by the local Soil and Water Conservation Districts.) This is a one-step process with major and minor watersheds being coded and entered simultaneously. Final reports will include procedures for mapping, accessing and updating the watershed files. All of these watersheds will be shown on a 1:500,000 scale map.

The watershed data base is managed using existing MLMIS software. It now contains boundaries for 82 major watersheds and about 4700 minor watersheds. These are stored on a county basis. The total volume of the data base when finished will be about 17,000,000 characters (letters, numerals, or other symbols). The size of the data base should not change greatly after initial compilation.

Ground-Water Information System (GWIS)

The Ground-Water Information System is composed of four different SWIM data bases: MDH well-logs, DNR water-use data, DNR aquifer data, and MGS subsurface geology.

DNR collects high capacity and observation well information, about 5,000 logs in all. MDH collects all new well log information, approximately 7,000 logs yearly. MGS collects all well log information, approximately 70,000 logs to date. In addition, DNR collects

yearly reported water use. Each of these information sources is essential to a comprehensive base for ground-water planning and research.

MDH Well Log Data Base

The MDH Division of Environmental Health maintains a data base designed to contain well logs submitted by drillers since 1975. Well logs submitted to MDH in 1978 are currently being entered. Water quality data generated by the MDH laboratory will be added. The most important items upon which retrieval can be based are unique well number, county code, driller's license number, location, and well use. These can be used to pick out potentially useful wells for the DNR and MGS.

Well logs are entered as they are received, regardless of the geographic area from which they come. This permits the Health Department to maintain an up-to-date picture of the well construction practices and water quality across the state. The current well construction rate is about 12,000 per year, of which about 7,000 are reported.

The well log information is keyed onto magnetic tape cassettes and, after proof-reading, is sent by telephone to the University Computer Center for permanent storage and entry into the SYSTEM 2000 data base. Data entry costs are about $1.00 per log. To date, about 3,000 logs have been entered.

DNR Division of Waters Water-Use Data Base

This data base began as a Water Planning Board project to determine water use based on DNR appropriation permit reports, and has been expanded with WPB estimates of supplemental and unreported water uses. The principal uses of this data base are for DNR management, coordination of permits among agencies, storage of basic information for the federal National Water Use Data System, and providing water-use information to the public and other agencies.

The water-use data base contains permit information, DNR annual water-use reports, county and watershed estimates of water use, and additional descriptive information, such as state and federal watershed, state and SIC use codes, and interpretive comments. Each entry into the data base may contain information on location, type of use, type of source, allowed use, reported use, disposal of water, and agency processing information. A detailed description of the data base and how to access the information is being written.

The data base is stored on the University of Minnesota's Cyber 172 computer and is managed by SYSTEM 2000. Anyone with a minimal knowledge of computers, the supplied documentation, and a university computer account will be able to access data bases freely. Only DNR staff, however, will be able to modify the data base contents.

The data base is presently based on over 10,000 DNR permits plus several hundred individual, county, and watershed entries. Less than half of the entries in the data base include actual water use information. The others describe potential or past water use. The projected size of the data base is 20,000 entries, with upgrades coming from 15,000 yearly water use reports.

DNR Division of Waters Aquifer Data Base

The DNR aquifer data base was created to meet the water management and availability needs of the DNR ground-water group. The aquifer data base contains hydrologically interpreted logs of high capacity wells and observation wells.

The raw data for the data base is acquired from the MGS and MDH files and data bases, from DNR well log and permit files, and from USGS and other source files. Each well log is edited, hydrologically interpreted and correlated, and entered into the data base. The DNR water-use data base is then checked for additional information about those wells. Field work is often necessary to determine such information as the aquifer parameters and current water levels. Information from DNR and USGS observation well networks keep the data base current on present water level conditions.

Data entry procedures are now quite complex because of the large volume of historical information from various sources that is being entered. Costs will not be adequately determined until editing assures the completeness and validity of the information. Although the actual data entry cost is only a few dollars a log, the correlation and hydrologic interpretation costs are impossible to determine because they are part of the overall DNR ground-water program.

