MINUTES OF THE MEETING OF THE HOUSE APPROPRIATIONS COMMITTEE
MARCH 24, 1981

The House Appropriations Committee convened on Tuesday, March 24, 1981 at 8:00 a.m. in Room 104 of the Capitol Building with CHAIRMAN ART LUND presiding and all members present.

HOUSE BILL 368 and 369.

REP. KEN NORDTVEDT asked the committee to table HB 369 but to fund HB 368 which is money to acquire books for the library system at the University. He felt a good library is more important than anything else in the system. The legislature must help maintain the good system of purchase.

REP. COZZENS asked how the $700,000 compares with others.

REP. NORDTVEDT said it depends on how much is left in the other budgets. The money is not line itemed.

HOUSE BILL 319 .

REP. JOHN VINCENT presented the bill. These funds would be appropriated to provide special services on campus for handicapped students. We are committed to aid the handicapped in the lower grades and should do the same at the University level. There are approximately 500 handicapped students within the University system at present.

Speaking as a proponent was DENNY KLEWIN, Assistant Dean of Montana State University. This would be a continuation of public law which covers the elementary and secondary levels of education. He used EXHIBIT 1 to explain federal requirements and how HB 319 would help. This appropriation would not be for mentally retarded but to certified handicapped people. The amount requested was $447,000 for the first year and then the amount will go down the second year. Certain initial costs are anticipated that will not be required later on. He further stated that 2 percent of the college population is handicapped.

PAUL NEIMAN, a student, said only a few hours spent with a handicapped student would show the problems faced and would indicate these funds would be well-spent.

ROGER MILLER, a student from Missoula, stated that there are special problems faced by the handicapped students and they need special assistance. Vo-rehab cannot give as much assistance as is needed because the funds are not available there either.

ROSIE THOM, a student from Western Montana College in Dillon, explained that items such as tape recorders are needed. The

state programs for the handicapped does not meet the needs of those with hidden handicaps. She stated they want to become taxpaying citizens but need help to do so.

JOE VASEK, a student from Eastern, said some of the students are people who are coming back to school after having been in the work force. They are limited in the alternatives for employment. There is a need to help people to learn and get back into society.

LARRY KALCHEK, a student at Montana Tech, stated the mental stress of going back to college is enough without having to face problems by being physically handicapped also.

David Howell, a student from Bozeman, said he has a hidden handicap. He has a specific learning disability which makes it very difficult for him to read. He needs help in reading and spelling and the funds are simply not available.

MARVIN QUINLAN, ASMSU lobbyist, spoke in favor of the bill. (EXHIBIT 2)

REP. DONALDSON asked if the peer group figures are included in the original figures. The answer was no. Out of the 14 institutions that have been contacted five are funded for this service; three are federally funded; three have no programs at all; and, three have some limited services for the handicapped. Only three or four of the institutions in the study have amounts expended on this service.

REP. COZZENS asked what other benefits are currently available to these students.

Mr. Klewin answered that the top dollar amount per student is $800 which helps pay for tuition, books, etc. or it can apply to special equipment. Some of the other programs provide the cost of getting them to the door. The special equipment is the problem usually.

REP. COZZENS asked how the needs are being met. The answer was the needs are not being met.

REP. BENGTSON asked how many people are being hired for counseling.

Mr. Klewin said it depends on the institution. Usually the staff hired is a counselor, a secretary, and two therapists.

CHAIRMAN LUND asked if federal funds are available.

Mr. Klewin said no.

REP. VINCENT closed the bill.

HOUSE BILL 616.

REP. JOHN VINCENT, sponsor, presented the bill. He explained that $230,000 was needed to continue present level funding of the Montana Water Resources Research Center which involves three branches of the University system. The center is in a situation where they need a firm commitment.

Speaking as a proponent was JOHN W. JUTILA, Vice-President for Research at Montana State University system. (EXHIBIT 3). He expressed concern that the program could be eliminated because of the loss of federal funding.

WILLIAM HUNT, Director of the Water Resources Research Center, referred to the booklet attached. (EXHIBIT 4) He was concerned about three basic questions facing the center.
(1.) What has the center done for the state?
(2.) What will the center do with these funds?
(3.) What will be the effect if the appropriations are not provided?
He stated that the center does a great deal of work with water projects. Saline seep is a problem in the northeastern part of Montana and this program has helped greatly with solutions to that problem. One of the programs is a pilot program started by the DNRC to reclaim the land which is being affected by saline seep. In part, they provide data for private consultants. There is a five-year plan which indicates ways in which the Montana center may help agencies and the public. Staffing in other agencies would be necessary if this funding is not allowed.

The bulk of the funds go into planning and staffing. He stated that 97 percent of all water diverted goes to irrigated agriculture. We must begin to look at methods to check stream flow. Many departments need to know about water rights and stream flow. The areas of water quality must be addressed as well as phosphate and pollution. If this agency is not funded, he felt the cohesive effort of bringing these research projects together would be lost. We would lose some of the services including the link we have with other water resource areas throughout the country.

ARNOLD SILVERMAN spoke in favor of the bill saying this program provides information to state government and to the citizens of the state. Previous support from the federal government has developed resource research efforts which amounts to over $2,000,000.

MARVIN MILLER of the Bureau of Mines said this is a good program. It is a combined effort of the University system, state agencies, and the federal government.

LARRY PETERMAN testified on behalf of the Department of Fish, Wildlife, and Parks and its Director, James W. Flynn. (EXHIBIT 5)

BOB GEMMELL of the Advisory Council of the Water Resources Research Center supported the bill. (EXHIBIT 6) He stated that we are entering a time when competition for water in the state is at an all-time high.

JOHN MORRISON of the consulting firm of Morrison-Maierle, supported the bill. He felt the state is in need of the services provided by this center. Projects that are approved by the center have a practical use in the state.

REP. CONROY asked why the funds were coming from the general fund rather than the renewable resource fund.

REP. VINCENT said he felt where the funds came from did not matter.

REP. CONROY further stated that some projects covered under the renewable resources bill seem to be duplications of this.

Mr. Hunt said this is a research oriented, and not necessarily implementation type, of project. He further stated that the organization tries constantly to avoid any duplication.

IRVING TIETZ informed the committee that everything in House Bill 709 is a defininte action plan. Many of those projects could not be done without the work done by the Research Center.

REP. BENGTSON asked if there were funds allocated in the University system for this center. The answer was no.

REP. BENGTSON then asked how this has been funded. The answer was through federal funds but that has now terminated.

REP. DONALDSON asked if the approximately $500,000 given to the Bureau of Mines is a duplication of projects.

SID GROFF, Geologist, said the two are separate. He said the DNRC, the Center, and the Bureau all work together in a coordinated effort. He said they work together but definitely try not to duplicate.

CHAIRMAN LUND said many studies have been done on saline seep.

MR. MILLER replied that the studies have been done and now the work need to be applied.

MR. MORRISON explained that there are about 20 projects up for approval.

REP. QUILICI asked how many FTEs (FULL TIME EMPLOYEES) are in the center. The answer was a half time director, a secretary, one-quarter time computer operator.

REP. COZZENS asked if the federal government does similar work.

MR. HUNT said the U.S. Geological Survey has an office. Also the Soil Conservation District are in Montana. They each have a part in deciding what the Center will be involved in.

REP. VINCENT closed on the bill stating that we are dealing with an extremely complex problem. There is a defininte need for research and a need to make rational decisions. Organized research is necessary to determine what projects should be attempted and completed.

SENATE BILLS 74, 88, and 100 .

SEN. BILL THOMAS presented the bills which could be termed legal housekeeping bills. Trying to update repealer relating to funding of library federation to reflect current practices.

Speaking as a proponent of the bills was JOHN NICHOLS, Chairman of the Legislation Committee, Montana Library Association. (EXHIBIT 7)

BILL CONKLIN, of the Great Falls Library supported the bills. He said the changes have been asked for because of the duplication in the section of law which covers it. This is trying to clear up an unnecessary section of the law. There is an agreement that exists between the federation and the local libraries. He used (EXHIBIT 8) to describe the formula used. He felt the formula itself should be taken out of the law. He recommended that the State Library Commission be allowed to adopt formulas instead of having it set in law. It would be done under the rule-making authority and under APA rules which would give the necessary input. It would delete some provisions of certain types of grants which are no longer pertinent. There is still an establishment grant available to a library participating for the first time. All libraries are automatically in the federation.

STEVE VANVOGT of the Billings City-County Library supported the bill saying it would eliminate requests for grants that no longer exist.

J. D. HOLMES of the Institute of Arts Foundation supported the bills.

REP. COZZENS asked Mr. Conklin how the formula was devised and if all six federations are in support of eliminating it. He explained how the formula was derived (EXHIBIT 9) and said all federations are now in favor of eliminating it.

REP. MOORE asked if there is a local support for libraries. The answer was yes.

REP. MOORE then asked about federal funding. The answer to that was that next year there will be 25 percent less in federal funding than this year.

SENATOR THOMAS closed on the bills.

EXECUTIVE SESSION.

HOUSE BILL 560.

CHAIRMAN LUND reported that $242,809.18 will be appropriated to Geraldine Strong to pay the claim.

REP. MOORE said this was not paid last time because the legislature had adjourned and then the Supreme Court made the decision, awarded in favor of her, and interest has been accruing for the past two years.

REP. COZZENS stated that the state has really not been losing money because the funds have been invested.

CHAIRMAN LUND said the unsettled claims were without recommendation from the Board of Examiners. It refused to make the decision.

CHAIRMAN LUND said the administrative rule is invalid and in the claimant's favor.

REP. BARDANOUVE said the board practically stole the man's money. He had a right to sue for damages.

REP. COZZENS protested saying we had heard only one side of the evidence.

CHAIRMAN LUND said the Board of Examiners is the final authority for that.

REP. QUILICI said if we keep hassling him, he will probably sue.

REP. MOORE further stated he put up the money in good faith and

and the agency did not hold up the bargain.

REP. QUILICI said the DNRC had the building and the pipes froze between the time of the sale and the time of the occupancy.

REP. LORY said we could pay those claims because they have gone through the board procedure. They were sent to us without recommendation.

REP. DONALDSON said that sets a precedent and he was not in favor of that.

REP. LORY said both claims went through the board and came back without recommendations. They were the claims of Douglas Remich and the Roman Catholic Bishop totalling about $9,000.

CHAIRMAN LUND said according to a letter from Leo Berry, Director of the Department of Natural Resources, the pipes were the responsibility of the state.

REP. MOORE then moved that HB 560 be amended to insert the figure $242,809.18. The amendment passed. He then moved the bill as amended to do pass.

REP. DONALDSON objected to setting the precedent. After much discussion, REP. MOORE withdrew his motion.

REP. MOORE then moved to amend HB 560 by deleting on page 1, lines 15, 16, 17, 18 and 19 and lines 24 and 25, and on page 2, lines 1 and 2. That motion passed. He further moved that in section 2, page 2, lines 4 and 5 the word sums be deleted and the word sum be inserted. Also on line 5 delete cases and insert case. That motion passed.

REP. MOORE then moved the bill DO PASS AS AMENDED. The motion passed with REP. CONROY opposing.

REP. DONALDSON moved that the committee send a letter to the Board of Examiners expressing its displeasure on the handling of these claims. The motion passed.

REP. LORY moved that the committee reconsider the action on HB 560.

REPS. COZZENS, SHONTZ, and DONALDSON opposed the action.

REP. MOORE moved to strike the amendments except the amount. It passed with REP. COZZENS opposing.

REP. MOORE then moved DO PASS on HB 560 AS AMENDED. It passed with REPS. SHONTZ, COZZENS, and CONROY opposing.

REP. COZZENS moved that the committee write the recommended letter. It passed.

HOUSE BILL 655.

REP. DONALDSON moved to amend on page 2, line 4, strike 70 and 85 and insert 60 and 65, and on line 9, strike 2 and insert .025, and on line 11, strike 70 and 85 and insert 60 and 65. $2,039,695 is the fiscal impact. The motion passed.

REP. MOORE then moved the bill DO PASS AS AMENDED. The motion carried with REP. COZZENS abstaining.

The meeting adjourned at 11:45 a.m.

Respectfully submitted,

REP. ART LUND, CHAIRMAN

jc

VISITORS' REGISTER

HOUSE _____ COMMITTEE

BILL SB 88, 74, 100 Date 3/24/81

SPONSOR Thomas

NAME	RESIDENCE	REPRESENTING	SUPPORT	OPPOSE
Wm Conklin	Great Falls	St. Library	✓	
J. W. Holmes	Helena	Dept of Arts Foundation	✓	
John Nichols	Helena	Montana Library Association	✓	
Stephen VanVogt	Billings	Billings City-County Library	✓	
[illegible]	Billings	Billings City-County Library		

IF YOU CARE TO WRITE COMMENTS, ASK SECRETARY FOR LONGER FORM.

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Form CS-33
1-81

VISITORS' REGISTER

HOUSE _____ COMMITTEE

BILL H.B 319 Date 3/24/81

SPONSOR _____

NAME	RESIDENCE	REPRESENTING	SUP-PORT	OP-POSE
Ryl Holt	Bozeman	MSU	✓	
Frank Reckle	Butte	Mt Tech	✓	
Dwell Douglas	Billings	EMC	✓	
Laurence L Kaiser	Anaconda	Mont Tech	✓	
Joe VRSEK	Billings	E.M.C	✓	
Wanda Howell	Bozeman	MSU	✓	
Rosie Thom	Dillon	WMC	✓	
Lonna Hedland Green	Bozeman	MSU	✓	
Kenny Klemm	MSU-Bozeman	MSU	✓	
Tim Morton	Dillon	WMC	✓	
Brooks Anderson	Billings	EMC	✓	
Larry PETERMAN	Helena	Mt. DFWP	✓	

IF YOU CARE TO WRITE COMMENTS, ASK SECRETARY FOR LONGER FORM.

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Form CS-33
1-81

WITNESS STATEMENT

NAME HUNT, WILLIAM R BILL No. HB616

ADDRESS BOZEMAN DATE 3/24/81

WHOM DO YOU REPRESENT MONT WATER RESOURCES RESEARCH CENTER

SUPPORT X OPPOSE AMEND

PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

Comments:

Brief oral presentation covering following points:

1) WHAT HAS MWRRC DONE FOR MONTANA

2) WHAT WILL MWRRC DO FOR MONTANA WITH APPROPRIATIONS FROM HB616

3) WHAT WILL MONT LOSE IF APPROPRIATIONS ARE NOT PROVIDED

Present written statements supporting HB616

Brief testimony introduced by

Univ of Mont

Mont College of Mineral Science & Tech

DNRC

DFWP

DHES

Bob Gemmell, Private Sector

John Morrison Sr., Private Sector

FORM CS-34
1-81

1. WHAT DOES FEDERAL LAW STATE REGARDING A COLLEGE OR UNIVERSITY'S RESPONSIBILITY TO THE HANDICAPPED STUDENT?

Section 504 of the Rehabilitation Act of 1973 (PL 93-112) mandates equal opportunit for qualified handicapped persons in educational programs. Section 504 obligates colleges and universities to make adjustments and accommodations. Furthermore, it grants handicapped persons the opportunity to participate fully in all education programs and activities.

2. WHAT DOES HB 319 PROVIDE?

Handicapped Services would provide the assistance needed for both students who are graduating from high school special education programs and persons who are disabled later in life. In either case the services on campus would provide the key to making the transition during college.

