University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Water Current Newsletter | Water Center, The

10-1-1972

Water Resources News, Volume 4, No. 8, October 1972

Follow this and additional works at: http://digitalcommons.unl.edu/water_currentnews

Part of the Water Resource Management Commons

"Water Resources News, Volume 4, No. 8, October 1972" (1972). *Water Current Newsletter.* Paper 68.
http://digitalcommons.unl.edu/water_currentnews/68

This Article is brought to you for free and open access by the Water Center, The at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Water Current Newsletter by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

WATER RESOURCES NEWS

NEBRASKA WATER RESOURCES RESEARCH INSTITUTE
212 AGRICULTURAL ENGINEERING BUILDING

THE UNIVERSITY OF NEBRASKA
LINCOLN, NEBRASKA 68503

Volume 4 Number 8 October Issue 1972

UPDATED VERSION OF PROPOSAL REGULATIONS NOW AVAILABLE

The Water Resources Research Institute has recently completed an updated version of "General Guidelines and Regulations of the Nebraska Water Resources Research Institute," September 1972.

These revised regulations contain new federal requirements for allotment and matching grant proposals. They also contain the format for research proposals and project reports.

Please discard previous editions of the regulations. New copies may be obtained by contacting the Nebraska Water Resources Research Institute, 472-3307.

EPA ISSUES NEW APPLICATION FORM FOR SUBMISSION OF GRANT PROPOSALS

The Environmental Protection Agency (EPA) has issued a new form for grant applications, EPA Form 5700-12 (4-72). This form is to be used when applying for any EPA project grant program, e.g., research, development, demonstration, or training. Applicants were previously permitted to use the old Public Health Service forms but effective July 1972, all new proposals for project grants should be submitted on the current EPA forms.

Application kits may be obtained from:

Grants Administration Division
Grants Information Branch
Environmental Protection Agency
Washington, D. C. 20460

EPA State and local assistance application kits are available at EPA Regional Offices. Additional information is available from the Nebraska Water Resources Research Institute, 472-3307.

RECLAMATION AND REUSE OF SOLIDS AND WATER

A seminar entitled "Conservation, Reclamation and Reuse of Solids and Water by Food Industries" will be given Tuesday, November 14, 1972 at 2 p.m. in Room 101, Biochemistry and Nutrition Building, University of Nebraska - Lincoln, East Campus.

Dr. R. A. Gallop of the University of Manitoba, Department of Food Science will be the guest lecturer. He will also be available on November 13th and 14th to talk with specific groups interested in pollution research.

Interested persons may contact:

Dr. G. W. Froning
Department of Poultry Science
472-2052

or

Dr. L. D. Satterlee
Department of Food Science and Technology
472-2831

FALL MEETING OF NEBRASKA SECTION OF AWRA

The annual fall conference of the Nebraska Section of the American Water Resources Association will be held Tuesday, November 28, at the Holiday Inn in Kearney. A business meeting will begin at 7:30 a.m. with the program scheduled for 8:45 a.m.

An interesting program on effects of irrigation on Nebraska resources has been developed. Papers to be presented include:

"N - Accumulation in the Soils and Water of Nebraska"
R. A. Olson, Department of Agronomy

"Soil Profile Chemical Changes Resulting from Irrigation"
R. A. Wiese, Department of Agronomy

"Waste Disposal Practice Effects on Groundwater"
W. F. Rapp, Jr., State Department of Health

For further information, contact: Deane Manbeck, Associate Professor of Agriculture Engineering, University of Nebraska, East Campus, 472-2824.

TECHNOLOGY TRANSFER CONFERENCE

"Technology Transfer in Water Research - The Interface Between Producers and Users" was the theme of a conference sponsored by the Nebraska Water Resources Research Institute. The two-day conference was held September 25-26, 1972 at the Nebraska Center for Continuing Education.

The objective of the conference was to produce a meaningful set of guidelines for the design of user-oriented research programs. The topics discussed were development of effective user-oriented research programs, how to get practitioners and academicians to talk to one another, how to design research with the user's point of view built in, mechanisms for effective transfer of research findings, and mutual internship programs.