The aquifer data base now contains information on about 3000 high capacity and 1000 observation wells. Although all historical water level information will not be stored in the data base, it will be available on computer tapes for output in hydrograph form. The projected size of the data base is 10,000 logs, including high capacity, observation, and contributing wells. The information is stored as a SYSTEM 2000 data base on the University of Minnesota CYBER 172 computer.

MGS Subsurface Geology Data Base

The Minnesota Geological Survey maintains a three-part data base containing subsurface geologic data. The principal uses of this data are geologic and hydrogeologic mapping, water and mineral resource analyses, and environmental studies. The three subdivisions of the data base are (1) water well drilling records, (2) engineering test boring records, and (3) mineral exploration drilling records.

Of these subdivisions, the water well data base is of primary interest to the Water Planning Board. A detailed description of the water well data base and its uses can be found in Information Circular #16 of the Minnesota Geological Survey by Holtzman and Wahl (1979). Information entered into the data base from water well drilling records includes all of the information occurring on the reporting form of the 1974 Water Well Construction Code.

Because the quality of much of the data from reporting forms is inconsistent, or of low utility without a specialized knowledge of driller's terminology, MGS generates additional data that is appended to the records before they are entered into the data base.

These include:

(1) Precise geographic locations. Locations plotted on maps in the field are digitized to obtain Universal Transverse Mercator coordinates (from which latitudes and longitudes are readily computable). In addition, grid overlays are used to obtain public land survey coordinates.

(2) Evaluation of well collar. Obtained from USGS topographic quadrangle maps.

(3) Aquifer used. Interpreted from well construction and geologic log, and coded using standardized geologic formation codes.

(4) Geologic formation and associated rock type encountered in drilling. Interpreted from driller's description and knowledge of geology near well. Coded using standardized geologic formation codes and lithology codes.

Addition of this data is relatively costly, but essential in order to insure utility and reliability in geologic, hydrogeologic and environmental studies. The final locations are very accurate ($\pm$ 50 m) and the interpreted geologic logs range from low to high reliability depending largely on local geologic complexity and the experience and care taken by individual drillers.

Data entry involves coding on standard coding forms, keypunching, verifying, and editing. The resulting error rate is extremely low. The cost per log (including field location and geologic interpretation) averages $8.00; keypunching, verifying, and editing account for about $2.00 of the total cost. All data is stored by county and unique number on magnetic tapes, each tape having a duplicate back-up.

All data processing is performed on the University of Minnesota Control Data CYBER 74 computer. Applications sofeware includes a report generator and automated mapping programs. Data has been successfully transferred to MLMIS, making a large body of additional software available.

Presently the water well data base contains records of about 10,000 water wells concentrated in 10 counties. An additional 60,000 are maintained in paper files. Data is usually entered on a project basis, with all useable data for a given study area being entered at one time. In the next five years it is expected that 5,000 to 10,000 logs will be entered annually. The size of the data base may well increase ten-fold in the foreseeable future. The data base is already so large that the use of generalized data base management programs (such as SYSTEM 2000) is uneconomical.

PART III - STATEMENT OF NEED

The purpose of the System for Water Information Management (SWIM) is to link together users of water data with those agencies and institutions which collect, store, and also make use of the data. Along with fulfilling its primary role to assist in the development and implementation of the State Framework Water and Related Land Resources Plan, the SWIM should also be able to address the needs of (1) individual state agencies, (2) local governments, (3) other public or private groups conducting water-related research, and (4) citizens.