3. AREN'T THESE SERVICES BEING PROVIDED AND FUNDED AT THE PRESENT TIME?

In general, no. Increasing numbers of disabled students on college campuses is a recent phenomenon. Funding for all areas of the University, as determined by previous appropriations and the new funding formula, does not include money for services for handicapped students.

4. WOULD THE SERVICES SUGGESTED IN HB 319 DUPLICATE SIMILAR SERVICES ON CAMPUS?

At the present time campuses are not adequately staffed nor funded to serve the growing disabled population. Existing campus services are complimentary but not duplicative because of the specialized services and skills required for the handicapped.

5. IS IT TRUE THERE'S AN INCREASING ENROLLMENT OF HANDICAPPED STUDENTS ATTENDING COLLEGES AND UNIVERSITIES?

Yes. Since the enactment of the Rehabilitation Act of 1973, colleges have noted dramatic increases in the disabled student population. Because of special education opportunities in the public schools, enrollment in higher education is expected to continue rising. (i.e., learning disabled students in Montana between the ages of 14-18 increased from 1713 in 1979 to 1995 in 1980.)

6. WHY WAS HB 319 NOT IN THE UNIVERSITY SYSTEM'S GENERAL BUDGET?

Funding for handicapped services has never been a part of the general university base budget nor is it included in the new university funding formula. The funding model used to establish special education (PL 94-142) for the public schools in Montana is being used to establish similar support funds for the colleges and universiti

7. HOW WERE THE NEEDS ASSESSED FOR SERVICES THROUGH HB 319?

Primarily by 1) evaluating the individual requests of handicapped students, 2) an assessment of necessary equipment and staff to meet these requests, 3) an evaluation of the aforementioned not provided by Vocational Rehabilitation, 4) interpretation of section 504 of the Rehabilitation Act which mandates University compliance in providing equal opportunities for handicapped students.

8. WHAT OTHER STATE AND/OR FEDERAL ASSISTANCE IS AVAILABLE?

There is no federal support identified for handicapped services. State support fo students is limited primarily to Vocational Rehabilitation.

9. HOW WAS THE FUNDING FORMULA FOR HB 319 DETERMINED?

Each institution determined the extent of programs, services, staff, and equipment required. In addition, the numbers of certified handicapped students on campus as of spring quarter 1980 were verified. The total estimated cost was divided by the number of certifiable disabled students to determine a per student rate (i.e., $920 - 81-82, $795 - 82-83). Additionally 8% inflation factor was added for the second year of the biennium.

BF/lp
3-23-81

EXHIBIT 2

ASMSU
OFFICE OF THE ASSOCIATED STUDENTS

To: The House Appropriations Comittee

From: The Associated Students of Montana State University

Re: Support for HB 319

The Associated Students of Montana State University (ASMSU), strongly urge your support for House Bill 319. House Bill 319, sponsored by Representative Vincent, provides that appropriations be made to post-secondary educational institutions and distributed proportionately in order to provide the unique and extended services that would enable handicapped students to participate on an equal basis with non-handicapped students in the college environment.

Since 1973, Montana has provided special education support for handicapped students between the ages of 6 and 21 in compliance with PL94-142. Under the same law, federal money is available to vocational and technical schools for the additional costs required for the education of their handicapped students. Such funding, either state or federal, is not currently available for students seeking a college education in the Montana University System.

At the same time, more and more handicapped students are coming to college as a result of the elementary and secondary school special education programs and a general awareness of the economic importance of a college degree. In addition, more older students and veterans are returning to college for retraining. One of the barriers that remains is that it requires more funding to provide handicapped students with the post-secondary education they seek.

The current per-student appropriation for post-secondary institutions is not an adequate amount for handicapped students. First, it is doubtful that many of the peer group institutions, that were used to develop the current university funding rationale had initiated programs such as this at the time the study was completed. Thus, this handicapped proposal is one that could justifiably provide funds in addition to those provided for in the general appropriations measure (HB 500). Secondly, this program is designed so as to not duplicate the services already provided by SRS, Social Security, and the like, but in fact should be considered a complimentary program.

Finally, when one compares the costs and benefits of this program, it is evident that providing adequate and effective training to these handicapped students is much less expensive than if they were to be institutionalized. It presently costs about $2500 per year to educate a non-handicapped student. A handicapped student can require a minimum of $3000 per year for the same education. But, if that person is instead institutionalized, the cost will range from $13000 to $36000.

Furthermore, a recent U.S. Bureau of Labor Statistics study indicates that each dollar spent on rehabilitation and education of handicapped people returns $9.00 to the economy as a result of increased taxes paid on earnings

ASMSU
OFFICE OF THE
ASSOCIATED
STUDENTS

of the worker and the subsequent decrease in the amount of welfare and other benefits needed. Once educated and employed, handicapped students will repay the "extra costs to society" in an average of five years.

The students of Montana State University hope that you will consider this program on its merits. Our Federal Government has mandated that educational institutions uphold economic responsibilities, so as to ensure equal educational opportunities for handicapped students in the educational community. Montana's post-secondary institutions are in dire need of supplemental funding to make a college degree and a career realities for the increasing numbers of handicapped students pursuing higher education.

Marvin Quinlan

Marvin Quinlan
ASMSU Lobbyist

EXHIBIT 2

Statement on HB 616
by
John W. Jutila
Vice President for Research
Montana State University

A. Statement of the Problem.

1. Water is Montana's most valuable and abundant resource. The Missouri, formed by the junction of the Jefferson, Gallatin and Madison Rivers at Three Forks, Montana, the Yellowstone River originating in the snowcapped peaks of Yellowstone Park, the Kootenai, Milk and Poplar Rivers bringing Canadian water to Montana, and the Clark Fork River draining nearly all of Western Montana's watershed, contribute nearly 40 million acre feet to the two major water basins of the U.S. In more understandable terms - Montana generates enough water annually to supply all the domestic water requirements of the U.S. for about two years. Thus, Montana, as the largest headwater state in the Nation, serves as the major source of the life blood of economic growth and development - water.

2. Montana water resources are unique both from the standpoint of quality and quantity. A substantial amount of water originates in relatively pristine environments and, even with heavy agricultural use, leaves the State still able to serve the domestic needs of down-river states.

3. The unique characteristics of Montana water and its uses are now changing, and will change dramatically in the decade ahead as energy and mineral development takes place in the State and neighboring states.

4. Montana has already been given notice that her options with regard to the management of water resources may have to yield to those of the region and the Nation. In consequence, the State, confronted with demands from other states for enormous amounts of water, must develop a comprehensive management plan for its water resources and coordinate these plans with neighboring states and Canadian provinces to avoid conflict with and default to more aggressive state governments.

5. There is a critical need to invest substantial money in water resource research and complementary training and service programs in order to preserve and manage this valuable resource.

B. Purpose of HB 616.

1. HB 616 offers to Montana an opportunity to improve our knowledge base on water resources, and provide training and technical services available through the Montana Water Research Center at Montana State University.

2. The Center was established at MSU by Board of Regents action in 1964 and since that time it has coordinated research and information dissemination programs on the campuses of MSU, U of M and Montana Tech. The Center also has served as a link between the research community and potential users of research findings such as industry, planning commissions and State agencies. Funded under the provisions of Water Resources Research Act of 1964, the Center, confronted with marked reduction in Federal funding of training and research, is faced with significant change and reduction in its services now offered unless the State appropriates monies to maintain its present level of activity.

3. The activities of the Center have had significant impact on many water resources areas including:

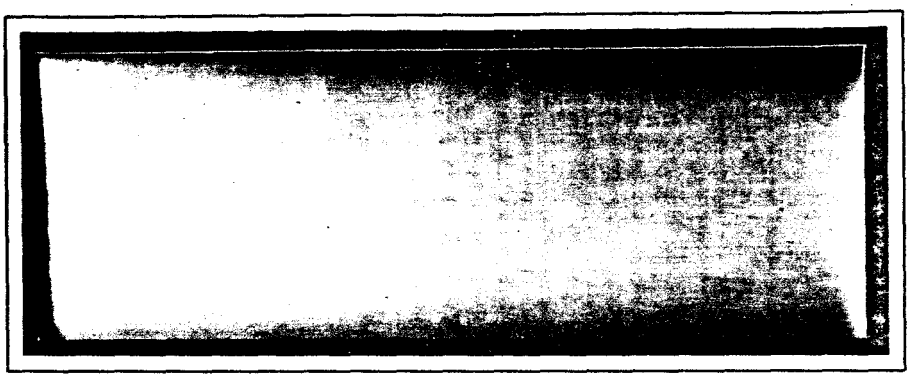
a. Ground water seepage and its effects on saline soils.

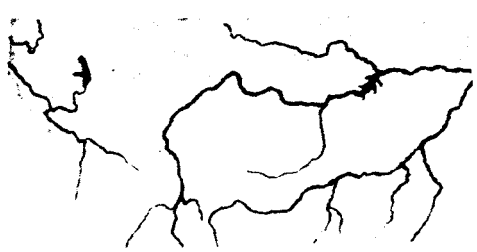
b. Legal research, writing and drafting of Montana water laws.

c. A water resource simulator for developing water management policy awareness.

I urge your support of HB 616

EXHIBIT 4





Montana University Joint

Water Resources Research Center

EXCERPTS FROM

FIVE-YEAR WATER RESOURCES RESEARCH AND DEVELOPMENT PLAN FOR THE STATE OF MONTANA

Submitted to

THE DIRECTOR
OFFICE OF WATER RESEARCH AND TECHNOLOGY
U. S. DEPARTMENT OF THE INTERIOR
WASHINGTON, D. C. 20240

by

The Montana Water Resources Research Center
Montana State University
Bozeman, Montana 59717

ACKNOWLEDGEMENTS

This report was prepared through funds provided by the Office of Water Research and Technology, United States Department of Interior as authorized by the Water Research and Development Act of 1978 (PL95-467) through Agreement No. 14-31-0001-0128 with the Montana Water Resources Research Center (MWRRC). The MWRRC appreciates the cooperation of all the individuals and agencies who have given of their time to review, offer comments and suggestions, and contribute to the preparation of this report; particular thanks are due to Dr. Eldon R. Dodge for his efforts in locating, reviewing and compiling the physiographic, climatological, water resources inventory and utlization data and assessing recent reports on the water development activities in Montana and to Mr. Howard L. Huffman for his efforts in condensing and editing the final report, and those members of the Montana Departments of Natural Resources and Conservation, Health and Environmental Sciences, and Fish, Wildlife and Parks for providing assistance in locating pertinent studies and interpreting conflicting data.

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Section 1

SUMMARY

The Montana Water Resources Research Center (MWRRC) has developed a five-year research and development program to meet requirements of the Water Research and Development Act of 1978 as implemented by the Office of Water Research and Technology (OWRT).

This involvement of all 54 state water institutes in what will culminate in regional and national summaries of "goals, objectives, priorities, and funding requirements" has provided the Institutes with the opportunity to become more familiar with state water problems and existing efforts to solve these problems. The MWRRC has accordingly reviewed and documented a report of Montana water resources and related land-use problems. This effort has made it possible to develop a prioritized research agenda which will be necessary for improving a comprehensive planning and management program to meet the State's water resources needs. The MWRRC has been privileged to have the opportunity for this cooperative effort with other state and federal agencies whose programs seek to alleviate water problems in Montana.

MONTANA WATER RESOURCES

Montana encompasses 94 million acres along the northwestern border of the United States and serves as one of the headwaters state for two of the nation's greatest river systems: the Mississippi and Columbia. The eastern two-thirds of the state is undulating plains drained by the Missouri and Yellowstone Rivers; the western one-third is drained by the Clark Fork and Kootenai Rivers. Of the 43 million acre-ft per yr of water flowing out of Montana, 29 million acre-ft per yr originate within the State. Approximately 65 percent of the annual outflow occurs in the May-July period. Agriculture is the major comsumptive user of water, withdrawing approximately 13 million acre-ft per yr of which 6 million acre-ft per yr are consumed. As the irrigation use occurs in the June-September period, approximately 28 million acre-ft of live storage is provided by reservoirs to maintain streamflow throughout the summer in major streams. Even with this amount of storage, major problems occur in providing quantitites of water required during low flow periods in locations where it is needed. This condition creates the problems to be addressed in planning and managing the state's water resources.

SUMMARY OF MONTANA WATER PROBLEMS

With increasing agricultural, industrial and municipal growth and increased water-based recreational activities, Montana faces some rather unique difficulties with water supply. At this time and for the projected demands through the year 2020 sufficient unappropriated water is available for additional consumptive uses. The major water-related problems concern providing water in locations where it is needed at times when it is needed.

Already the irrigation demands are interfering with stream flow in some areas; the increased use of groundwater is causing critical supply problems in some areas. The projected energy developments for eastern Montana pose potential problems in maintaining adequate instream flows for acquatic and riparian ecosystems, irrigation, and municipal requirements in low flow periods.

Increases in irrigated acreages coupled with changing irrigation technologies, the instream flow reservation system available to state and federal agencies (including Indian water rights claimed for the seven Indian reservations in Montana), and the prospect of interbasin transfers present institutional, economic and legal problems.

The most significant water quality problems identified result from sediments and salts from non-point sources of pollution and from reduced streamflows due to withdrawals. Communities utilizing lagoons and waste stabilization ponds for waste water treatment pose as a potential threat to the quality of the groundwater in those areas. The effects of coal mining and in-site mining of materials, such as uranium, on groundwater quality and quantity are not fully known.

As agriculture currently accounts for 95 percent of the water used in Montana, an intensive evaluation of the crop production functions based on soil-water-crop-climatic conditions affords the greatest potential for water conservation in the state.

While all these conflicts and conditions are serious considerations in the future planning, management and development of Montana's water resources, each has already reached critical proportions in at least one area of the State.

FIVE-YEAR PROGRAM

It is neither desirable nor possible for the Montana Water Resources Research Center to direct its resources toward the solution to all problems identified in the plan. To attempt to do so would clearly duplicate the efforts of other organizations and agencies having specific missions involving research. Cooperation with those mission-oriented agencies with water resources research programs, either current or projected, will be developed when complimentary efforts will hasten or optimize the answering of identified needs.

Funding of the Water Center research projects will be encouraged in support of those agencies already seeking solutions to the most critical state, regional, and national water problems. It is intended that the funds allocated through the MWRRC/OWRT Annual Cooperative Program (ACP) be directed toward state needs. In the absence of worthy proposals addressing priority research problems identified in the Montana five-year program (this is almost inconceivable), research proposals addressing problems of lower priorities and sensitive to high priority regional and national needs will be considered. Proposals addressing identifed priority research needs for OWRT's Matching Grant and Focused Research Programs will be encouraged.

A large number of water and related land-use problems identified in this program have associated institutional research needs. This is especially true in problem areas listed as Utilization and Conservation and Planning and Management, to a lesser degree for other problem areas. Worthy proposals addressing social, legal, economic, and other institutional aspects of identifed problems will be encouraged.

ALLOCATION OF FUNDS

The allocation of funds for the programs of the Montana Water Resources Research Center are given by categorical areas in the following table. The table indicates the distribution of the OWRT Annual Cooperative Program funds and also the distribution of an equivalent amount to be requested from the State of Montana. There is no guarantee that Congress will appropriate nor that the Water Center will secure funds to meet the projections. The values shown are for planning purposes only.