One hundred people attended the conference, including research administrators, representatives from state and federal agencies, research institute directors and representatives of private consulting firms. The program consisted of speakers, panels and workshops.

Proceedings of the conference are being prepared and should be available for distribution before the end of November. A special section will be devoted to conference highlights which will single out the most innovative and useful findings. Proceedings will be sent to all participants. Anyone interested in obtaining a copy should contact the Water Resources Research Institute, 212 Ag. Engr. Building, University of Nebraska - Lincoln, East Campus, 472-3307.

OWRR DIRECTOR RESIGNS

Dr. H. Garland Hershey resigned as Director of the Office of Water Resources Research (OWRR) in the Department of the Interior. The resignation was effective as of October 25, 1972.

Dr. Hershey was the second man to direct OWRR since 1964. His resignation was submitted for personal reasons, primarily the illness of his wife. The Hersheys plan to return to Iowa City, Iowa where he was Iowa's state geologist for 22 years.

No successor to Dr. Hershey has been announced.

??? TO SEE OR NOT TO SEE ???

Envisioned in 1919 was a scenic river drive on both sides of the Missouri River between Blair and Bellevue. In fact, it is still "envisioned" in the minds of many Omahans today.

Two sections of the proposed riverfront drive of 1919 were built--one just north of the south Omaha bridge and another north of Read Street near the Metropolitan Utilities District water plant.

This drive was "envisioned" as part of a linkage of present city parks in the eastern part of the city--Mandan, Browns, Riverview, Levi Carter and Miller. Present parkway riverfront plans are more extensive than the 1919 version and would follow the hills and bluffs instead of cutting away from the river. It is planned to connect with major streets and highways and lead to all historic, recreational and natural areas in the riverfront project.

REQUESTED DELAY IN BIG BLUE PLAN

Governor Exon asked the State Natural Resources Commission to delay enforcement of flood plain zoning suggestions along the Big Blue River, pending the possibility of 1973 legislation.

The Governor wrote to the Commission after a meeting with Beatrice Mayor Robert Sargent and spokesmen for the Concerned Citizens Committee which was formed to oppose flood plain suggestions for the Big Blue. The city requested a study of flood zoning along the river after the passage of Nebraska's 1967 Flood Plain Act.

A formal hearing on the plan has been scheduled on November 9 at the State Capitol. The hearing will be conducted by the U.S. Army Corps of Engineers. If no protests are made, the plan will go into effect 20 days after the hearing.

MISSOURI RIVER WATERFRONT

Approximately 50 persons representing eight Nebraska, three Iowa and three Missouri communities met in October to explore possibilities for developing the Missouri River waterfront.

The organization will emphasize recreation and area history. It was expected that proper riverfront development would attract many tourists to the area. Dr. Daryl Long, President, Peru Chamber of Commerce, described the river as a valuable resource. A Lincoln planning consultant, Alan Eastman of Allied Planning and Management Services said the project would be complicated and long-range, but a great deal could be accomplished over a period of five to 15 years. He suggested the use of an existing agency such as River Country Council of Governments to hasten funding. Each community was asked to appoint a representative for local promotion of the project and to gather information on various local attractions.

MISSOURI RIVER BASIN COMMISSION NOTES

The Missouri River Basin Commission headed by John W. Neuberger, was established by Executive Order on March 22, 1972 and is one of seven established under the Water Resources Planning Act of 1965. The main objective of MRBC is to provide coordinated and comprehensive planning for the development of water and related land resources in the Missouri Basin.

Membership in the Commission is derived from ten states: Colorado, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, North Dakota, South Dakota and Wyoming. All major federal water agencies are also represented.

The MRBC will serve as the main organization for the coordination of federal, state, interstate, local and nongovernmental plans for the conservation and development of water and related land resources in the basin.

Among its many functions, the Commission will coordinate planning, construction of projects, and the collection and analysis of basic water resource data. The primary function of the Commission is to prepare a comprehensive coordinated joint plan (CCJP) for the river basin.