(1) State Agencies. For individual state agencies, SWIM and its various components will be able to provide information to aid in the decision-making process for the following types of mandated functions:

A. Regulation. State agencies carry out their regulatory functions chiefly through the permit process (DNR and PCA) or through zoning (shoreland management, floodplain management, and wild and scenic rivers). Permits are issued for water appropriations or activities which affect public waters such as pollutant discharges, dredging, or drainage of wetlands. Zoning is a regulatory function which affects water by controlling land uses adjacent to water bodies. While individual agencies need organized and current information for their own regulatory processes, these processes can also generate data which, if properly standardized and consistent, can be used in filling the information needs for broader planning or research efforts or for management activities other than those directly associated with the regulatory function that is generating the information.

B. Management. Other than strictly regulatory functions, some state agencies deal with water related management activities. These activities may make use of information generated under the regulatory programs or may collect and utilize self-generated data. Some of the management activities include (1) management of state-owned water and related land resources (e.g., DNR game lake and fish lake management or DNR water recreation activities), (2) resource conservation activities (e.g., Soil and Water Conservation Board), (3) classifications and inventories (e.g., DNR Public Waters Inventory, DNR Lake Classification or PCA Water Quality Classifications for Lakes and Streams).

C. Public Health and Safety. The Minnesota Department of Health and Minnesota Pollution Control Agency undertake programs designed to protect public health and safety. These include licensing water well contractors, performing water tests of individual water supplies, water quality monitoring of municipal water supplies, and special water quality monitoring in problem areas (leaks, spills, seepage from landfills, etc.). The programs generate

chiefly technical measurement of water quality parameters. However, the well logs turned in by drillers have extensive utility in many other research activities.

D. Planning and Research. Several state agencies are mandated to plan and conduct research on water-related issues. This list includes the Water Planning Board, with its State Framework Water Plan; the PCA, including its 208 Water Quality Planning Program; the State Planning Agency; the DNR's water planning activities; and, in a somewhat special category, the Minnesota Geological Survey. Most of these activities depend on information generated from the regulatory or management functions listed above. It is here that the need for an integrated water management information system is most critical. Some examples of planning problems which need information derived from several different sources include: impact of drought conditions on Minnesota agriculture; water availability, both surface and ground; projections of future water use; and the impact of such activities as irrigation, power plant construction, and hazardous waste disposal on water resources.

The above functions are indicative of the many state agency programs generating or utilizing data concerning water, its use, distribution and quality.

(2) Local Governments. Local governments often perform functions for the state at the local level or have some of their own water use and management activities. While the Shoreland Management Act is a state law, each county and municipality is responsible for drafting its own shoreland zoning ordinance in compliance with general state criteria. Some types of local government do their own regular water quality monitoring. One example of this kind of activity is carried out by the Metropolitan Waste Control Commission.

(3) Other Public Organizations. Other public groups that conduct water-related research or planning include various federal entities (U.S. Geological Survey/Water Resources Division, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, and various basin commissions). Several large data bases and inventories exist at the federal level (STORET, WATSTORE, and NAWDEX). Several programs in the college and university system are active in water research. At the University of Minnesota, major programs include the St. Anthony Falls Hydraulic Lab, the Water Resources Research Center (WRRC), the Minnesota Geological Survey, the Limnological Research Center and the Marine Advisory Service.

Private groups such as environmental organizations or industries are involved in water-related research from time to time. Private consultants are both major generators and major users of water information.

(4) Citizens. Citizens need water-related information for several reasons including solving their own personal needs (permits for appropriations, water quality monitoring of individual supplies) and for becoming involved in environmental issues.

It is clear that, with the number of users and/or collectors at the various levels described above, considerable benefits could be obtained by coordinating storage of data, standardizing certain aspects of the recording of data, and providing a centralized information and access point to users who require multiple sources of data. In addition, the process of putting together a SWIM should give the LCMR and other legislators a better over-all view of the amount and types of water-related information that are currently available and those pieces of information still needed to improve water-related decision-making. The creation and continued support of SWIM is directly in line with stated legislative policy to "establish and maintain statewide environmental information systems sufficient to gauge environmental conditions" (Minnesota Statutes Section 116D.02, State Environmental Policy Act).