Item	OWRT ACP Funds	State of Montana Funds
Surface, ground, atmospheric water systems	$25,000	$40,000
Water utilization and conservation	25,000	30,000
Water quality protection	12,000	18,000
Water resources management	8,000	7,000
Project Planning, Coordination, Technology Transfer, Information Dissemination, and Administration	45,000	20,000
	115,000	115,000

In general, the streams west of the Continental Divide have steeper slopes than those to the east; the distance from the Divide to the eastern border is several times that to the western border. The lowest point in the west is about 1,800 ft elevation where the Kootenai River enters Idaho. On the east side of the Divide, the plains area slopes eastward from about 4,000 ft near the Rockies to about 2,000 ft along the eastern border. Highest point in the state is Granite Peak (12,799 ft) which is just north of Yellowstone National Park.

Sedimentary Areas

The plains area is underlain by a thick sequence of sedimentary rocks of Paleozoic, Mesozoic, and Cenozoic Age. The general slope to the east is interrupted by large structural domes and basins formed during the earth movements which produced the Rocky Mountains.

In general, the sandstone beds in the plains area are important aquifers while the shale beds are nonproductive when wells are drilled. The Madison Limestone formation is the source of some of the large springs in Montana, while another extensive aquifer system is contained in the coal beds of the Fort Union Formation in southeastern Montana.

Geothermal Areas

A number of active geothermal sites are present in the state, particularly in the western and southcentral mountains. These usually take the form of hot springs, such as Chico Hot Springs south of Livingston, Bozeman Hot Springs near Bozeman, Fairmont Hot Springs and Warm Springs near Anaconda, and Camas Hot Springs at Hot Springs.

HYDROLOGICAL CHARACTERISTICS

Water (or the lack of it) has always been extremely important to Montanans. Miners fought over it in the western part of the state, and cattlemen went to "war" over it in the east. The importance of the major sources of water will be discussed next.

Surface Water

Montana is a river headwater state with approximately 17 percent of its area draining to the Pacific Ocean through the Clark Fork and Kootenai tributaries of the Columbia River and about 82 percent of its area draining to the Gulf of Mexico through the Yellowstone/Missouri/Mississippi Rivers. Of the portion of the state east of the Continental Divide, almost a third is drained by the Yellowstone River system and about two-thirds by the Upper Missouri River system. An almost negligible area drains into Hudson Bay in Canada. Major tributaries of the Clark Fork of the Columbia are the Blackfoot, Bitterroot, and Flathead Rivers. The Missouri River is formed by the junction of the Gallatin, Madison, and Jefferson Rivers near Three Forks. Other major tributaries of the Upper Missouri are the Sun, Marias, Musselshell, and Milk Rivers. In the Southeast, major streams flowing into the Yellowstone are the Bighorn, Tongue, and Powder Rivers. The Little Missouri River originates in Wyoming but drains 3,400 sq mi in the southeast corner of Montana. The major river

Section 2

MONTANA'S WATER RESOURCES

Montana is the fourth largest state, averaging 500 mi in length from Idaho to North Dakota and 275 mi in width from Wyoming to the Canadian border. It contains 94,168,000 acres (147,138 sq mi) of which about 900,000 acres (1,400 sq mi) are covered with water.

The Continental Divide crosses the Canada-Montana boundary in Glacier National Park, runs south to the vicinity of the city of Butte, then goes west until it reaches the Idaho border and becomes the extreme southwestern border of Montana. Because of the location of the Divide, the state is divided between two major river basins-the Missouri and the Columbia. Montana is also tributary to Canada's Hudson Bay drainage with a very small part of its area (0.5 percent) contributing flow through the Waterton-St. Mary River area in Glacier National Park.

The state is a mix of areas of glacial, sedimentary, and igneous origin. Physically, Montana is mountainous in the western and southcentral third with the remaining two-thirds being primarily plains. Several small mountain ranges are located in central Montana, however.

Montana's large size, coupled with the diverse topography, provide the basis for some unusual problems. Wide variations in altitude are combined with differing weather patterns to create quite different climatic conditions in different parts of the state. These differences, in turn, lead to a variety of water resource conditions. The most important factors are covered briefly in the following discussion.

GEOLOGICAL CHARACTERISTICS

Geologically, the state has been described as four regions (25). Glaciated plains lie north of the Missouri River in northcentral and northeastern Montana, sedimentary plains make up southeastern Montana, a foothills transition region borders these plains regions on the west, and the Rocky Mountains cover the western and southcentral parts of the state.

Mountains and Plains Areas

The plains regions are characterized by flat, treeless expanses and gently undulating topography. Large, glaciated regions frequently contain potholes from which surface water rarely, if ever, drains. Bottom land and banks along streams often have extensive growths of cottonwood trees and brush. In addition, hilly areas in southeastern Montana have scattered stands of pine trees.

By contrast, the mountainous portion of the state in western and southcentral Montana is usually evergreen forested. The extensive mountain valleys are frequently important agricultural areas.

In the part of Montana east of the Continental Divide, groundwater occurs in several different formations. One of these is the valley fill alluvial deposit, which may yield relatively large flows from pumped wells. Such deposits are found along most river beds except for fast flowing mountain streams. These unconsolidated gravel, sand, silt, and clay deposits, which may be 50 ft or more thick in the larger river valleys, are generally hydraulically connected to the surface stream.

Basin-fill aquifers, which consist of poorly consolidated gravel, sand, silt, and clay, are localized in the valleys of southwestern Montana. These aquifers may be up to 6,000 ft deep in some mountain valleys and are often overlain by valley-fill alluvial aquifers. Wells in basin-fill aquifers usually yield large quantities of water.

Glacial deposit aquifers are found in a belt along the northern border of the state. The aquifers here are in sand and gravel buried channel deposits, as well as in extensive glacial outwash deposits. Well yields in this area are extremely variable.

Sandstone aquifers underlie much of central and eastern Montana. Some are exposed at the land surface while others are in structural depressions with extensive accumulations of fine sediments confining them. Yields from wells in the sandstone aquifers vary from 75 gal/min to as much as 500 gal/min. In addition to the sandstone aquifers, the Fort Union Formation in southeastern Montana contains extensive coal beds which serve as aquifers.

The Madison Limestone Formation underlies practically all of Montana east of the Rocky Mountains. Pumped wells in the Madison Formation yield from several hundred to several thousand gal/min. A regional aquifer system analysis for the Madison aquifer was begun by the U.S. Geological Survey in 1975 and should supply much needed data for proper development of this water resource.

In the mountainous area west of the Continental Divide, are numerous valleys filled with unconsolidated material eroded from the surrounding mountains. In places, these porous and permeable deposits are several hundred feet thick and form important ground water reservoirs. Moderate yields are obtained from wells in several locations.

Wells yielding up to 5,000 gallons are located in the alluvial deposits along the Clark Fork and Bitterroot Rivers near Missoula. Similar alluvial deposits exist elsewhere on the Clark Fork and Bitterroot Rivers, as well as on the Little Bitterroot, Flathead, Kootenai, and Whitefish Rivers. These aquifers are quite variable in permeability, providing well yields as high as 500 gal/min.

Ground and surface water are not separate resources but are parts of the total water resource of a region. Since much of Montana generally undergoes long rainless periods during the summer and fall, the streamflow at such times may consist primarily of ground water which was discharged into the streams. Although large quantities of water are found in storage in aquifers throughout the state, only the upper portion of the ground water reservoir can be continually utilized unless managers resort to ground water mining. Combined use of ground and surface water may offer great possibilities for future water development.

Runoff

The large amount of water stored in mountain snowpack is an important factor in determining Montana's available water supply. Snowmelt usually begins in April, peaks in May or early June, and is essentially complete in July. Through the remainder of the summer and fall, stream flow (except for runoff from locally heavy thunderstorms) comes from ground and surface waters stored during the snowmelt and spring rainy season. During the summer, there is occasional heavy thunderstorm rainfall in eastern Montana. These are often accompanied by damaging hailstorms.

Figure 1 shows generalized values of mean annual runoff for the state. Values vary from less than 0.25 in. east of Miles City in eastern Montana to over 20.0 in. east of Kalispell and along the northern Idaho border; both of the latter areas are mountainous. A few very small drainage areas in the mountains at the western edge of Glacier Park exhibit much higher values than the map shows, but these areas are too small to be of any real significance except in their immediate vicinities.

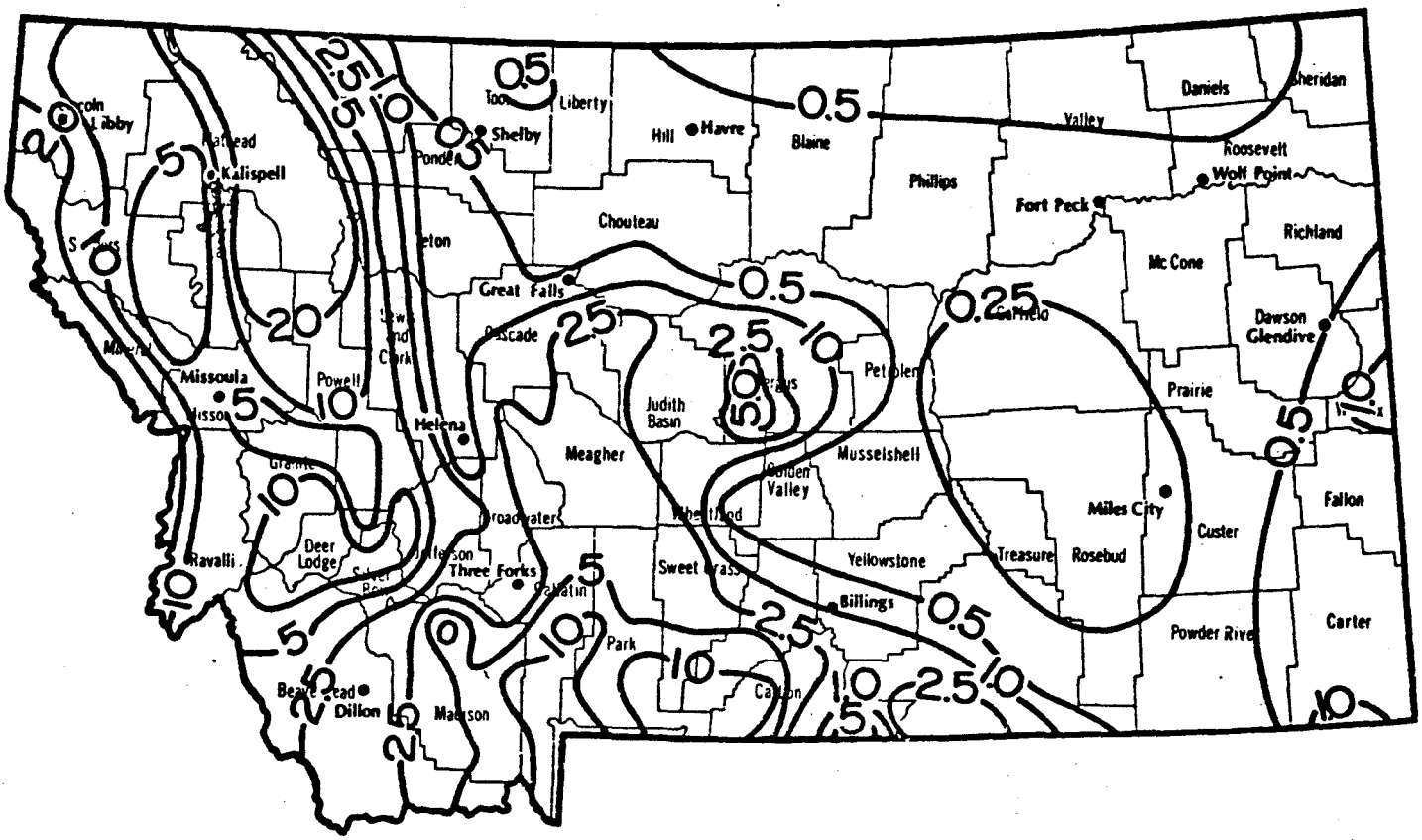

Figure 1. Mean Annual Runoff, in Inches (generalized)

Source: United States Geological Survey and Montana Bureau of Mines and Geology, *Mineral and Water Resources of Montana*, (Washington, D.C.: May 1963).

The growing season (freeze-free period) lasts 3 mo or longer in most of the agricultural areas of the state. Miles City (in the southeast) has the longest recorded average freeze-free period of 135 days. On the other hand, freezing temperatures and snow may occur in any month of the year in the high mountain valleys of the west. Hardy grasses thrive in such localities, however, and produce excellent grazing for livestock.

Snowfall also varies widely in distribution, occurring most heavily over the western moutains. Extremes range from 22 in. in the northeast (Sheridan County) to over 300 in. at many locations in the mountains. Average annual snowfall in the western valleys is about 50 in.

Temperature Variations

Temperatures vary widely among different parts of Montana, as well as between winter and summer. Mean monthly temperatures range from +10° F in January to +75° F during July in the central and eastern portion of the state. At the high altitudes in the west, nighttime winter temperatures have occasionally been recorded as low as -50° F. On the eastern plains, summer temperatures in excess of +100° F are not unusual.

Winters in eastern Montana may be extremely cold and summers quite hot. Severe winter cold waves are often abruptly terminated by warm "chinook" winds coming down the east slopes of the Rockies. At these times, temperatures rise rapidly and become quite mild. West of the Divide, cold waves are much rarer and cloud cover in winter is more common.

Weather Patterns

As was mentioned earlier in this section, Montana's weather is influenced by air movements from the Gulf of Mexico, the southwestern United States, the northern Pacific Ocean, and the polar region. Moist air generally enters the state from the Gulf of Mexico and the northern Pacific cost, warm dry air from the southwestern part of the country, and cold air from the polar region. Most of the state's moisture, particularly in the western mountains, comes from the northern Pacific. The extemely cold air of winter usually comes down the east side of the Rocky Mountains from the polar region.

High pressure systems occasionally are centered over the northern Rocky Mountains and shunt approaching storm systems to the north of Montana. As these high pressure systems break down or move on to the east, the way is opened for storm systems to enter the state from the Pacific coast or the north.

WATER QUALITY

The quality of Montana's water varies considerably from one area to another. This is true of both surface and ground water supplies.

Surface water is subject to degradation from a number of sources. In the western mountains, logging operations may be contributors. Several problem areas exist where inadequately treated sewage finds its way into a stream. Agricultural operations contribute to pollution through irrigation

return flows and cattle grazing and feeding activities. Other activities which contribute to the problem include mining (acid mine drainage), power generation (thermal pollution), and construction. Turbidity seems to be the primary problem with drinking water supplies in western Montana.

Although the quality of groundwater is frequently very good, problem areas exist there, too. A major problem in parts of eastern Montana centers around saline seep, particularly in the shallow glacial aquifers. Other major threats to ground water quality come from in situ mining operations and surface wastewater impoundments. Subdivision developments have contributed to quality problems in some areas.

INVENTORY OF WATER RESOURCES

Montana's surface water resource is well known. Streamflows are measured and reported monthly by the U.S. Geological Survey. Amounts of water in storage in impoundments is also reported periodically. When these data are coupled with the snow measurements and runoff forecasts of the U.S. Soil Conservation Service, a good picture of surface water supplies is available. When quality is considered, problem areas are fairly well known.