The MRBC is the largest land area covered by a River Basin Commission. It covers 1/7 of the nation. The Basin has 1,773 public water systems serving 6.3 million people, 107 major man-made reservoirs, 3.8 million surface acres of water and 732 miles of navigable waterways carrying 2.5 million tons of cargo each year.

Basin problems include: 897 water quality problem areas, 9 towns that now have water supply quantity problems and 463 towns that have inadequate drinking water quality, 121 urban flood damage centers (average annual flood damage exceeds $95 million and by 2020 will increase to over $390 million), 14.3 million acres in flood plain which need regulation with regard to flooding and environment, and 180 million acres which need land treatment and management by the year 2020.

MISSOURI RIVER MONEY HURDLE

Five million dollars has been authorized by the Senate-House conference for emergency bank stabilization on the Missouri River between Gavins Point Dam and Sioux City, Iowa.

The Missouri River program is part of the Omnibus Flood Control Act of 1972.

The conference committee accepted the plan which was introduced by Representative Charles Thone. They rejected a Senate bill authorizing less money.

RESEARCH REVIEW

TITLE: Recharge Simulation Model

PRINCIPAL INVESTIGATORS: D. M. Manbeck and T. L. Thompson

DATES: July 1, 1972 - June 30, 1975

The objective of this project is to develop a digital simulation model of groundwater recharge which can be used to guide planning for irrigation development.

As irrigation agriculture expands, increasing demands are placed on the state's groundwater reservoirs and practical methods are needed to predict the behavior of these systems. An important paramenter of this behavior is the recharge of groundwater from precipitation and/or artificial means.

One method of reducing declines in groundwater levels is artificial recharge of aquifers. However, not enough is known about the interrelationships of factors affecting water movement from the soil surface to the groundwater to accurately predict the success of artificial recharge schemes under all anticipated conditions. This project will evaluate the many variables and parameters affecting the movement of water from the soil surface to aquifers and produce a generally applicable digital simulation model of recharge to groundwater systems.

FISH TALE

In an Omaha World Herald article, Allan Tubach, World Herald Art Director, said he nearly gave up fishing after an incident which took place in Valentine, Nebraska at Snake River.

It happened last year when Allan pulled a rainbow trout from the river. "When the trout grabbed the hook, most of the other fish in the vicinity scattered," he said. "But there was one exception. Instead of swimming away with the others, this fish stayed with the one I had hooked. I decided this must be the wife, and she was concerned about what was happening to her mate.

The 'wife' stayed in the water near the back. I baited the hook again and threw it back into the river. The 'wife' immediately swallowed the hook. She almost threw herself on it like maybe this was a death wish." Tubach said he has fished to some extent since then, but without much enthusiasm.

WATER POLLUTION VETO OVERTURNED

On October 17, the Senate and House overrode President Nixon's veto of a water pollution bill (S 2770) authorizing $24.6 billion over a three-year period. The President said the bill's purpose was outweighed by its "shocking" price tag. Senator Edmund S. Muskie (D-Maine) said the bill provides "plenty of flexibility" for controlling spending since the expenditures under it will be spread over a seven-year period. Under this bill, industries and municipalities are required to conform to clean water standards. The bill also provides aid for necessary waste treatment facilities and equipment.

OWRR PRIORITIES FOR FISCAL 1974

The Office of Water Resources Research (OWRR) has identified the following major subject areas for priority research support in the fiscal year 1974 program. Some examples of specific research topics within these major subject areas are presented to indicate the range of problems needing research. A given research proposal may deal with limited aspects of an identified problem, or it may deal with several of these problems. The problems are listed simply as examples of subjects to which research proposals may be related. In preparing the proposal, the principal subject or problem on which the proposed research is to focus should be identified by number and title as used herein. No significance should be attached to the order of appearance of the subject areas on the prioity list.

OWRR will consider funding subject areas of research not included on this priority list if the research proposal provides convincing reasons that the subject area of research is of high priority, and within the purview of Title II of the Water Resources Research Act of 1964, as amended.

Because certain important and urgent water resource problems require research involving a number of technical disciplines in the physical, life, or social sciences, law or public administration, significant progress toward their solution may require relatively high level of effort. For that reason, OWRR is prepared, as appropriate, to consider a limited number of proposals with corresponding funding levels as determined by sound research design and prudent management.