PART IV - STATEMENT OF DESIGN

The development of the System for Water Information Management (SWIM) must be viewed as a continually evolving process that will be modified as a result of expanding and changing data needs. The growth of SWIM will be in response to use and not as a result of any initial grand design which would probably not be comprehensive, may be inflexible to change, and may be cumbersome or excessively expensive to utilize once large amounts of data become available. SWIM will not centralize all water resource information into a single data base. Rather, it will serve as a mechanism to tie together existing and future information systems within the state and elsewhere in order to coordinate and simplify user access. Data may be supplied either through a user service bureau created by SWIM staff or from the data source.

SWIM should interact with the Minnesota Land Management Information System (MLMIS) to help prevent all available natural resource information pertinent to making water and related land management decisions. Initially, the primary data sources for SWIM will be state agencies. Many of these agencies will also be the primary users because priority will be given to having the data required for water management in a coordinated reference system. As implementation of the State Water and Related Land Resources Plan proceeds, the use of SWIM in conjunction with MLMIS as an analytical tool for water management planning will be expanded. Its operation must be constantly reviewed to insure that it is effective and that the quality of the information it supplies remains at a useful level.

PART V - FUNCTIONS

The proposed functions for SWIM should be viewed as organizational and developmental guidelines and not as strict rules governing its use. Basically, these functions can be considered as being either policy or service in nature.

Policy Functions

The following elements define the goals and direction for SWIM:

(1) Provide a forum for the formal interaction among data suppliers and users. The primary mechanism for accomplishing this will be a proposed inter-agency SWIM User Committee. Changing user needs and increasing use of SWIM may necessitate periodic revision or even a complete change in the methods used to bring users and SWIM resource personnel together.

(2) Organize a service bureau for centralized user-oriented access to data bases. This element would involve development of a strategy which will provide user access to all SWIM data bases, either through automated data entry or standardized access procedures. This implies operating an information clearinghouse function coordinated by the SWIM staff as well as by accessing all data bases from one source. This will be an ongoing function since new data sources may be added to SWIM or existing sources may add new data types or change the nature of their filing systems.

(3) Establish official reference standards. This element would serve to establish guidelines for file linkage procedures and for uniformity of data formats which will allow easy access to data sets and provide a standardized output. This function would be limited primarily to the operation of SWIM and will not necessarily apply to the standardization of individual state or federally funded data collection programs.

(4) Define overlap and duplication of data collection. This element would assist data sources in the most efficient and economical means of inputting data into SWIM by eliminating the entry of duplicate or redundant data. As new data sources are added to SWIM, their data types currently being entered to define areas of duplication or redundancy.

(5) Assess overall SWIM needs and assign priority and accountability for SWIM staff activities. The first priority for this assessment will be in reference to the implementation of the Framework Water and Related Land Resources Plan. Second priority should be given to collecting data for projects when inter-agency coordination is required to solve some water management problem. Initiation for this later assessment may come from either the SWIM staff or from the agencies.

Service Functions

These elements affect actual data access and use:

(1) Review and catalogue data. This activity is to establish on computer file and to provide for the future update of the water data source catalogue. The catalogue describes sources of water information housed in both automated and manual files and this catalogue should be expanded to include additional federal and private data sources. Eventually, the water data source catalogue may be tied into a full natural resource directory operated through the State Planning Agency.

(2) Provide technical reports and newsletters when appropriate. This effort will document the methods for accessing and utilizing SWIM data bases, descriptions of official reference standards, and the findings of any SWIM sponsored research. Justification for major research publications will only be warranted when requested and funded by legislative, executive, or state body offices. The content of any SWIM publication should be reviewed by a proposed inter-agency user committee and the responsibility for public access to these documents should rest with the SWIM staff.

(3) Provide educational training including systems documentation. This effort will explain the purpose, uses, limitations, and access to the information offered by SWIM. This may be accomplished by distributing and explaining users manuals and conducting user workshops. The responsibility for the overall implementation of this function should rest with the SWIM staff.