More problems exist with groundwater, however. While general information is available on the ground water resources of the state, there is little comprehensive data on specific basins and aquifers. In particular, better quantified data are needed on discharge rates and sources. Also, more information is needed on the quality aspects of groundwater.

AWARENESS OF PROBLEMS

Water has always been extremely important in the West and the people of Montana seem generally aware of the problems associated with the resource. Federal and state agencies have worked to solve problems relating to both quality and quantity. The Montana Water Resources Research Center has worked along with them in searching for these solutions.

Individuals are also becoming more aware of the state's problems with its water. When the Cooperative Extension Service at Montana State University recently conducted "Project 80", a series of public meetings held in all parts of the state, it found many Montanans to be both knowledgeable and interested in water resource matters. With hundred of people taking part in this "grass roots" activity, concern over the state's water resources ranked high on the list of problem areas.

An extremely important provision of the 1973 Montana Water Act also allows governmental entities to reserve water for existing or future beneficial uses, or to maintain a minimum flow, level, or quality of water. Such agencies must make application to the DNRC and include the following:

(1) Purpose of the reservation, including the beneficial uses intended

(2) Need for the reservation and why a water right by permit will not meet the needs

(3) If consumptive use is involved, why it cannot build the necessary facilities to divert, convey, and use the water in the near future, and how that situation may change

(4) If the application is for instream use, such as fish and wildlife, recreation, water quality, or protection of existing rights, it must document why the requested flow or level should be protected. It must also describe the environmental benefits and costs of maintaining and not maintaining the flow or level requested.

(5) Amount of water necessary for the purpose

(6) Show that the reservation is in the public interest, showing the public benefits which will occur, both economic and environmental.

The 1979 Legislature's Senate Bill 76, "An Act to Adjudicate Claims of Existing Water Rights in Montana," provides that four water judges be appointed. They will, in turn, appoint Water Masters to review the permit applications; each water judge shall then study and adjudicate all water rights granted thereby. Such judges have now been appointed and they estimate that the water rights, both surface and ground, for which applications are filed prior to January 1, 1982, will be adjudicated within 10 years. When this occurs, the state and its water users will--for the first time--have a written record of all water rights, quantified in time and amounts of water.

UTILIZATION OF MONTANA'S WATER

The major uses of Montana's water are irrigation, thermoelectic power generation, industry, municipal, livestock, and rural domestic use. In 1975, the Department of Natural Resources estimated (10) that the total water withdrawal and consumptive uses of water were as shown in Table 1. In this instance, the terms "consumptive use" and "stream depletion" seem to be used synonymously. Since most withdrawals in Montana are not measured, these values are estimates only. Consumptive use (streamflow depletion) of irrigation water has been assumed to be 47 percent of that withdrawn.

Ground Water

The major use of groundwater in Montana is for domestic use. Public water systems serve 191 cities, towns, and communities in the state, with the majority of the systems served by ground water supplies. A total of 159,000 urban

and 197,000 rural persons--about one-half the population--are served by groundwater. About 40 percent of the total water for domestic use comes from groundwater.

The only other measureable use of groundwater is for irrigation. Only about 1 percent of the irrigation water is taken from this source, however.

Surface Water

Irrigation, the most important use of surface water in Montana, began in Montana in 1862. Since that time, the irrigated acreage has increased rather steadily; in 1975, approximately 2.5 million acres were irrigated. Gravity ditch, lateral systems, and flood irrigation have been most widely used, but sprinkler systems are becoming more popular.

Table 1

TOTAL ANNUAL WITHDRAWALS AND CONSUMPTIVE USE OF WATER IN MONTANA BY RIVER BASINS

Withdrawals

	Columbia Basin		Upper Missouri Basin		Yellowstone Basin		Total	
	mgd	afy	mgd	afy	mgd	afy	mgd	afy
Irrigation		2,211,000 (92.5%)		6,710,000 (98.3%)		3,491,000 (97.1%)		12,412,000 (97.2%)
Thermoelect.					163.0		163.0	
Industry[1]	85.3	96,000	17.2	19,000	50.2	56,000	152.7	171.000
Municipal[2]	56.4	63,000	47.2	53,000	29.5	33,000	133.1	149,000
Livestock	3.9	5,000	19.0	21,000	10.7	12,000	33.6	38,000
Rural[3]	7.3	8,000	8.8	10,000	3.5	4,000	19.6	22,000
TOTALS[4]		2,383,000		6,813,000		3,596,000		12,792,000

Consumptive Use

	Columbia Basin		Missouri Basin		Yellowstone Basin		Total	
	mgd	afy	mgd	afy	mgd	afy	mgd	afy
Irrigation		1,040,000 (95.5%)		3,160,000 (98.5%)		1,650,000 (97.8%)		5,850,000 (97.7%)
Thermoelect.					0.3			
Industry[1]	12.8	14,400	2.6	2,850	7.5	8,400	22.9	25,600
Municipal[2]	20.7	23,300	17.4	19,000	10.9	12,200	49.0	55,000
Livestock	3.9	5,000	19.0	21,000	10.7	12,000	33.6	38,000
Rural[3]	7.3	8,000	8.8	10,000	3.5	4,000	19.6	22,000
TOTALS[4]		1,090,700		3,213,450		1,686,600		5,990,600

[1]Self-Supplied, [2]Includes Industry using Municipal water, [3]Domestic Use
[4]Since irrigation is seasonal and periodic, mgd values are not shown or totaled.

Source: Montana Department of Natural Resources and Conservation, Water Resources Division, April 1975.

Irrigated acreages are quite accurately known for each county of the state. Total equivalent acres are 1,787,496 east of the Continental Divide and 637,470 to the west. About 98 percent of the water withdrawn and consumed east of the Divide is used for irrigation; west of the Divide the corresponding figures are 92.5 percent for withdrawals and 95.5 for consumption. On the average, then, estimated irrigation withdrawals amount to about 5.72 acre-ft/acre in the east and about 3.47 acre-ft/acre in the west. These values reflect the more ample rainfall and milder summer weather in the Columbia Basin drainage and also show what appears to be excessive use of water on many irrigated acres, particularly in the Missouri drainage.

Although much less than irrigation, the next most important use of Montana's water is for municipal needs. With a 1975 state population of about 700,000, 498,000 were served by municipal systems while 197,000 rural people had their own supplies. The average daily per capita withdrawal of municipal supplies was about 270 gal/cap/day. Of this amount, about 62 percent (170 gal/cap/day) is estimated for residential use and 100 gal/cap/day for commercial and industrial use. Irrigation of lawns and gardens is widely practiced through July and August in most Montana communities with a resulting marked boost in per capita consumption.

The U.S. Geological Survey estimates that about 37 percent of the total municipal use (about 100 gal/cap/day) is consumed, with the remainder returning to surface and groundwater. Rural domestic withdrawal was simply estimated at 100 gal/cap/day.

As can be seen on Table 1, the other listed uses--thermoelectric power generation, industry, livestock, and rural--all require significant withdrawals. However, power generation consumes only a very small part of the water withdrawn.

Other important uses of Montana water deal with non-consumptive instream uses. These include maintenance of adequate flows to preserve water quality, support fish and wildlife, for recreational purposes, and for hydroelectric power generation. While these non-withdrawal uses--except for hydroelectric requirements--are not easily determined, they are recognized as beneficial uses of water by Montana law and are of great importance to Montanans.

Water rights granted for instream use may have considerable influence on water withdrawals permitted for rights junior in time to such instream rights. The granting of water rights for fish and wildlife preservation has been upheld in Montana. Such rights were originally filed for by the Department of Fish, Wildlife, and Parks (DFWP) for 12 trout streams. The filing was done in 1970 and 1971 under a 1969 law which authorized such filings.

In 1978, the Board of Natural Resources and Conservation (BNRC) signed an order establishing water reservations on the Lower Yellowstone River and stipulating that flow duration information be developed for numerous tributaries in the Yellowstone basin in order to quantify the various flows granted on a percentile exceedance basis. The DFWP is currently gathering data for additional instream water rights filings for the upper Clark Fork of the Columbia, the Missouri River above Canyon Ferry Dam, and the Missouri River from Fort Benton to Fort Peck Reservoir.

WATER SHORTAGES

As was pointed out earlier in this report, Montana has always been subject to serious drought periods. Lack of snowfall in the winter months leads to reduced runoff during the snowmelt season. Reduced runoff means less water in storage in reservoirs with resulting impacts on irrigation, power generation, municipal use, and fisheries. Lack of rains during the spring has a damaging effect on dryland crops in eastern Montana. It is not unusual for low streamflows to result in decreases in generation of hydroelectric power and restrictions on the use of domestic water. Already scarce water may be withdrawn for irrigation to the extent that the stream is dewatered and the fishery harmed.

The potential for damage to the ground water system is also there. If more use is made of this resource for sprinkler irrigation, there may be harmful effects on groundwater supplies. This reasoning can be extended to the use of slurry pipelines for the transportation of eastern Montana coal to the markets. Withdrawal of groundwater without compensating recharge could do permanent damage to the ground water system.

EXISTING AND FUTURE WATER REQUIREMENTS

Montana is a large state with a substantial water supply. Only a small part is now consumed in the state, however. Because a large portion of the annual volume flows out of the state unused during the spring flood season, under present water law, Montana stands in real danger of permanently losing, except for instream uses, this water to other downstream states. At present, the probability of construction of additional water storage reservoirs to capture this spring runoff for later beneficial release during the low flow season of the summer and fall seems remote.

According to the April 1975 report of the Montana Department of Natural Resources and Conservation (10), irrigated acreage in Montana totals about 2,425,000 with about 637,500 west of the Continental Divide and about 1,787,500 on the eastern side. The June 1979 Pacific River Basin Commission report (25) indicates that 193,000 acres of the irrigated land in the west need a supplemental water supply. This report also states that about 164,000 acres of new irrigation may be developed by 2020. The Water and Power Resources Service (WPS)--formerly the Bureau of Reclamation--has reported that about 481,000 acres of potential irrigation projects are available east of the Divide with a benefit-cost ratio greater than 1.0 (June 1980 letter from the Montana Water Users Association).

Much of the anticipated development in coming years is anticipated to be in the Yellowstone Basin. The Future of the Yellowstone River report (12) presents an overview of the existing and possible future demands on the water resources of the basin. Projections for future irrigation, municipal, and industrial development, along with the associated water consumption, for the year 2000 are shown in Table 2.

CONFLICTS ASSOCIATED WITH EFFORTS TO MEET REQUIREMENTS

The Future of the Yellowstone report concludes that even though the annual demand--including the increases shown in Table 2--is much less than the available annual flow, it will not be possible to meet all demands at the times and locations required due to seasonal variations in flow and local scarcity of water in some sub-basins. This would indicate that some additional storage and regulating facilities are needed; the report shows 26 potential reservoir sites in the basin. Included in these sites, however, is the 4,000,000 acre-ft Allenspur site above Livingston which the Montana Legislature has said would not be in the public interest. Environmentalists, sportsmen, and other citizen's groups seem adamantly opposed to increased water storage in stream channels.

Table 2

INCREASED ANNUAL WATER CONSUMPTION IN THE YELLOWSTONE BASIN BY THE YEAR 2000

(In acre-ft per year, all values are increases above 1975 estimates)

	Irrigation		Energy	Municipal		Total
Level of Development	acres	acre-ft	acre-ft	Population	acre-ft	acre-ft
Low	79,160	158,320	48,350	56,858	5,880	212,550
Intermediate*	158,320	316,640	147,160	62,940	6,960	470,760
High*	237,480	474,960	326,740	94,150	10,620	812,320

*Water is assumed available for coal slurry export under these two levels of development (at present this is prohibited by law).

The issues are clear. Should more storage facilities be built? If so, where should they be? If not, how can the increasing demands on the water resource be met? How should the available water be allocated among agricultural, municipal, industrial, power generation, coal gasification, and instream needs? When the resource is limited, how are priorities established? How much development of the ground water resource should there be? Should groundwater be used for transporting coal in slurry form? Should coal slurry pipelines be used at all? How can the necessary things be done while still maintaining good quality? These are only a few of the questions which the Montana Water Resources Research Center can help answer.

RESULTING PROBLEMS

The Montana Department of Health and Environmental Sciences (DHES) is charged with the responsibility for restoring and maintaining the physical, chemical, and biological quality of the waters in the state for public health purposes. Montana Water Quality law mirrors federal legislation to permit the state to participate in the Federal Water Pollution Control Act and the

1977 amendments known as the Clean Water Act. Two types of water pollution are of concern--point source and non-point source.

Any point source discharging pollutants to Montana waters must obtain a permit issued by the Water Quality Bureau of DHES. Such permits are issued only when the treatment proposed will meet certain effluent standards based upon the greatest degree of pollutant reduction through application of the best available technology, including, where practical, a standard permitting no discharge of pollutants. The quality standards applied to each stream are based upon the classification of the water in accord with its present and future most beneficial use.

Non-point pollution includes irrigation return flows, acid mine drainage, and run-off from logging operations, construction sites, and agricultural and livestock activities. The law provides that the water quality management plan must identify non-point sources of pollution and set forth procedures (including land use management) to control such pollution to the extent feasible.

The Statewide Water Quality Management Plan (208 Study) of October 1979 labels sediment and salts from non-point pollution, and reduced stream flows (due to withdrawals), as Montana's most significant water quality problems. In keeping with this, the DHES has filed for instream reservations on the lower Yellowstone River to maintain the minimum water quality standards.

Irrigation return water produces salinity impacts on streams. These flows also carry sediments and nutrients and contribute to elevated stream temperatures. Agriculture-related salinity impacts are also caused by percolation and runoff from saline seeps into shallow aquifers and surface waters. Dryland saline seeps have similarly affected surface and ground water quality.

Water Quality in Montana--1980 (9) presents a comprehensive water quality inventory for the state. The report lists 19 streams that will not support fishing and/or swimming along all or a portion of their lengths. It states that most of the unswimmable and non-fishing waters of the state have had their qualities degraded by non-point source pollution, in some cases aggravated by improperly treated municipal or domestic discharges. Thirty-five municipalities have been identified as causing potential ammonia toxicity problems in receiving waters.

The report also states that threats to ground water quality are increasing in Montana, largely because of in situ mining operations and surface wastewater impoundments. The Water Quality Bureau is now developing regulations for protection of shallow aquifers from surface pollution which, along with groundwater quality standards, will be published by December 31, 1981. Other groundwater problems have been identified in subdivision developments in western Montana. It is also reported that saline seep has impaired productivity on over 200,000 acres of land in the state. Discharge permits for construction of drains for saline seep ponds are now required to protect surface waters.

Montana's Soil and Water Conservation Districts have identified 873 miles of dewatered streams in the Statewide 208 area. Several of the state's

prized fishing streams are critically affected by irrigation withdrawals during the late summer. This dewatering of streams is considered by some to be Montana's priority nonpoint source "pollution" problem. Sediment, along with salinity and stream dewatering, ranks as one of Montana's "big three" water quality problems.

Turbidity seems to be the primary problem with water supplies for drinking in western Montana. Supplies in the eastern part of the state, particularly of groundwater, are generally high in dissolved solids. Of the 609 community water systems in the state, 13 have turbidity problems, 13 have fluoride problems, 4 nitrate problems, and 1 each have arsenic and selenium problems.