1. Analysis of Planning, Managerial, Financial, Operating and Regulatory Policies of Water Resources Institutions. The analysis of water rights doctrines, especially as they affect the process of decision-making, user attitudes and water management practices and policies, requires further study. In dealing with different states, many and sometimes confusing water-right systems are encountered.

Research on these rights is needed to produce a common water law that would be applicable to all states and/or would achieve some common base that could be applied to each state's system for purposes of general compatibility.

Research and perhaps case history studies are needed on the problems associated with multiple jurisdictions and conflicting objectives in metropolitan and regional water resources planning and management. Also, technological tools for planning water resource development on a regional or basin-wide basis may have advanced beyond our institutional capabilities for implementing the plans. While the many conflicts, discussions, and negotiations involved in finding acceptable plans are truly part of the democratic process, further understanding of the mechanisms of the process could serve to expedite the implementation phase, thus benefiting all parties concerned.

Research goals should be to provide a basis for establishment of improved mechanisms, including evaluation of alternative means of augmenting and conserving supply, for water resources planning, implementation of plans, uncertainties, and confusion among claimants to the resource. Research is needed to investigate the institutional and political restraints on shifting water from agricultural to municipal-industrial uses, and other uses of potential or actual greater priority. More research should be directed toward resolving the legal, social, and economic problems associated with the development of new sources of water supply (e.g., precipitation augmentation and waste-water reclamation programs), both from the standpoint of state governments and of interstate relationships. In addition, determinations ought to be made as to just what is the participation of the general public in water resources planning and development. Furthermore, does that portion of the public which is being heard from actually provide a true consensus of the Nation's population?

2. Water Resources Policy and Political Institutions. Understanding of policy and institutional problems is indispensable to sound water resources management by both the public and private sectors of the Nation. Research is needed on how institutional policy is measured and formulated and what policies and institutional arrangements are conducive to sound water management. Among the questions to which research could be directed are those involving current policies and institutions. The river basin as a water management unit needs further evaluation with respect to the compatibility of water resources management objectives and the needs of regional economic development. How institutional arrangements affect the role of the private sector in water resources development needs to be researched. A very large segment of water resources needs are fulfilled via the activities of the private sector. Comprehensive socio-economic analysis of the water system requires understanding of how the private sector responds to alternative water management institutions. How have federal policies and alternative state tax and regulatory policies affected

the private role in the several functional areas of water service? How have Federal and state grant programs influenced the use of private investment capital in the financing of local water development? What would be the most effective means to evaluate the changes taking place in our society toward interest in other than strictly economic and technological factors of water resources development, e.g., such important policy-related elements as quality of life, esthetics, and similar humanistic aspects?

3. Hydrologic Systems Analysis. The application of operations research tools such as mathematical modeling and simulation, optimization and design theory need to be assessed and further explored in relation to hydrologic events and to planning of surface and ground water resources development. Research of a hydrologic nature should be initially designed so that physical results obtained are in a form that is suitable for economic analysis. Research needs in the area of optimization include a better definition of benefit functions to portray the economic losses incurred during shortages in agricultural, municipal, and industrial water supplies. Rainfall-runoff models applicable to large watersheds and using both deterministic and stochastic approaches are needed. Correlation of mean annual or seasonal runoff with precipitation, evapotranspiration, physiographic and vegetal parameters would be useful in application to similar areas of sparse hydrologic data. Operations research and information theory techniques should be examined for potential application to inflow-outflow problems in hydrology, to flood routing, reservoir operation, data network design, automatic control and monitoring of water distribution systems, etc.