(4) Provide user service assistance. Technical assistance will be provided through the development of software or advice on problems. This service is a means for solving individual user problems and should be the primary responsibility of the SWIM staff.

(5) Provide technical assistance to state government and subdivisions to insure compatible water data filing systems. This service will be limited to the needs and uses of SWIM. Priorities for providing technical assistance will follow the guidelines for SWIM data collection needs.

(6) Coordinate water data related funding requests. This activity is limited primarily to the priority data collection needs of SWIM. The responsibility for this review should be shared by the SWIM User Committee and staff.

PART VI - OPERATIONAL STRUCTURE

A description of the proposed operational framework for SWIM is helpful to potential users in understanding any procedures that may be developed governing access to water information. For FY 1980, SWIM will be managed by the Water Planning Board during the formalization of the Framework Water and Land Resources Plan in order to coordinate both projects. For FY 1981 and on, SWIM will probably be managed by an operating agency such as the State Planning Agency. It is proposed that the operational framework for SWIM consist of a policy making body termed the User's Committee, a small core SWIM staff to operate a service bureau, and individual agency data bases operated by their own agency personnel. The first two will be responsible to SWIM management agency, the latter to individual agency heads.

User's Committee

The Data Work Group of the Water Planning Board (WPB) recommends that, for the successful continued operation of SWIM, a permanent User's Committee should be established. This group would set policy and provide technical advice to the WPB and SWIM staff, irrespective of the final administrative location of the information system.

Suggested structure of the group is as follows:

(1) The membership should be divided into two categories: voting and associate.

(2) The 12 voting memberships would be offered to:

(a) Those state agencies currently on the WPB:
Department of Natural Resources
Department of Health
Department of Agriculture
Energy Agency
Pollution Control Agency
Soil and Water Conservation Board

(b) Additional state agencies represented on the WPB Technical Committee:
Department of Economic Development
State Planning Agency
Minnesota Geological Survey
Water Resources Board
Minnesota Department of Transportation

(c) The coordinator of SWIM

(3) Each agency would have only one vote; however, since it is anticipated that meetings will be working sessions, one agency might send representatives from several different divisions if the subject of the meeting warrants it.

(4) Associate members, who would be encouraged to attend all meetings in which they had a special interest, will include, but not be limited to:

(a) Federal Agencies:
Corps of Engineers
U.S. Geological Survey/Water Resources Division
Soil Conservation Service/USDA

(b) Regional Agencies:
Metropolitan Council
Regional Development Commissions
Metro Waste Control Commission
Watershed Districts

(c) Lake and River Basin Commissions

(d) Educationally-Related Groups:
College and University Departments
Water Resources Research Center
Sea Grant
Fresh Water Biological Institute

(e) Environmental Groups:
Sierra Club
Clean Air/Clean Water

(5) Representatives to the User's Committee should be technically oriented, either as a user of water data or as a person working with the development of agency data bases or information systems.

(6) The group will elect a chairman to serve a two-year term.

(7) Minutes of meetings will be recorded, with the distribution of the minutes to be the responsibility of the SWIM coordinator.

(8) During FY 1980, the User's Committee will remain a subgroup of the WPB Technical Committee, with final responsibility to the WPB itself. Beyond FY 1980, the committee would be responsible to the agency head at SWIM's permanent location.

In summary, the important characteristics of the User's Committee are that it is a permanent group of technically oriented persons who are willing to work toward a coordinated and efficient system for managing Minnesota's water resource information.

SWIM Staff

As for most of the other aspects of the information system, the staffing structure must be regarded in two time periods: for FY 1980 and beyond FY 1980.

Only one position has been requested from LCMR for FY 1980, that of a systems coordinator. If SWIM is to become a functioning management system, providing inter-agency coordinative activities as well as centralized user access for applications to planning, research or other multi-agency management problems, the coordinator cannot alone handle the work required. Therefore, beyond this transitional year, additional staffing will be required.