Eight major fish kills have occured in Montana since 1976. A total of 17.5 river miles were affected and an estimated 50,000 fish were killed. Agricultural pesticides caused five of the six fish kills occurring in 1979.

The current emphasis on developing domestic energy in the United States may cause serious problems for Montana water quality. Potential developments include seven major coal mines, two coal-fired thermoelectric plants, and six coal gasification or liquifaction plants.

IMPLICATIONS FOR THE FUTURE

It is estimated that an annual expenditure of $1.25 million will be required by 1983 to develop general and site-specific control programs for all types of nonpoint source pollution problems in Montana. Correction of the remaining point source problems will be accomplished primarily through the planned expenditure of about $82 million by the Montana Construction Grants Program through FY 1983.

The future of the water resource in Montana may become one of "trade-offs." Consumptive uses in some areas may only be met by sacrificing instream needs, providing additional storage, or establishing interbasin water transfers. If groundwater is used during periods of low flow to meet consumptive needs, then surface water may be needed during high flow periods to recharge the ground water system. In order to provide the quantities of water needed at the times and places required, a broad management system is needed.

In developing this management guide, a number of decisions must be made. Should more storage reservoirs be built and if so, where? Should the state investigate the possibility of marketing water to other potential users? How can Montana best work with the neighboring states and Canada to best utilize the water resource? Should the state encourage the movement of its coal resources by slurry pipelines or by continuing the emphasis on rail shipment? These are but a few of the things to be considered.

Additional study is needed in many areas. Most important among these are those things which affect the quality of Montana's water. More must be learned about the causes and control of saline seep. Land management practices must be developed which will control not only saline seep, but sediment and stream dewatering as well. Standards must be developed and applied to meet the anticipated municipal and industrial treatment needs. Critical stream

reaches must be identified and means developed to protect the quality and make the water safe for human consumption. Additional work must be done on upgrading sewage treatment facilities to help control the degradation of receiving streams or ground water systems.

A lot has been done by communities, state and federal agencies, and university researchers to solve these problems. Much remains to be done, however. A great opportunity is offered for the Montana Water Resources Research Center to serve as a catalyst in approaching the state's water problems.

Section 4

WATER AND RELATED LAND PLANNING AND DEVELOPMENT ACTIVITIES

As Montana's people became increasingly aware of the pressures being exerted on their water resources, they called for something to be done. As a result, studies relating to this most crucial factor in the state's development were stepped up. Problems and needs were identified, solutions were attempted, and recommendations for future courses of action were made.

Attempts to follow up on these recommendations have frequently resulted in the recognition of previously unforeseen problems and the rise of opposition groups. This natural reaction has been good, in general, because it has meant that each proposal for water development is closely examined and evaluated before any action is taken.

Some of these studies and reports have been aimed at specific subjects, while others are much broader and cover a variety of problem areas. Some of the major activities are summarized in the following categories.

ENERGY DEVELOPMENT

A study of energy projection implications, known as the Yellowstone Energy Study, was prepared as part of the Missouri River Basin Commission Level B Study (3) by the Harza Engineering Company. The Harza study forecast years 1985 and 2000 development at three levels; low, most probable, and high. The water requirements for the high forecast for year 2000 was about 219,000 acre-ft, of which only about 142,000 acre-ft was for electric generation. The remainder--about 77,000 acre-ft-was for coal slurry transport. The study also recommended irrigation of the White Horse Bench Unit of 2,000 acres of benchland near the confluence of the Clarks Fork and Yellowstone Rivers, improvement of flow regimen in tributary streams above Livingston, and installation of a six-megawatt Tongue River power plant.

Another study, A Resource Survey of Low-Head Hydroelectric Potential in the Pacific Northwest Region, (2) presents detailed data for theoretical power production potential for small run-of-river hydroelectric development of the Pacific Northwest Region, including that part lying in Montana. For Montana streams, the report shows that for plants capable of handling the flows expected to be equalled or exceeded 30 percent of the time, total power would be about 3,575 megawatts and total annual energy output about 14,690 gigawatt hours (one gigawatt=one billion watts). These figures are theoretical only, based on development of total head at 100 percent efficiency.

The Upper Missouri River Basin Level B Study (Draft Report) (7) plans for three new hydropower plants totaling 22.5 megawatts (million watts). Proposed locations are below Gibson Dam on the Sun River, near Tiber Dam on the Marias River, and at the existing Broadwater Dam on the Missouri River near Toston.

In addition, a 90-megawatt peaking power facility is recommended to be added to the Canyon Ferry Dam. Tests to determine the downstream effects of such peaking operation at Canyon Ferry were conducted in July 1980; the proposal has drawn considerable opposition from property owners and other interests. A peaking power facility at Fort Peck Dam to provide 185 megawatts of power is also recommended for further study to see if adequate fish and wildlife protection can be provided downstream. Also included is a multi-purpose project--the Fort Benton Dam--which would provide 360 megawatts of power and include an 8,700 acre irrigation project.

A hydroelectric power element is included in several other reports.

ECONOMIC EVALUATION

Technical Report No. 11 of the Yellowstone Impact Study, The Economics of Altered Streamflow in the Yellowstone River Basin, Montana, (17) discusses methods which might be used to compare the value left in the river for instream uses with the value of that water if withdrawn for consumptive use in agriculture or thermoelectric plant cooling. It concludes that an adequate method to assess the decremental change in recreational values resulting from lowered stream flows is not available.

A linear programming model was used to estimate that the increases in agricultural profits resulting from withdrawals for irrigation were $1.30, $3.03, and $7.09 per acre ft at 0 percent, 25 percent, and 50 percent respectively of the instream flows requested by the Department of Fish, Wildlife, and Parks in 1974. The model divided the Basin into two areas with from two to four counties in each and used a streamflow frequency distribution over a 30-yr period. Similar evaluations could not be made at 75 percent (or higher) of the DFWP reservation requests because in some years inflows to certain subareas were less than the instream reservations, leaving no water available for withdrawal. However, results from the model using 50th percentile streamflows indicated that in the year 2000 irrigators in the basin would pay about $116,000 to secure a one percent reduction of the instream flow request when it is within 90-100 percent of the requested flows. The value of water for thermoelectric plant cooling is stated to be from $100 to $200 per acre-ft.

GROUNDWATER

Montana statues provide that controlled ground water area may be established by the Board of Natural Resources and Conservation when factual data show the following:

(1) Ground water withdrawals exceed recharge.

(2) Excessive ground water withdrawals are likely to occur in the near future because of consistent and significant increases in withdrawals.

(3) Significant disputes exist regarding priorities, amount of ground water in use, or priority of type of use.

After a public hearing, if the Board finds that withdrawal of ground water in the area exceeds the safe annual yield from recharge, it must order the aggregate annual withdrawals reduced. All new appropriations of ground water within the area, including domestic wells, may be made only by permit.

A publication, Groundwater in Montana (23), summarizes published reports by the U. S. Geological Survey, the Montana Bureau of Mines and Geology, and the Water Resource Surveys of the Montana Water Resources Board and emphasizes that ground water and surface water are not separate resources. Characteristically, during the long dry periods of late summer, Montana streams are maintained largely by ground water discharge which often contains irrigation return flows. The ground water supply, in turn, is recharged mainly by precipitation, stream flow, and that part of the water withdrawn for irrigation which is not consumed. The report states that over 42,000 wells and 18,000 springs in both unconsolidated and bedrock aquifers were recorded in 1969.

Well depths, water table depths, and well yields (actual and potential) for unconsolidated aquifers are shown for 55 sub-areas of the state. Where known, specific capacities, number of wells, water temperature, and well water use are also shown. For six of these sub-areas, dissolved solids concentration data are also provided.

The report discusses briefly the possibilities for conjunctive use of ground and surface water for irrigation in Montana. One possibility may call for surface water use (and recharge to ground water) during spring flows, and ground water use during late summer. The other possibility may require additional ground water withdrawals during the periods of drought which have occurred in Montana with distressing regularity and severity.

IRRIGATION

One study, The Flathead River Basin Level B Study, (21) gives total irrigated acreage in the basin as 166,700 with 24,000 to 49,000 acres of new irrigation projected. There is now a late season water shortage for 127,000 acres. Over 800,000 acre-ft of irrigation water is withdrawn in an average year. Consumption use need, however, is assumed to be only two acre-ft/acre. Two irrigation projects are proposed: Creston Bench with 14,500 acres of sprinkler irrigation and the Flathead Irrigation Project feeder canal lining. Feasibility studies are recommended to investigate the possiblity of water storage in the upper Stillwater Basin. Stabilization of Whitefish Lake with drawdown limited to 30 in. is recommended to provide 6,500 acre ft of water for recreation, late-season irrigation, and fishery needs. Further study of pollution alleviation on Ashley Creek is recommended.

The Upper Missouri River Basin Level B Study (7) contains recommendations for over 161,000 acres of new irrigation, with 127,000 acres of this in the Lower Marias Project. In July 1977, the cost was estimated at $126,000,000 with a benefit-cost ratio of 1.3. Two large supplemental irrigation projects are recommended. The Gallatin Unit calls for 51,139 acres to be supplied (along with 7,957 acres of new irrigation) by about 200 ground water wells and

the Milk River Supplemental for 108,140 acres to be supplied by pump lift from the Missouri River near Telegraph Creek into a 60-mile diversion canal. For the Milk River project, four different alternatives are considered. Total cost of the recommended irrigation projects is estimated as $266,566,000.

The Level B report estimates that canal consolidation, canal lining, land leveling, better drainage, and better water management could reduce annual diversions in the basin by over 1 million acre-ft.

Another report, The Potential Increase in Irrigated Acreage in Montana Due to Increased Red Meat Production, (12) includes estimates of the increase in irrigated acres required to accommodate red-meat projected production in Montana. This has been used as a basis for estimating future irrigation water requirements. Montana's DNRC has projected an increase of from 1.82 to 2.43 times the 1970 red-meat production for the year 2020. Montana's 65,652,162 acres of grazing land was fully utilized and in places overgrazed in 1970 and cannot support appreciable increases in red-meat production. Almost all the hay available in the state in 1970 was consumed. Feed to meet the additional livestock production, if provided by increased irrigation, was estimated to require from 634,370 to 1,912,370 acres of new irrigation by the year 2000. Based upon an average withdrawal of 4 acre-ft per acre, this would mean additional irrigation water requirements of about 2.5 to 7.6 million acre-ft annually for red-meat production, which in present Montana agriculture generates the major demands for irrigation.

WATER RIGHTS AND REGULATION

Montana seeks to control its own water-use destiny. The revised constitution, enacted in 1973, makes the following statements about water rights:

(1) All existing rights to the use of any waters for any useful or beneficial purpose are hereby recognized and confirmed.

(2) The use of all water that is now or may hereafter be appropriated for sale, rent, distribution, or other beneficial use, the right of way over the lands of others for all ditches, drains, flumes, canals, and aqueducts necessarily and in connection therewith, and the sites for reservoirs necessary for collecting and storing water shall be held to be a public use.

(3) All surface, underground, flood, and atmospheric waters within the boundaries of the state are the property of the state for the use of its people and are subject to appropriation for beneficial uses as provided by law.

(4) The legislation shall provide for the administration, control, and regulation of water rights and shall establish a system of centralized records, in addition to the present system of local records.

As was indicated earlier in this report, the 1979 legislature provided through Sentate Bill 76 that four water judges adjudicate all water rights in the state. Thereafter all water rights are to be obtained by a permit issued by the Department of Natural Resources.

The Yellowstone River flow reservations (3,14) and the associated moratorium may well constitute an event of great significance in the administration of Montana Water Rights. In 1974, the Montana legislature declared a moratorium on applications for water rights in the Yellowstone Basin. This action was taken in response to the feverish coal leasing activities in southeastern Montana and the intense industrial competition for water from the Yellowstone River and its southern tributaries which resulted from the drive for domestic sources of energy following the 1973 Arab oil embargo. The moratorium suspended all applications for diversions over 20 cfs or for storage over 14,000 acre feet, but provided that state and political agencies could file for instream reservations in accord with the 1973 Montana Water Act.

Accordingly, the Montana Department of Fish, Wildlife and Parks (DFWP) made application for instream flows for the Lower Yellowstone (below the Bighorn River) and for the Bighorn River at its mouth. In addition, 14 conservation districts, 2 irrigation districts, and 3 government agencies filed for total future withdrawals of 1,186,482 acre-feet per year. Eight municipalities also filed for 391,517 acre-ft per year, and four reservatons were filed for multipurpose storage projects totaling 1,175,800 acre-feet. The DFWP filed for 8,200,000 acre-feet including average flows of 42,000 cfs and 45,000 cfs for June 8 - 30 at Miles City and Sidney, respectively, and the Department of Health and Environmental Sciences for 6,600,000 acre-feet per year. A total of 36 applications for reservation of Yellowstone Basin water were filed.

After release of the final Environmental Impact Statement by DNRC on January 31, 1977, applications were subjected to examination by contested case hearings as specified by law. The hearings lasted 2 months and were completed on September 27, 1978. A major area of controversy centered around the DFWP application on the Powder River and applications of Utah International and Intake Water Co. (Tenneco) who had large filings for industrial water withdrawals held in abeyance by the moratorium. The hearings produced 33 volumes of testimony and numerous exhibits.

The Board of Natural Resources and Conservation signed their order establishing reservations on December 15, 1978. This order provided for a minimum flow of 25,140 cfs at Sidney during June, 11,964 cfs and 10,526 cfs for May and July respectively, with flows for other months decreasing to a maximum of 2,670 cfs in August. The total annual reservation is 5,492,310 acre-ft. The average annual discharge is about 9,500,000 acre-ft.

The Board order of December 1978 is likely to be contested in court and its full significance may not be known for years. In addition to its use to maintain streamflows for water quality and fish and wildlife, the reservation process provides a means to obtain a water supply for those future consumptive water users least able to compete price-wise with industry for water. These

users, principally agricultural and municipal, are unable to satisfy their future needs through the water permit system, which addresses only present users of water, and they are unable financially to pay high prices for water. Adequate minimum stream flows also enable present irrigators to continue withdrawals without expensive and damaging reconstruction of their diversion works. Whether flows of the magnitude granted during May, June, and July will be upheld in the future, only time will tell. The minimum instream flows granted were said to be equalled or exceeded 85% of the time. Whether contested or not, the Board is required by law to review the instream reservations at least every 10 years, with the initial reservation calling for review in 5 years.

The problems associated with Indian water rights are knotty ones, indeed. Three law suits were pending in Federal District Court in Billings, when four more law suits were filed by the United States of America. These suits were filed on behalf of the Fort Belnap, Fort Peck, Blackfeet, and Flathead tribes and were concerned with the general adjudication of the Poplar, Milk, and Flathead Rivers and tributaries. All seven suits were dismissed during the summer of 1979 by the federal judges. Since that time, the United States of America has appealed the decision to the Ninth Circuit Court in San Francisco.

Filing of the four law suits in federal court came about as a result of the passage of SB 76--a bill to adjudicate all water in state court. The federal government and Indian tribes realized that SB 76 was going to pass during the last legislative session so moved to keep the jurisdictional question of Indian and non-Indian Federal Reserved rights in federal court.

Senate Bill 76 also provided for a Reserved Water Right Compact Commission to negotiate compacts with the various Indian tribes and federal agencies with regard to their water rights. The tribes from two reservations--the Flathead and Northern Cheyenne--have begun official negotiations. Additionally, the Department of Interior and the Department of Agriculture have designated official representatives to begin negotiations.