4. Urban and Metropolitan Water Resources Problems. Research is needed on urban hydrology and the effect of man's activities on water. Such research should include evaluation of the impact of urbanization on the frequency and magnitude of flood peaks, reduction of low flows, decrease in natural ground water accretion, impairment of water quality, erosion, etc., and development of methodology and technology to cope with such problems. Knowledge of the effects of urbanization on drainage, water quality, stream regimen, water yield and flooding are essential to intelligent development and utilization of metropolitan water resources. A study of public acceptance of alternative sources of municipal water supply should be encouraged. Research is needed to define and quantify social, esthetic, and recreational use of metropolitan water supply reservoirs, and preservation, protection, and beneficial uses of marshland, estuaries and other waters in close proximity to urban regions. Research is needed on the effects of urban encroachment on rural watersheds, the effects of changing land use patterns, the economic consequences of the conversion of irrigated land to urban uses and the conversion of irrigation water and water rights to municipal and industrial use. Innovative approaches to water-related recreation, attractive waterfront development, and open space in the urban environment are needed. Research is needed on methods to reduce the cost of providing water and sewerage service. The use of "withdrawals" as a measure of water demand can be misleading when the

demand can be misleading when the demand-supply balance in water management and planning becomes critical. A new, rigouous definition of "water requirements" (residential, industrial, commercial and public uses) is needed which will take into account the factors of usage, withdrawal, consumption, recycle, returns, and dilution, as well as new and future technologies having an impact on water usages. Considerations must also be given to the economic dimensions of water use practices.

Alternative procedures for determining municipal and industrial water prices need to be developed. The possibility of refinements in classifying consumers into different groups with differential price schedules should be undertaken. Determination of the demand for municipal water at different price and quality levels is needed. Research is required to identify the true benefit value to be used in evaluation of proposed developments and to determine the upper limits or the maximum amount that municipalities and/or industries are willing to pay for good quality water.

Studies on non-structural alternatives to urban flood-plain zoning are needed.

Intergovernmental and metropolitan organizational devices for supplying urban water should be analyzed, and the kinds of financing employed, institutional arrangements used, success or failure of meeting specified objectives should be studied. There are probably hundreds of arrangements nationally, running across and through all units and levels of government. Knowledge of how one unit of goverment compares with another in the adequacy and cost of services being provided could lead to improved urban water management practices.

Contemporary water resource plans are being formulated for river basins and states. How can these plans be maximally sensitive to urban water resource needs and vice versa, how can urban water resource plans best fit into river basin and state water resource plans?

5. Ecologic Aspects and Environmental Consideration of Water Resources Planning and Management. Improved means of identifying, assessing and predicting ecologic impacts of water development such as dam building, drainage, irrigation, dredging, filling, channelization, and weather modification are needed. Conjunctive ecological studies designed to minimize harmful effects and optimize the beneficial effects of these water developments on the environment are indicated.

For example, applied ecological research is needed to improve the management of lakes and of reservoirs and irrigation systems, including enhancement of fish and wildlife, esthetic and other environmental values; to devise improved methods for controlling aquatic plants, bacterial growth, and animals that plug or reduce waterflow in pipes; to determine the requirements of instream flow for fish

and wildlife and recreation and other purposes; to assess the impacts of herbicides and other pesticides on the ecosystem and develop guidelines or means of minimizing harmful side effects; to develop a better understanding of the relative importance of dispersed-source versus point-source pollution as related to environmental quality; and to evaluate environmental effects of phreatophyte control and suggest alternatives to their eradication.

Research should be directed toward defining physical-chemical-biological relationships between water quantity and quality with the ultimate objective of achieving unified hydrologic/ecologic water systems models relating quality parameters to flow characteristics. This would facilitate the successful integration of current ecological considerations into water resources development planning. Also, systematic interdisciplinary approaches should be developed to insure the integrated use of natural and social sciences and the environmental design arts in water management planning and decision-making.

In addition, studies are needed to suggest more effective organizational arrangements among regional civil jurisdictions to implement and finance solutions to environmental problems. These studies should identify appropriate incentive programs, cost-sharing and other financial arrangements to deal with water resource environmental problems. In-depth investigations are needed on the current status of legal authorities and institutional arrangements for maintaining a sound approach to water development from an ecological point of view while giving due consideration to economic and social needs. Ecologists, biologists, engineers and investigators from other disciplines can contribute to the integrated interdisciplinary assessment of water development projects on a post-audit or case history basis. They can aid in planning by development of improved prediction capabilities and by preparing guides for establishment of priorities and of ranking for the funding of water projects. Among those prediction capabilities most needed are methodologies for forecasting technological change in the long-term planning horizon relevant to water resources development, including the probable impact of foreseeable technological developments and allowing for risks inherently involved in technological forecasting.