During FY 1980 the coordinator will be responsible to the Water Planning Board. This location is recommended at this time because the Board's interagency nature should keep SWIM staff from getting too involved in a line agency's particular internal data management problems. After FY 1980, another administrative location for the system, such as the State Planning Agency, will have to be found.

Agency Data Bases

Individual sources which supply data to SWIM will be responsible for the automated entry of their information or will be responsible for making their manual files accessible to users. Occasionally, an agency may prepare maps or reports which it would not normally enter into an automated data base. Such interpreted data may be entered into a special SWIM data base. Also SWIM staff may assist an agency in developing the programming required to manipulate data as long as this software can be used to make data accessible by SWIM.

PART VII - PROPOSED WORK PROGRAMS

This report outlines a framework for continuing the development of a water information system for Minnesota. Although over the past 18 months, much effort has been directed toward establishing the nucleus of a coordinated data retrieval system, additional progress can be made in this area and much still needs to be done to develop a service bureau function for disseminating information. The work programs for the proposed SWIM User's Committee and SWIM/staff presented in this section are designed to expand the current work effort and present a detailed work program for establishing a completely operational water information system by FY 1981.

Work Program for SWIM Staff for FY 1980

Two main types of activities remain to be accomplished for the successful completion of a functioning water information system -- (1) the organization (and automation, in some cases) of individual agencies' water and related land information and (2) the coordination of centralized activities necessary to knit separate data bases into a functioning integrated "system." During the 1978-79 biennium, Energy Agency staff has concentrated on the first objective. The Data Work Group strongly recommends that the proposed SWIM coordinator primarily concentrate on the second objective.

For FY 1980, during the first half of the year, the emphasis must be placed on ascertaining the overall needs of the information system, including the requirements of a service bureau in order to develop a reasonable budget request for the 1980 Legislative session.

In order to prepare a work plan and budget, the coordinator must:

(1) Provide firm and thorough groundwork for the design of the overall system (as opposed to working extensively with individual agency data bases);

(2) Research and coordinative needs of the system in developing common reference standards, geographic locators, commonly agreed on standards for quality of data, and so forth;

(3) Research the data and/or systems analysis needs for individual agency data bases in order to help set priorities for SWIM activities; and

(4) Develop the working arrangement for future service bureau activities.

During FY 1980, in addition to developing the system design as a whole, the coordinator should devote time to the following functions:

(5) See that the work begun during FY 1979, with individual agency data bases, such as those at the Health Department and the DNR, be continued;

(6) Provide limited systems analysis to those agencies wishing to automate their data bases; and

(7) Provide limited Service Bureau functions, as in maintaining data bases, and maintaining the catalog of Water Information sources compiled during FY 1979.

In order to answer the specific system analysis and programming needs of individual agencies, the Data Work Group recommends that, during FY 1980, such services be purchased by contract. Beyond FY 1980, the Data Work Group anticipates that additional staff members would be added to SWIM. These staff members would have systems analysis and programming skills in addition to experience in applying water data to practical planning and management problems.

Work Plan for the Data Work Group from March 21, 1979 to June 30, 1980

The following areas of involvement for the work group will require a considerable amount of agency commitment in order to accomplish all these proposed tasks in only 17 months. To date, several of the agencies involved with preparing the final report for the Data Work Group have received no funding to support the personnel they have committee to this effort. If these agencies cannot continue their present level of support and, if supplemental help such as outside funding or additional agency membership does not occur, then priorities will have to be assigned to these proposed tasks.

(1) Implement user input into the development of SWIM by establishing a User Committee to replace the Data Work Group. The membership and organizational structure of this User Committee is described on pp. 16-17 of this report. The primary purpose in soliciting additional membership is to expand the capabilities of the current work group to design and continually update the service functions of SWIM.