WATER STORAGE

Potential water storage in the Big Hole River was investigated by reconnaissance studies (Potential Off-stream Reservoir Sites in the Big Hole River Basin) (18) of an extensive list of possible sites for water storage located off the main stem of the Big Hole River, made at the request of the 1972 Montana Legislature. From a list of 120 possible sites, DNRC selected 7 sites for further study. These sites provide storage ranging from about 5400 acre-ft at Fat Man on Trail Creek to about 11,400 acre-ft for a site on French Creek. Estimated annual yield for these sites is about 10,800 and 9,000 acre-ft respectively. Construction costs are from $0.9 to $2.7 million and estimated costs per acre-ft of water vary from about $3 to $21 at the seven sites, using interest at 6.625 percent.

The report states that the actual interest of potential irrigators in irrigation development is unknown, and recommends a study to determine the

demand for irrigation water in the area. A cursory analysis of the increase in net income in converting from range land to irrigated alfalfa indicates a break-even price for irrigaiton water of $3.25 per acre-ft.

The State of Montana administers over 40 water conservation projects, the construction of which was started during the depression and drought of the 1930's. These projects, consisting of dams, reservoirs, canals, and ditches, were built primarily to provide irrigation water. Water users' associations operate most of the projects, under marketing agreements with the DNRC which require them to collect a user's fee, expend an operation and maintenance charge, and to repay the State's investment in the project. Because of deterioration with age, poor maintenance, and design by outdated standards, many of the projects now require substantial and expensive rehabilitation. In 1979, the estimated cost of such rehabilitation was over $65 million (20). Action on several projects involving dams and spillways is urgent because failure during floods could cause considerable destruction of life and property.

GENERAL PLANNING STUDIES

Most of the studies made encompass a variety of problems, rather than being aimed at a single area. The major studies of this type are described briefly in the following discussion.

The Columbia-North Pacific Region Comprehensive Framework Study (24) presents plans and programs for further study for that part of the Columbia River Basin within the United States. The Montana portion is covered by five subareas, namely the Bitterroot, the Flathead, the Upper Clark Fork, the Lower Clark Fork, and the Kootenai. The latter two include some areas of Idaho. Irrigation predominates as a water user in those areas. Modification, exchange, and monitoring of existing water rights and diversions, additional upstream storage, and improved water delivery systems are recommended alternatives for the Bitterroot area. Water quality problems in the Flathead area are cited as are the unique environmental values of the Wilderness areas, Glacier Park, Flathead Lake, and the mountains of the Flathead region are pointed out.

The possibility of generating over 1300 megawatts at three hydroelectric sites: 330 at Smokey Range on the North Fork of the Flathead, 380 at Spruce Park on the Middle Fork, and 552 megawatts at Buffalo Rapids downstream from Flathead Lake are pointed out. For the Upper Clark Fork area, it is recommended that the 20-mile reach of the Clark Fork from Butte to Warm Springs which includes Silver Bow Creek be brought into conformity with State standards by adequate treatment of mining mill wastes. In the Lower Clark Fork Region the rapidly growing water demands of the city of Missoula can be met by groundwater or development of nearby tributary streams. Expansion of Noxon Rapids hydroelectric plant to increase peaking capacity by 71 megawatts is recommended. The signficant environmental and recreational potential of the Kootenai area are mentioned. Expansion of Libby Dam power after 1980 is mentioned, and the treaty rights which permit Canada to divert part of the Kootenai to the Columbia River is stated as a major consideration in planning

in the basin. Acceleration of ongoing studies with special emphasis placed on providing legal and administrative means for enforcing minimum stream flows is recommended.

The Flathead River Basin Level B Study (21) has been adopted by the Montana Board of Natural Resources and Conservation as part of the Montana Water Plan. The report covers an area of 5,405,550 acres of northwestern Montana lying along the west slope of the Continental Divide and extending about 130 miles south from the Canadian border to the divide between the Clark Fork and Flathead Rivers near the Montana-Idaho border. About 60 percent of the area is in public ownership. Indian land holdings amount to 614,000 acres, but reservation lands total 1,244,940 acres. The plan, a product of 3 years of Level B study, presents numerous alternatives and recommendations. Among these are (1) the need for development and improvement of water supply systems for about 20 communities and, (2) the need to upgrade or provide new or expanded sewage treatment at about 20 communities.

The area provides outdoor recreation for people from throughout the United States, and in particular from Montana, Idaho, and eastern Washington and Oregon. It is estimated that such use will increase from 3.4 million activity occasions in 1970 to 8.3 million in the year 2020.

This study covers the most water-abundant basin in Montana, and many of the conflicts regarding water development are shown in the paradoxical desires of residents such as the following: (1) residents are concerned about the loss of water to downstream users, yet most oppose development, (2) many oppose the influx of tourists with the accompanying part-time employment and numbers of visitors, (3) while fish and wildlife are very important to most, the growth in population is depriving and/or degrading the habitat of this resource, (4) many oppose new hydropower dams and perhaps alternative energy sources, yet few practice energy conservation, and (5) most favor wilderness and free-flowing stream preservation, yet many derive their living from the forest resource, use hydro-energy in their homes, or work in industry dependent upon abundant energy availability.

The irrigation portion of this study was described earlier in this section of the report.

Improved land management to increase crop production and reduce erosion is recommended on 500,000 acres of cropland, and on forest, urban, and wooded areas to improve the environment and visual aspects. Average annual costs of the recommended plan are estimated at $34,543,000 with annual benefits of $40,893,000.

The Clark Fork of the Columbia River Basin Cooperative Study (22) was a Type IV Study and covered 10 western Montana counties as an approximation of that part of the Columbia Basin in Montana. The area covered corresponds to Water Resources Sub area 1702 except that the latter includes Bonner and Pend Oreille counties in Idaho.

The study was conducted to identify water and related land resource problems, potential projects, and ongoing programs needing modification. It provides a comprehensive inventory of the economic development and environmental quality problems of the area. Some actions recommended are as follows:

(1) store 28,000 acre-feet of spring runoff in 3 reservoirs (Browns Gulch, Lower Willow, and Rattlesnake) and in Whitefish and Stillwater lakes for late season supplemental irrigation water, (2) improve the municipal water systems of 20 towns, and (3) reserve minimum stream flows for 7,484 miles of live streams. It recommended a preferred plan that would result in the following estimated changes in water use by year 1990:

(1) About 2000 acre feet/year of stored water will supplement acres now irrigated

(2) About 35,000 acre feet/year of water will be used on 14,000 acres of new irrigation

(3) Savings of 126,000 acre feet/year will result from conversion from flood to sprinkler irrigation

(4) The increase in municipal and industrial water use will be insignificant compared to total water available

The Yellowstone Impact Study (13) was made to evaluate the potential physical, biological, and water use impacts of water development on the middle and lower reaches of the river. Three levels of future development were projected with the associated stream withdrawals. The impacts of altered streamflow on river morphology and water quality, and the resulting effects on existing water users, recreation, and fish and wildlife were analyzed. The study, accomplished during 1974-76, resulted in the publication of 11 technical reports ranging from the Effect of Altered Streamflow on the Hydrology and Geomorphology of the Yellowstone River Basin, Montana (No. 2) to the Economics of Altered Streamflow in the Yellowstone River Basin (No. 11). New irrigation was assumed possible on 237,472 acres that are economically feasible to irrigate with a low, intermediate, and high level of development. Consumptive use was estimated at 2 acre-feet per acre. Energy development projections are based upon the Northern Great Plains Resource Program's National Report and Regional Work Group study and the Montana University Coal Demand Study to project water demands for three levels of development, similar to irrigation.

The Yellowstone River Basin and Adjacent Coal Area Level B Study (3) was a reconnaissance study which projected water use for agriculture, municipal, rural domestic, and livestock by projecting historical trends and considered water requirements for coal development. Energy development was based on a study by Harza Engineering Co. This study, with the recommended plan, projects additional irrigated acreage in the Yellowstone Basin of about 116,000 acres. This would result in average streamflow depletion of 554,000 acre-ft at Sidney by the year 2000. Energy requirements for water amount to about 262,000 acre-ft per year, of which about 157,000 acre-ft is for electric power generation and synthetic gas productiion, and 78,000 acre-ft is for slurry pipeline transport of coal.

The Montana Water Assessment Report (19) reviews the supply of water in the state, legal restraints to water use, and use projections to the year 2000, by major river basins.

Conclusions of the Assessment Study include the following:

(1) Demands for all uses of water, instream uses and consumptive uses, are increasing.

(2) Existing studies of Montana water use do not include adequate hydrologic data and are of limited use since they only deal with annual rather than monthly increases in streamflow depletions.

(3) Since municipalities have the power of eminent domain over other water rights and use rather minor amounts, sufficient water will be available for urban growth.

(4) Several regionsin the Upper Missouri and Yellowstone River basins do not have adequate water to meet all projected needs.

(5) Water quality problems, attributable to both humans and natural phenomena, exist in several regions throughout the state.

(6) Instream reservations, Indian water rights, hydropower water rights, Canadian and Wyoming apportionments of inflows to Montana, and unadjudicated valid water rights throughout the state all contribute to much uncertainty about how much water is available in Montana for future use.

(7) The major competition for water use is between instream (fish and wildlife, water quality maintenance, hydropower) uses, and consumptive uses (irrigation, industrial and energy uses).

(8) In most of the state, unappropriated water is probably available for additional consumptive uses, and additional streamflow depletions are expected.

The "best guess" projections of the assessment study for additional consumptive water requirements are:

Use	Low	High	
Irrigation	150,000	250,000	acre feet/year
Energy	100,000	150,000	" " "
Municipal & Industrial	7,000	9,000	" " "
Total	257,000	409,000	acre feet/year

The Upper Missouri River Basin Level B Study Draft Report (7) provides the basis for water resource planning for all of Montana drained by the Missouri River and its tributaries, except the Yellowstone River. Included in the study is the St. Mary drainage to Hudson Bay, since a diversion from this river supplies some water to the Milk River, a tributary of the Missouri. The study area covers about 83,200 sq mi, ranging from the Canadian border south into Yellowstone Park, with a 1975 population of 313,100 residents.

Crucial problems identified and addressed include streambank erosion, flood damage, irrigation water shortages, water quality degradation, stream dewatering, sediment deposition and erosion, and numerous inadequate community water storage and distribution systems.

Over 161,000 acres of new irrigation, 159,279 acres of supplemental irrigation, three new hydropower plants, implementation of several hundred fish and wildlife projects on 161,300 acres of public land, and five local flood control projects are recommended in the report.

The Level B study endorses the saline seep prevention, abatement, and research program in the Triangle Conservation District's area and recommends that additional funding be sought from the state and/or the Old West Regional Commission. It also endorses the nonregulatory program for alleviating nonpoint source pollution with the soil conservation districts serving as lead agencies, as recommended in the Statewide and Blue Ribbons 208 water quality management plans.

Other local problems recommended for support include the following: (1) Muddy Creek land and channel management, rehabilitation, and stabilization, (2) Montana's Floodplain Management Program, (3) Acceleration of land and water conservation measures on both private and public lands in the basin, (4) Further study to seek a solution to the thermal pollution in the Madison River downstream from Ennis Lake and (5) Additional research and demonstration projects on streambank erosion control. Two multipurpose projects are included: the Boulder River 2,700 acre-ft reservoir for irrigation, recreation, and fisheries enhancement which will provide full irrigation to 3,400 acres and supplemental water to 7,300 acres; and the Fort Benton Dam project which will provide 360 megawatts of power and includes an 8,700-acre irrigation project. The study supports the reformulation study being conducted by WFS to determine and minimize the impacts from Morony Dam to Fort Benton--an important paddle fish and sauger spawning area--and in the wild and scenic river area below the proposed afterbay dam.

The DNRC, Water Resources Division, Report to the 46th Legislature (20) provides an excellent summary report to the 1979 session, detailing specific activities of the Water Resources Division of the DNRC, the accomplishments of the Division and their costs. The budget for 1979 was $2.69 million, of which $1.7 million was from the State's general fund, $550,000 was grants primarily from the State's Renewable Resource Development Program (funded by the coal severance tax), and $450,000 was from federal revenue funds. The report describes in some detail the status of the work on Water Rights through 1978, as well as the status of and studies relating to state-owned water conservation projects, the Dam Safety Inspection program, the Flood Plain Management program, the Hiplex Weather Modification project at Miles City, and the Landsat Cooperative Project with NASA. Also covered are the general framework of Water Planning and Water Resource Development activities of the Division.

The problems and issues raised here have helped to provide the background necessary for developing the problem categories. Most of the agencies conducting the studies described in this section of the report are represented on the Water Center's Advisory Council so they have included these problem areas in their suggestions for developing the 5-year research plan. By working closely with representatives of state and federal agencies, industry, consulting, and university researchers, the Montana Water Resources Research Center has been able to keep abreast of Montana's current needs.

Section 5

PROBLEM CATEGORIZATION AND RANKING

INTRODUCTION

The water resources research needs for Montana have been assessed on a continuing basis during the past two and half years by the MWRRC Coordinating and Advisory Councils through questionnaires and discussions with representatives of state and federal agencies, users associations, public interest groups and water resources consultants. This process generated a list of more than 30 research topics related to the problems indicated in the previous sections of this report. Problems of concern to future water resources management and development are also identified.

As many of the topics were very specific and were part of a broader area of research concentration, a categorization of six general problem areas was suggested by the MWRRC University Coordinating Council on July 7, 1980. The six general problem areas and subareas suggested were discussed by the MWRRC Advisory Council on July 24, 1980. The problem areas were redefined at a subsequent review of a draft of the 5-year research at a joint meeting of the MWRRC University Coordinating Council and Advisory Council on September 12, 1980.

PROBLEM CATEGORIZATION

A summary of the water resources research problems and needs for Montana is listed in seven problem group categories with priority topic areas of each problem group identified in the following paragraphs. As these problem groups and topic areas are a composite effort of representatives of state and federal agencies, the Montana University System, and the private sector, an absolute ranking was not given.

I. Groundwater Systems. Physical, chemical, and hydraulic characteristics of aquifers, recharge and discharge areas; inventory of quantity and quality of groundwater; mechanics of groundwater movements including conjunctive operation with surface flows.

Research topics in this area include:

A. Inventory of quantity and quality of groundwater in Montana needs to be completed.

B. Sources and mechanics of recharge of Montana aquifers need better definition.

C. Groundwater models need to be improved, calibrated and verified; water quality programs need to be incorporated.

D. Information on dynamics of water quantity and quality in groundwater systems (included spatial and temporal variations due to interaction with surface flows) needs to be developed for comprehensive planning purposes.

E. Legal and institutional arrangements for providing conjunctive use of water from ground and surface supplies need to be developed.

II. Surface Water Systems. Physical, chemical, and hydraulic characteristics of surface water; inventory of quantity and quality of surface water; mechanics of streamflow and overland flow, circulation in lakes and reservoirs; flood routing; bank storage; spatial and temporal variations of flow; droughts; or floods.

Research topics in this area include:

A. A comprehensive program needs to be developed for identifying and managing the instream flow needs required for (1) wildlife habitat and riparian ecosystems, (2) water quality standards, (3) energy developments including hydropower, fossil fuel, and synthetic fuel plants and systems, (4) agricultural irrigation withdrawals, (5) industrial demands, and (6) municipal and domestic supplies.