6. Evaluation of Economic Importance of Various Uses of Water, Cost Allocation, Cost Sharing, Pricing and Repayment. Methodologies are needed for estimating future demands in time and place with full consideration given to the economic relationships between supply and demand as well as the impact of new technologies.

Study is needed of methods allocating costs among the various functions of multiple-purpose water resource projects. This is made difficult because market pricing techniques customarily do not reflect certain values which are recognized by the public. Research is needed to develop alternatives to market pricing for quantifying esthetic, recreation, fish and wildlife benefits, and water quality.

Beginning with the Federal Water Project Recreation Act, the concept of cost-sharing with private and non-federal public bodies in the development of multiple-purpose water resource projects has been a subject of much discussion. A specific research effort examining past practices in repayment of water resource development costs and identification of multiagency cost-sharing programs could make a real contribution toward a more viable and realistic national water resources policy.

Research is needed for improving the methods used in evaluating primary, secondary and externality benefits of water resources projects. Also, research is needed to identify costs and reimbursement possibilities associated with esthetic, amenity, recreation, and other benefits, to establish methods for determining attitudes and public preferences with respect to competing demands on the water resource, and the ability and willingness to pay for such benefits. Meaningful comparative studies are needed on cost of water importation versus water reuse.

The evaluation rate for public investment in water resource development has frequently been proposed to be the opportunity cost for in investment in the private sector. Research is needed to develop a method to estimate that cost by taking into account the weighted marginal rates of return for new investment in all elements of the private sector such as agriculture, savings, the stock market, and business, and thereby determining the private rate of return foregone when federal investment is made. A determination is needed of the true rate of return on private capital.

Research is needed on the adequate treatment of risk and uncertainty in the design of water resource systems. The question of risk involves the adequacy of forecasts as a means of reducing hydrologic risk. Research is needed to define functional relations between derived benefits and adequacy of forecasts for selected projects. This should involve a fundamental searching examination of the nature and significance of risk and uncertainty. The research should produce usable methodologies for incorporating such risk and uncertainty concepts into planning and design of water resource systems.

Analyses are needed to determine the effects of real costs of water supply and water quality upon production costs of industries, business and agricultural activities. These data could be used as a cross-check on existing allocation, cost-sharing and pricing procedures.

7. Analysis and Evaluation of Water Resources Projects. Benefit-cost analysis has been the principal tool for evaluation of public investment programs, including watershed and water resources programs. It has ranked projects and programs in terms of the objective of economic efficiency only. Research is needed to determine appropriate alternatives and multi-objectives which will insure that presently unquantified environmental amenities and values may be given appropriate considerations. Evaluation of methods to quantify values in terms of appropriate

objectives and assigning weights to these values is needed so that alternative objectives and/or combinations of objectives can be compared. This would include a diversity of objectives such as alleviation of poverty, improved distribution of income, environmental quality, and other social values.

Studies are needed to examine possible competition between objectives of water resource developments such as industrial and domestic demand for water versus agricultural use and/or recreational use. Research might be carried out, for example, to determine regional economic and social impacts of the various utilitarian, recreational, and/or amenity uses of water.

Post-audit studies of existing water resource projects for irrigation, water supply, flood control, and multiple purposes should be made with a view to identifying the full range of benefits, effects, and social values on the economy of the project area. The studies should be wide-ranging in analyzing planned and unplanned effects, as well as considering projects in the light of national economic efficiency benefits and alternative objectives such as environmental quality, regional and local economic development, and social well-being. Where benefits cannot be set forth in monetary terms, an attempt should be made to provide descriptive measures.

8. Ground-Water Supply, Management, and Protection. Research is needed on management methods and techniques to protect the ground-water resource from degradation and overdraft; also to insure its availability and safety for domestic, municipal, industrial, and agricultural purposes. In many areas over the nation, productive aquifers find limited use because the quality of the native ground water is unacceptable or the water has become contaminated. Many constituents or properties imparting objectionable tastes, odors, or esthetic traits exceed allowable limits.