(2) Outline the water information needs of the Framework Water and Related Land Resources Plan. This step will involve reviewing the final reports and technical papers of each Technical Committee work group to identify explicit and implicit water data needs. These reports or papers will be reviewed by the most qualified group member and the needs or contributions of that topic area to the development of SWIM will be presented. It is estimated that this entire project should be accomplished in approximately two months and will be synchronized with the proposed activities of the SWIM coordinator (see pp. 18-19).

(3) Establish official reference standards for SWIM. The first priority of this task will be to review the linkages between the current SWIM data bases (see pp. 5-10) in order to identify any potential user access problems. This task should begin after the SWIM coordinator has become familiarized with the Water Data Source Catalogue (see p. 6-7) and the Framework Water and Related Land Resources Plan. Second priority should be given to standardizing the georeference, geological, hydrological, and chemical parameters which will be presented in SWIM output and to identify the software required to accomplish this.

(4) Consider additional sources of water information which could be incorporated into SWIM. This would be a cooperative project between SWIM and the proposed User Committee. First priority should go toward accessing automated data bases and determining what software or SWIM staff assistance would be required to tap these data resources. The second priority of this task should be to identify non-automated data bases and to determine their potential for computer operation. The following list of potential state and federal automated data bases is not meant to be exhaustive but is intended to demonstrate the large quantity of data that may be available.

-- STORET (Storage and Retrieval System)--An EPA system containing water quality information concerning samples taken in Minnesota water bodies.

-- WATSTORE--A USGS data bank that contains information concerning surface and groundwater-quality and quantity.

-- MSIS (Model States Inventory System)--A data base on public water supplies collected under the Safe Drinking Water Act.

-- MLMIS (Minnesota Land Management Information System)--A data bank and analysis system that contains among many other resources variables about locations of watersheds, major lakes, rivers and wetlands.

-- DNR Lake Files--The Department of Natural Resources maintains several files concerning Minnesota lakes. Included are: Game Lake Inventory, Fish Lake Inventory, and Bulletin #25 Lake Inventory. Bulletin #25 includes identification numbers and locations of over 15,000 Minnesota lake basins.

-- SCORP (State Comprehensive Outdoor Recreation Plan System)--A system maintained by the Department of Natural Resources that inventories public and private recreation sites in Minnesota.

-- Land Classification/Land Ownership System--An inventory of state and county owned land. It includes a classification of DNR managed lands relating to their "best use."

(5) Review policies on data accessibility and the legal responsibilities of SWIM. This task would involve soliciting legal counsel to determine if any information in the data bases accessed by SWIM can be considered confidential. Also, there is a need to determine what the limits of responsibility are for each data source or the SWIM staff to supply data to a user.

(6) Review the possibility of a SWIM service charge. This task involves determining if a user can be charged for SWIM services if a data request is such that it places an undue burden upon the personnel or operating budgets of SWIM or its affiliated data sources.

Automated Data Entry

Used herein to denote either the coding and key punching of data or the one-step process of direct entry in machine processable form. In either case the process is a routine one rather than a one-shot case.

Binary File

No manufacturer is completely consistent in the use of this terminology. Herein used to mean data is in machine useable form and does not require translation from character codes.

Data Base

We have attempted to limit this term to computer processable files which have a consistent data structure, whether it be ordinary sequential tape files or files generated by software packages.

Data Base Management System (DBMS)

This terminology is used for software packages which simplify user access to data by handling file definition and data organization.

Data Sets

Used herein to denote collections of data rather than in any more specialized sense.

Information System

Denotes the whole range of information storage from manual riles and maps to computer processable formats.

Prototype Data Base

Structure there but not all the data.

Software Package

A set of computer programs which achieve a common goal - e.g., data base management, statistical analysis, plotting data etc. These packages range from those available in the market place to software shared by a user's community.

SYSTEM 2000

A proprietary data base management system owned by MRI Corporation. This packate is one of three DBM systems available at UCC, the others being SIR and DMS/170.