B. The existing consumptive uses need to be correlated with available water supplies as many drainages throughout the state are over-appropriated and require formulation of careful management plans for reallocation policies.

C. Information and research is needed on the basic processes and mechanisms controlling the hydrologic regimes of lakes, streams, reservoirs and wetlands in relation to biology, chemistry, water quality, groundwater seepage and evaporation to develop management tools.

D. Better information and methods for evaluating probable maximum flood (PMF) for assessing flood hazard risks need to be developed for rainfall and snowmelt (or combinations thereof) processes.

E. Definitive information is needed to develop interflow relationships between surface and groundwater systems (including return flows) with minimal data requirements.

F. Legal and physical implications of interbasin transfer and reserved rights need to be established.

III. Atmospheric Water Systems. Physical, chemical, and meteorological characteristics of atmospheric water; mechanics of cloud formation and movement; weather modification; spatial and temporal variations; structure of storms; physiographic effects; extremes; probable maximum and minimum values.

Research topics in this area include:

A. Better information and methods for evaluating spatial and temporal distributions of precipitation (area-amount frequency relations) used for predicting probable maximum precipitation (PMP) for assessing flood hazard risks need to be developed.

B. Estimates of evaporative losses from soil and free water surfaces need to be refined.

C. Assessment of summer and winter research on operational cloud seeding projects are needed for Montana; hail suppression criteria need to be established to protect state and local interests.

D. Baseline values for chemical properties of precipitation need to be established to assess effects of future industrial and energy developments on changes in these properties.

E. Methods for utilizing short-term (5-day, 30-day) climatological and meteorological projections for forecasting streamflow need to be developed for increasing efficiency of water storage and utilization.

F. Legal, institutional and social implications of weather modification need to be assessed and arrangements for providing these must be developed.

IV. Water Utilization and Conservation (including engineering, management, and control of water). Practices or processes for the management and control of water and for determining the effects of man's non-water activities on water quantity, increased availability through improved management and conservation practices; improved technology for design, construction, and operation of works required to implement water development plans.

Research topics in this area are denoted by user segments.

A. Agriculture

1. Optimum quantities and application rates and schedules of irrigation need to be determined for crop-soil-climatological combinations found in Montana.

2. Crop tolerance of impaired water needs to be determined (in conjunction with quantities and application rates).

3. Hydrologic and economic effects of rehabilitating deteriorating irrigation systems needs to be evaluated and compared with reverting to dryland farming practices or other alternatives.

4. Effects of agricultural land management practices on streamflow and water quality need better quantification.

5. Efficiency and economics of irrigation water delivery and spreading systems capable of matching crop moisture requirements and schedules need to be improved.

B. Energy Development

1. Effects of peaking hydro operations on downstream riparian and aquatic ecosystems need to be ascertained.

2. Effects on streamflow regulation and user demands caused by operating hydro plants serially situated on a river (or within a river basin) in a peaking mode need to be determined.

3. The economic and technological feasibility of utilizing micro-hydroelectric systems in agricultural and other remote site applications need to be assessed.

4. Total effects (including seasonal variations and at downstream locations) of synfuel and coal gasification plants need to be determined. Currently most scenarios optimistically deal in long-term annual averages.

5. Methods and computer models for predicting effects of surface mining on hydrologic characteristics of groundwater and surface water systems need to be developed.

6. Methods for predicting effects of land rehabilitation practices or groundwater and surface water systems in surface mining areas need to be developed.

7. Effects of in-situ mining operations (principally for uranium) on groundwater systems need to be developed.

C. Municipal/Domestic

1. Methods for providing potable water at reasonable costs in rural communities need to be ascertained.

2. Benefit/cost ratio of storm water handling systems for small communities need to be evaluated vis-a-vis potential hazards of discharging into local water courses.

3. Realistic design demand criteria for rural water systems need to be determined.

4. Innovative, inexpensive water and wastewater treatment facilities need to be developed for small communities in northern climates.

5. More definitive information showing the effects of urbanization and changing land uses on stream flows and natural recharge zones need to be developed.

V. Water Quality Management and Protection. Identification and quantification of point and nonpoint source pollutants entering surface and groundwater

systems, formulation of mechanisms associated with effect of pollutants on the water resources and associated ecological systems, and development of methods for mitigating impacts on these systems.

Research topics in this area include:

A. Methods need to be developed and verified for identifying and predicting (1) the quantity and rate of movement of contaminants arising from agricultural, municipal, industrial, and energy activities in groundwater systems and (2) the interaction of these contaminants with aquifer materials in groundwater systems.

B. Quantitative information and analysis of sedimentation processes, causes, and effects is needed to establish the relationships between (1) sediment source and quantity in streams, (2) best management practices (BMP) and water quality, and (3) role of suspended silts in the aquatic and riparian biological and ecological systems to formulate mitigation methods.

C. Methodology for rapidly detecting, identifying, characterizing, and determining the toxicity levels of pollutants of all types (biological organisms, organic and inorganic compounds, and heavy metals) need to be developed.

D. Criteria and methods for developing minimum groundwater pollution standards need to be developed from field and computer model studies; this includes assessing and developing suitable methods for disposal of hazardous wastes.

E. Legal and institutional arrangements for controlling and enforcing groundwater pollution need to be developed.

VI. Water Resources Planning and Management. Methodologies and criteria for providing guidelines for planning decisions to physical, economic, legal, and social aspects of water management..

Research topics in this area (not stated in previous sections) include:

A. A dynamic state water plan needs to be formulated to guide, coordinate and plan all major water resources activities of the local, state, federal and private entities in the state.

B. Quantification methods for Federal and Indian reserved water rights need to be developed, evaluated and implemented.

C. Mechanisms for obtaining more meaningful public participation in water policy formulation need to be developed, evaluated, and implemented.

D. Methodologies for obtaining quantifiable forecasts of social and economic effects of proposed water policies and projects need to be assessed, improved, evaluated and implemented.

E. Reliable methods for determining the effects of pricing, subsidies, and regulatory restrictions on water demands need to be developed, evaluated, and implemented.

VII. Water Resources Data. Field data collection programs, data aquisition methods or equipment, data evaluation, processing, and publication programs.

Current research topics in this area include:

A. An inventory of all Montana water resources data collected by the various local, state, and federal agencies needs to be conducted to assess quantity, quality, character and location of data currently available to planners, engineers, and managers.

B. A data network system needs to be developed for accessing existing data and cataloging and storing data newly acquired by the various agencies. (A data network newsletter should be implemented to inform members of the data network about when, where, and by whom data are being collected.)

C. An assessment of existing data is required to ascertain if gaps exist in types and quantities of data necessary to conduct future planning programs.

D. Minimum requirements need to be developed for a continuous, permanent water resources data collection and management program necessary to monitor effects of current activities on water resources systems and to provide more accurate data for planning future developments and management policies.

PROBLEM RANKING

The unique environment of the Montana water resources, characterized by pristine headwaters of two of the nations major river systems providing water for agriculture, recreation, energy development, municipal, and industrial uses within the state boundaries as well as a host of needs for the downstream states, creates many equally-important research priorities. The Advisory Council, representing many agencies and interests, indicated that, insofar as possible within the limitations of the funding and expertise available, research on topics listed in a number of the problem areas should be initiated. Those general subject areas in which research would make the most significant contributions to understanding, planning and managing the water resources of the state of Montana include, but are not restricted to, those specific topics dealing with:

A. State water management planning
B. Agricultural conservation of water
C. Instream flow requirements and reservations
D. Groundwater systems
E. Energy development
F. Water quality management and protection

IMPORTANCE TO MONTANA

The importance to Montana of the above-listed areas of water resources research subject is summarized as follows:

A. State water management planning. A dynamic (flexible and evolving) framework for planning and managing the state's water resources needs to be completed and enunciated to all water resources agencies and private and public organizatons operating in the state. Such a framework document will serve as an umbrella for planning development and research. Although a form of this is being formulated by the Department of Natural Resources and Conservation, it needs to be expanded to include the active programmatic concepts developed by other agencies with their staff members providing substantive input and acting in something other than an advisory capacity.

B. Agricultural conservation of water. The greatest opportunities for water conservation may be realized by dedicating a significant effort to improving the understanding of water-soil-crop relations in the Montana climatological environment and in improving the efficiencies of the irrigaton systems. A relative minor decrease in water usage in this area will result in a significant increase for other purposes as agriculture currently uses approximately 95 percent of the state's water resources.

C. Instream flow requirements and reservations. The state legislation enabling governmental agencies to apply for instream flow reservations makes it imperative that information and methodologies be developed for correctly assessing the water requirements for various activities and users and the total effects of not providing minimum flows. Information in this area will be needed to implement the allocation of water rights filed for under Montana Senate Bill 76, to aid in settling Indian and other federal water reservations, and to quantify adverse effects when flows fall below minimum requirements. With the many conflicting demands on the surface waters, this is also one of the more important research subjects.

D. Groundwater systems. The over-appropriation of surface water in the state has increased the number of permits being filed for groundwater uses in Montana. The Water Rights Division of the Department of Natural Resources and Conservation often does not have adequate information on the hydraulic performance of the groundwater systems to legally deny permits in some areas considered to be critical. As a consequence, a few groundwater areas are in danger of becoming over-appropriated. The concept of conjunctive use permits must be instituted to avoid proliferating legal battles now coming into the courts over groundwater/surface water interference. The advent of lagoons and other water-spreading methods for wastewater treatment for smaller communities and restrictions on hazardous waste disposal require extensive knowledge of processes involved in preventing serious groundwater pollution.

E. Energy development. A more complete understanding of the effects of current and impending energy developments in Montana and other

neighboring states on the quantity and quality of the water in both surface and groundwater sources must be developed for implementing management procedures and methods for mitigating adverse effects. Energy developments in Montana include the current and future surface mining of coal, probable near-future development of synthetic fuel plants, development of low-head hydroelectric sites, trend toward peaking operations in existing major hydroelectric plants and the renewed and accelerated interest in developing petroleum sources previously considered to be uneconomical.

F. Water quality management and protection. The Montana Department of Health and Environmental Sciences (DHES) is mandated for developing standards for groundwater pollution levels and is responsible for approving "best management practices" plans for statewide water quality programs formulated from 208 studies. Reliable information and methodologies for quantifying or predicting the relationship between the source of pollution and the level of pollutant and its toxicity in surface or groundwaters under a variety of physical and ecological must be developed for the DHES to carry out these mandates.

Section 6

WATER CENTER PRIORITIES

INTRODUCTION

All the problems listed in Section 5 cannot be researched with the limited funding of the Center. In fact, all the funds currently available to the Center may not be adequate to research completely any single problem listed. The strength of the Center, as it currently operates, lies in its unique capability of obtaining and providing the broad range of research expertise and experience of the state's academic institutions in assisting the state, federal and private agencies in obtaining knowledge of water resources related processes and providing the methodology and information necessary to assess and solve problems in water resources areas. The structure of the Center with non-university members on its Advisory Council allows the Center to determine how projects may be integrated into an overall research effort addressing the water resources problems and concerns of Montana.

The Center must be guided by the philosophy of conducting research that is strongly influenced by the needs of the state to be most effective in contributing to the best management and planning of Montana's water resources. Initially, research which can show success in a relatively short time (about two years) will be emphasized. This philosophy is adopted for two reasons:

A. Montana is in the process of developing a set of policies to guide the planning and management of its water resources. These policies depend, to a large degree, on the emerging and continually changing technological, economic, and social information and processes which are developed, tested, and implemented by strong viable water resources research programs such as that which is available through the Montana Water Resource Research Center.

   The water resources agencies of Montana function primarily in a regulatory capacity and do not, as a rule, conduct research necessary for updating policies and procedures. The MWRRC is orienting a major segment of its efforts toward a cooperative research program to provide the state agencies with water resources research services for assistance in formulating planning and management policies and procedures.

B. The State of Montana has not provided funding to support water resources research per se except for the matching components on OWRT and other federal research grants obtained in the Montana University System, those projects conducted in irrigation by the Montana State Agricultural Experiment Station, or projects supported by state agencies at irregular intervals through funds designated for "planning" or for "investigative" reports. Most of the funds for conducting water resources research in Montana are derived from conducting federal grants for projects in areas specified by the granting agencies. Such projects may, or may not, fit into the overall research needs of the state in the next 5 years. For this reason

the OWRT programs in which the MWRRC assigns the research priorities will be emphasized to give some continuity and direction to areas vital to the needs of the state. The 5-year research priorities may be used to suggest orientation of water resources research proposals submitted to other agencies.

Based on expected funding for the MWRRC, available expertise and research programs of other agencies, prioritiy water research problems were selected although it was recognized that research proposals for any topics given in Section 5 of this report will be considered.

MWRRC EMPHASIS

MWRRC will emphasize research to provide information, methodologies, and assessments for addressing significant water resources problems including, but not limited to, the following topics:

A. Groundwater

1. Improve, calibrate, verify groundwater models incorporating water quality.

2. Dynamics of groundwater quality and quantity.

3. Legal and institutional aspects of conjunctive use permits.

B. Surface Water

1. Identification and management of instream flow processes and requirements.

2. Improved methodology for assessing flood hazard risks.

3. Basic mechanisms relating physical properties and ecosystems to hydrology of surface water.

4. Effects of interbasin transfer and reserved rights.

C. Atmospheric Water

1. Baseline values for precipitation chemistry.

2. Assessment of institutional aspects of cloud seeding.

D. Utilization and Conservation

1. Irrigation practices based on crop-soil-climatological parameters.

2. Improved efficiency and economics of irrigation practices and systems.

3. Effects of peaking hydroplant operations on ecosystems.

4. Total effects of energy developments (synfuel, mining, petroleum operations) on water resources systems.

5. Methods and criteria for providing water of good quality and ample quantity to rural communities.

E. Water Quality

1. Improved methods for identification and characterization of pollutants in surface and groundwater.

2. Path of pollutants and their interactions with instream and channel surface surroundings.

3. Relationships between (a) sediment source and quantity in streams, and (b) suspended land silts and aquatic ecosystems.

4. Assessments for minimum ground water pollution standards and institutional arrangements for enforcing standards.

F. Planning and Management

1. Mechanisms for public participation in water policy formulation.

2. Quantifiable forecasts of social, economic, legal and institutional effects of water policies and projects, including effects of pricing, subsidies, and regulatory restrictions on water demands.

Research on other topics in the state priorities listed in Section 5 may be conducted through MWRRC projects as cooperative efforts with other state and federal agencies. Specific topics in which the MWRRC may cooperate include formulation of the State Water Plan; design, development, and implementation of a water resources data base and network; and assessment of quantity and quality in groundwater systems. The MWRRC is available and prepared to cooperate with any agency, user, or entity in conducting research in any area giving results which may be integrated into overall planning and management of Montana water resources.

The importance to the State of Montana of all research on topics listed in Section 5 and those reiterated for MWRRC priorities emphasis in this section was indicated in Section 5 and justifies conducting such research as possible within the available funding during the next five years. The order in which the research is emphasized will be guided by the needs and priorities of the agencies interested in the results.

INTERINSTITUTE COOPERATION

The Montana Water Resources Research Center is currently cooperating with other water research institutes through consortia of institute directors of the states in the Missouri and Pacific Northwest River Basins and through the National Association of Water Institute Directors (NAWID).