Water management agencies are becoming more and more informed and interested in artificial ground-water recharge as a means of conserving surface runoff for future use. Artificial recharge by water spreading is now practiced in many areas, particularly California, by delaying runoff over permeable alluvial fans, thus permitting more time for the water to infiltrate. Better techniques should be researched as to feasibility of water spreading and well injection in various surficial earth materials and aquifers. Similarly, recharge pits may be used to harvest storm and other high water runoff for replenishment of ground-water reservoirs. Research is particularly applicable in regions where the surficial materials are of low permeability. Research is needed also on the geochemical effects of artificial ground-water recharge. For example, chemical reactions or bacterial activity that might reduce the aquifer permeability or plug the injection wells.

In many areas throughout the United States, storage of certain peak streamflows might be accomplished by recharge into saline or brackish aquifers. Some of the problems in this procedure include the degree of mixing that will result between the fresh recharge water and the salty water of the aquifer, and the possibility of reducing the permeability of the aquifer by chemical precipitates or bacterial activity, and plugging of the injection wells. Municipalities faced with conjunctive use of surface and ground waters would permit adequate planning of the recharge-withdrawal operations.

One of the most difficult problems in analyzing and modeling the ground-water flow in regional aquifer systems is to define the permeability distribution in the aquifers and in interbedded strata of low permeability. Generally this has to be done with relatively few data points. Research is needed on the principles relating permeability distribution and regional flow patterns; techniques for utilizing geologic, geophysical, and geochemical data for predicting the permeability distribution; and new techniques for analyzing the flow of ground water and contaminants in the aquifer system.

Regarding the degradation of ground-water quality by contaminants, basic research is needed on the geochemistry--reactions among water, soil and rock materials, and contaminants in the aquifer system.

A serious deficiency of aquifer system models is the inability to portray accurately fluid movement in the unsaturated zone, losses from the system by evapotranspiration, and accretions by infiltration or recharge. This aspect of fluid movement also has an important influence on surface runoff. Research is needed on the physics of fluid movement in unsaturated granular media.

9. Protection and Rehabilitation of Estuarine Resources. Research is needed to develop criteria, standards and guidelines for including ecological effects in planning for water resource development of estuaries and coastal bays, such as: dredging, filling, dams, diversions, land-cut canals, hurricane barriers, and waterfront finger-type developments. These studies should attempt among other things to assess the biological effects of these developments by changing temperature, salinity, flow regimes, circulation, flushing and sedimentation, and destruction of vegetation.

Studies designed to develop information or techniques useful to planners are indicated, also, in the areas of socio-economics, political science, institutional arrangements and law. Assessment of human factors, constraints, and public attitudes regarding optimum use of estuarine areas is needed to integrate with technical physico-chemical and biologic information.

10. Thermal Loading Problems. With the expected increase in number of electric generating plants and the consequent thermal loading of rivers, lakes, and estuaries, increased research attention is needed in physical mixing and thermodynamics of the heated discharges; in development of economically competitive alternatives to use of once-through water as a heat-transfer medium; on biologic, ecologic, environmental and sociologic impacts, on types and quantities of data required to properly evaluate facility sites and to choose among alternative sites; on adequacy of regulations and procedures for site selections with respect to water use and management; and on possible ways of beneficially utilizing the heat for food production, recreation, or other purposes.

11. Water Demand Considerations. In regions where water supply is unable to keep up with the demand, the value of water for specific purposes will increase. Further research is needed on the effect of price on demand with specific attention to the value of water for irrigated agriculture, recreation, industry, urban use and other purposes.