In addition to assisting in developing the regional 5-year water resources research plans of these two regions, other specific cooperative efforts include:

A. Missouri River Basin States

1. Representative on advisory council to team conducting "An Evaluation of Legal and Institutional Arrangements Associated with Groundwater Allocation in the Missouri River Basin States."

2. Participation in planning a technology transfer conference, "Allocation of a Finite Resource--Water, in an Interdependent System," to be jointly sponsored by Institutes in Missouri Basin States.

B. Pacific Northwest River Basin States

1. Director serves a member of the Research Assessment and Coordination Committee with Institute Directors from Idaho, Oregon and Washington providing local management to OWRT-sponsored research projects to be selected and conducted on water-related aftereffects of the St. Helens eruption.

2. Participation in joint preparation of group of proposals submitted by investigators from Idaho, Washington, and Montana Institutes on effects of ash fall from St. Helens eruption on a series of lakes traversing the fallout plume.

As the activities of the Water Resources Research Institutes become more coordinated on a regional basis, additional cooperative efforts may be expected on specific studies and projects.

United States Department of the Interior
WATER AND POWER RESOURCES SERVICE
~~BUREAU OF RECLAMATION~~
Upper Missouri Region
P.O. Box 2553
Billings, Montana 59103

IN REPLY
REFER TO: UM-720
214.

MAR 20 1981

Mr. William Hunt, Director
Water Resources Research Center
Montana State University
Bozeman, MT 59717

Dear Mr. Hunt:

Based on your recent telephone conversation with our Regional Research Coordinator, John Lawson, we understand that the Montana Water Resources Research Center may not receive federally assisted funding for fiscal year 1982.

We hope, should this be the case, that the Center can possibly obtain funding from another source as the Center has provided a very necessary service in the area of water resources.

Through the use of the Center's Advisory Council, organizations and agencies such as ours who work with water resources in the State have had the opportunity to provide input and identify water research needs.

Not only has the Center provided useful research in the area of water resources, but has been a useful mechanism for organizations and agencies to form a stronger liaison and closer cooperation in working with water resource problems in the State and Region.

We support the Water Resources Research Center's objectives and encourage your efforts in maintaining the Center for the future.

Sincerely yours,

(Sgd) Joseph L. Miller

Acting Regional Director

United States Department of the Interior
WATER AND POWER RESOURCES SERVICE
~~BUREAU OF RECLAMATION~~
Upper Missouri Region
P.O. Box 2553
Billings, Montana 59103

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We support the Water Resources Research Center's objectives and encourage your efforts in maintaining the Center for the future.

Sincerely yours,

(Sgd) Joseph L. Miller

Acting
Regional Director

United States Department of Agriculture
Soil Conservation Service
P. O. Box 970
Bozeman, MT 59715

March 20, 1981

Dr. William A. Hunt, Interim Director
Montana University Joint
Water Resources Research Center
Montana State University
Bozeman, MT 59717

Dear Dr. Hunt:

The Soil Conservation Service has actively supported the Montana Water Resources Research Center's Program. Wallace Jolly, Assistant State Conservationist, is a member of the Advisory Council and represents our agency's interest in water resources research.

Our participation has included presenting research needs, working with investigators on proposals, and making recommendations on proposal acceptance to the council.

It is our understanding you have received word from the federal office of Water Research and Technology that they will no longer provide funding for this program after fiscal year 1981. In addition, nonfederal sources of funding the Water Resources Research program is presently being pursued. We believe future research is needed to help find solutions to the most critical state, regional, and national water problems.

During the past two years the development of the five-year resources research and development plan for Montana has been completed. We believe this plan gives guidance and emphasis on water resources research needs for the state.

We are hopeful that future water resources research can be continued.

Sincerely,

Van K Haderlie
State Conservationist

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
Federal Building, Room 428
301 South Park Avenue, Drawer 10076
Helena, Montana 59626

March 20, 1981

Dr. William A. Hunt
Director
Water Resources Research Center
Bozeman, MT 59717

Dear Bill:

I would like to express my appreciation and that of the U.S. Geological Survey for the assistance we have received in recent years through the Water Resources Research Center in Montana. The research projects have made a significant contribution in solving some of the many water problems that are faced not only by State government, but also by Federal agencies. Research projects such as the saline seep, coal hydrology, and lake eutrophication investigations have been especially beneficial to our organization.

We hope that the Water Resources Research Center will be able to continue to assist in solving these problems which affect not only government, but all the citizens of Montana.

Sincerely,

George M. Pike
District Chief

EXHIBIT 3

TESTIMONY OF JAMES W. FLYNN, DIRECTOR

DEPARTMENT OF FISH, WILDLIFE & PARKS

March 24, 1981

In House Appropriations Committee
on HB 616

Mr. Chairman, members of the committee, my name is Jim Flynn. I appear today on behalf of the Department of Fish, Wildlife & Parks in support of HB 616.

In Montana, as in most other western states, the wise use and allocation of our surface and ground waters is one of the most important decisions facing us today. Decisions made concerning water use now will not only affect our generation, but future generations of Montanans as well.

A substantial, sound data base concerning all aspects of our water resources is necessary to make wise and meaningful decisions as well as to solve many of the existing water problems we face today. The Montana University Joint Water Resources Research Center has been instrumental in sponsoring research projects and funding worthwhile studies to develop such a data base. My department has served on the advisory council to the Water Resources Center for many years, and can attest to the quality of work administered by the center and the relevancy of the research results. Every effort is made by the center to identify real problem areas and tailor research projects to address those problems.

The need for water related data has not diminished. If anything, that need will increase in the future as competition increases for the use of Montana's limited water resources. The Water Resources Research Center provides a useful function by providing needed data for the wise use and allocation of our waters. That function must be continued. We urge this committee to support HB 616.

EXHIBIT 6

March 23, 1981

COMMITTEE CHAIRMAN AND COMMITTEE MEMBERS

1-13-616

You have received testimony on what the Water Resources Research Center does---how it accomplishes it's goals, and what the 5 year plan for water resources research contemplates.

Present legislation to identify and quantify existing rights to water is well underway. The unspoken purpose of this legislation is to establish Montana's claims to water more firmly so that we can protect against down-stream states who would claim our water. After the process of establishing rights by declaration of rights is completed the procedures call for an adjudication process by water masters and water judges.

We are entering a period when competition for water within the state is being intensified to the point, that it will soon become apparent that water is in short supply to meet all of the demands in certain areas during periods of peak consumptive use. As competition for water becomes more keen among competeing uses within the state, the need to more accurately assess water availability, and the effects of use and misuse of scarce supplies in order to plan for optimization of water utility will be necessary. The Water Resources Research Center is needed to provide inventory data and provide baseline data on cause and effect as it relates to water quantity and quality allocated to the various competeing uses. Without this research and information supplied in scientific reports, it will be most difficult to complete the State Water Plan or to make rational decisions in the allocation of water resources. We urge you to continue the Montana University Water Resources Research Center with appropriate funding.

We should point out that our services on the Water Resources Research Center Advisory Board are uncompensated in any manner. Our interest is derived from a long career in the area of water resources planning and development.

Sincerely,

Bob B. Gemmell
Water Resources Research Center
Advisory Council

EXHIBIT 7

Montana Library Association

DATE: March 9, 1981

TO: Members of House Appropriations Committee

FROM: John Nichols, Chairman
Legislation Committee, Montana Library Association

RE: Legal Housekeeping Bills (SB 74, 88, 100) - Summary

Since two of the above bills have had some questions raised about them, and therefore I referred to the Appropriations Committee, we felt it would be appropriate to develop a brief factsheet about all three bills in an attempt to answer some of your questions. any of you have any further questions about any of these three bills, please feel free call me (at Lewis and Clark Library, 442-2377) or Alene Cooper (at the Montana State Library, 449-3004).

SB 74 - Repeals Section 22-1-411, MCA, which was originally enacted in 1939 and provide funding for joint county or regional libraries. Joint county or regional libraries ha never been established in Montana - library federations were developed instead, and fu provisions for Federations are specified in Section 22-1-402(c). In 1974 when changes made in the code relating to library federations, rather than repealing 22-1-411 as sh have been done, an attempt was made to update the section by substituting the words "library federation" for the words "joint county or regional library." This change ma the Section even more redundant and ambiguous and the Montana Library Association beli the only solution is to repeal this Section.

SB 100 - Changes Section 22-1-402(c) to reflect current funding practices for library federations by identifying sources of funds as either state (Coal Severance Tax revenu or contract fees from participating libraries. This bill also provides that all funds provided for federation services be maintained as a separate account which is current practice in federations.

SB-88 - Would amend Sections 22-1-412 and 22-1-413, MCA, and repeal Sections 22-1-414 through 22-1-416, MCA. These sections were originally developed to provide for a state aid program and funding formula for state funds for state aid to public librarie The fiscal note attached to this bill indicates no fiscal impact since there are currently no state funds appropriated for state aid to public libraries. The major problem with this formula is that when utilized it is highly inequitable. In 1977 and 1978, the State Library Commission attempted to utilize this formula for the distribution of federal grants (L.S.C.A.) and found that the distribution of funds provided woefully inadequate funds particularly to the federations in eastern Montana. The State Library Commission subsequently adopted a more equitable formula for distribution of federal L.S.C.A. grants at the request of the state's librarians. The definition of grant programs contained in these sections are also out of date. Establishment grants are now unnecessary since Coal Severance Tax funding permits all libraries in the state to be members of federations and receive federation services. At current levels of funding, there are insufficient funds for special project grants as defined in the statutes. The State Library Commission has been responsive to the changing needs and demands of library federations in their adoption of more equitable formulas for the distribution of federal L.S.C.A. Grants and Coal Severance Tax funds to the federations and the Montana Library Association believes that Senate Bill 88 should therefore be passed in order to permit the State Library Commission to continue to be as responsive at it has been in the past.

The Montana Library Association feels these bills would update the language of statute relating to library federations and reflect more accurately current practices in the administration and financing of federations in the state of Montana. We appreciate yo consideration of these bills and hope that if you have any questions concerning any of them that you will contact either of the above mentioned people.

EXHIBIT 8

BACKGROUND INFORMATION FOR THE SUPPORT OF SB 88

22-1-416 MCA. Formula for distribution of grants. This formula (population times area times % of local support) was used for the distribution of federal grants (LSCA) in 1977 and 1978. In 1978 $90,000 LSCA grant funds were distributed as follows:

Broad Valleys	-	$17,137.44	(19.0416%)
Golden Plains	-	1,475.37	(1.6393%)
Pathfinder	-	28,259.73	(31.3991%)
Sagebrush	-	6,355.53	(7.0617%)
South Central	-	14,981.04	(16.6456%)
Tamarack	-	21,790.62	(24.2118%)

Enclosed is a letter from Bob Cookingham citing reasons that the Commission should change this formula.

The State Library Commission does not think coal severance tax funds come under this section of the law, but if this formula had been applied to c.s.t. funds the distribution for FY 1980 would have been approximately as follows:

Distribution of $383,000

Broad Valleys	-	$128,896
Golden Plains	-	8,698
Pathfinder	-	70,906
Sagebrush	-	17,133
South Central	-	69,061
Tamarack	-	88,303

This distribution of funds would have provided too little money to both Golden Plains and Sagebrush to fund the basic services required.

22-1-414 MCA. Definition of Grant Programs. In this section of the statute establishment grants seem to be particularly out of date since all libraries are now participating in federations (Ronan and Darby are the only exceptions) for basic services and the costs of providing basic services are funded with c.s.t. funds.

STANDING COMMITTEE REPORT

MARCH 30 19 81

3-31

MR. SPEAKER:

We, your committee on HOUSE APPROPRIATIONS

having had under consideration SENATE Bill No. 74

A BILL FOR AN ACT ENTITLED: "AN ACT TO UPDATE THE PROVISIONS RELATING TO FUNDING OF LIBRARY FEDERATIONS TO REFLECT CURRENT PRACTICE; REPEALING SECTION 22-1-411, MCA."

Respectfully report as follows: That SENATE Bill No. 74

DO PASS BE CONCURRED IN

REP. ART LUND Chairman.

STATE PUB. CO.
Helena, Mont.

STANDING COMMITTEE REPORT

3-30

19 81

3-24

MR. SPEAKER:

We, your committee on HOUSE APPROPRIATIONS

having had under consideration SENATE Bill No. 88

A BILL FOR AN ACT ENTITLED: "AN ACT TO CLARIFY THE ROLE OF THE STATE LIBRARY COMMISSION; TO REVISE THE FUNDING PROGRAM FOR LIBRARIES; AMENDING SECTIONS 22-1-412 AND 22-1-413, MCA; REPEALING SECTIONS 22-1-414 TEROUGH 22-1-416, MCA."

Respectfully report as follows: That SENATE Bill No. 88

XXXXXX BE CONCURRED IN

Art Lund, Chairman.

STATE PUB. CO.
Helena, Mont.

STANDING COMMITTEE REPORT

MARCH 31 19 81

3-24

MR. SPEAKER:

We, your committee on HOUSE APPROPRIATIONS

having had under consideration SENATE Bill No. 109

A BILL FOR AN ACT ENTITLED: "AN ACT TO UPDATE LIBRARY FUNDING PROVISIONS TO REFLECT CURRENT PRACTICE; AMENDING SECTION 22-1-402, MCA."

Respectfully report as follows: That SENATE Bill No. 109

DO PASS BE CONCURRED IN

REP. ART LUND Chairman.

STATE PUB. CO.
Helena, Mont.

STANDING COMMITTEE REPORT

MARCH 24 19 81

MR. SPEAKER:

We, your committee on HOUSE APPROPRIATIONS

having had under consideration HOUSE Bill No. 560

A BILL FOR AN ACT ENTITLED: "AN ACT TO APPROPRIATE MONEY TO THE STATE BOARD OF EXAMINERS TO SATISFY VARIOUS COURT JUDGMENTS OR CLAIMS AGAINST THE STATE: ANDPPROVIDING AN IMMEDIATE EFFECTIVE DATE."

Respectfully report as follows: That HOUSE Bill No. 560

1. Page 1, line 20
Following Line 19
Strike: $242,404.36
Insert: $242,809.18

DO PASS AS AMENDED
DO PASS

Rep. Art Lund, Chairman.

STATE PUB. CO.
Helena, Mont.

STANDING COMMITTEE REPORT

MARCH 24 19 81

3-16

MR. SPEAKER:

We, your committee on HOUSE APPROPRIATIONS

having had under consideration HOUSE Bill No. 655

A BILL FOR AN ACT ENTITLED: "AN ACT TO INCREASE THE REIMBURSEMENT RATE FOR SCHOOL BUS AND INDIVIDUAL AND ISOLATED TRANSPORTATION COSTS; AMENDING SECTIONS 20-10-141 AND 20-10-142, MCA."

Respectfully report as follows: That HOUSE Bill No. 655

1. Page 2, line 4
   Following: line 3
   Strike: 70 cents and 85 cents,respectively
   Insert: 60 cents and 65 cents,respectively

2. Page 2, line 11
   Following: line 12
   Strike: 70 cents and 85 cents,respectively
   Insert: 60 cents and 65 cents,respectively

DO PASS AS AMENDED

DO PASS

Art Lund, Chairman.

STATE PUB. CO.
Helena, Mont.