In addition to the economic factors controlling water demand it is clear that other factors will control demand in the future. It is contended that water should be viewed as a facilitative resource for economic development. In opposition to that view is the suggestion that water development projects be used as a mechanism for regulating growth and/or maintaining a status quo environment. Research should be directed toward evaluating the cost of future growth subsidization through water resources development as opposed to the economic consequences of failure to underwrite further economic development in water-short areas. The consequence of either course of action, identification of the benefits derived, the measurement of the benefits derived, the effects of such policy on GNP, the regional economy, quality of life, etc., needs to be determined if intelligent water resource policy is to be developed. Research is needed to determine appropriate alternative objectives and to develop methods to evaluate the benefits in relation to costs for the different objectives, such as, improved distribution of population, environmental quality, and other social values.

NEW PUBLICATIONS RECEIVED BY INSTITUTE - OCTOBER 1972

1. "Annual Report," Water Resources Research Center, University of Florida, 1972.

2. "Flow into a Stratified Reservoir" University of California, August 1972.

3. "Summary and Analysis of Public Response to the Proposed Principles and Standards for Planning Water and Related Land Resources and Draft Environmental Statement," U. S. Water Resources Council, July 1972.

4. "Lake Michigan: A Bibliography," U. S. Department of the Interior, Office of Water Resources Research, August 1972.

5. "Ground-Water Resources of Orange and Ulster Counties, New York," M. H. Frimpter, Geological Survey Water-Supply Paper, 1972.

6. "Biennial Report Institute of Water Resources," University of Alaska, 1972.

7. "Factors Affecting Water Management on the North Slope of Alaska," J. K. Greenwood, R. S. Murphy, University of Alaska, March 1972.

8. "The Biodegradation of Organic Substrates Under Arctic and Subarctic Conditions," A. P. Murray, R. S. Murphy, University of Alaska, March 1972.

9. "Technical Personnel Access Directory," Office of Research and Monitoring for EPA, March 10, 1972.

10. "Winter Survival of Fecal Indicator Bacteria in a Subarctic Alaskan River," Office of Research and Monitoring for EPA, August 1972.

11. "Shallow Seismic Refraction Mapping of Eocene Water Tables, Northern Mississippi," F. E. Followill, Water Resources Research Institute, State College Mississippi, July 1971.

12. "An appraisal of Plans to Meet the Fresh Water Requirements of the Mississippi," D. C. Williams, Jr., C. P. Cartee, M. H. Malchow, University of Southern Mississippi, July 1972.

13. "Annual Report: West Virginia," Fiscal Year 1972, Water Research Institute.

14. "Workbook of Thermal Plume Prediction Volume I Submerged Discharge," M. A. Shirazi, L. R. Davis, Pacific Northwest Water Labortory, August 1972.

15. "Groundwater and Well Hydraulics: An Annotated Bibliography," Report 121, P.S. Huyakorn, C.R. Dugeion, Water Research Laboratory, University of New South Wales, February 1972.

16. "Studies of Air Engrainment in Steep Open Channels," Report 122, K. K. Lai, Water Research Laboratory, University of New South Wales, July 1971.

17. "Optimization of Water Resources Development: Optimization of Capacity Specifications for Components of Regional, Complex Integrated, Multi-purpose Water Resources System," Wm. W-G Yeh, Wm. J. Trott, University of California, June 1972.

18. "An Introduction to Finite Difference Methods as Applied to Groundwater Problems," P.W. Huntoon, University of Nebraska, 1972.

19. "Water Pricing Policies as a Tool Allocating Municipal Water Supplies," D. F. Mazour, University of Nebraska.

20. "Forest Fertilizer: A State-of-the-Art Review and Description of Environmental Effects," Wm. A. Groman, Pacific Northwest Water Laboratory, August 1972.

21. "A Framework Plan for the Missouri River Basin," 1972.

22. "California State Water Project: Annual Report 1971," Dept. of Water Resources.

23. "Water for California: The California Water Plan, Outlook in 1970," Bulletin No. 160-70, Summary Report, Department of Water Resources, December 1970.

24. "North Dakota: Annual Report for 1972," North Dakota Water Resources Research Institute, University of North Dakota, Grand Forks.

25. "Water Resources Development in the Mullica River Basin: Part I, Biological Evaluation of Mullica River-Great Bay Estuary," J.B.Durand, R. J. Nadeau, Rutgers University, July 1972.

26. "Annual Report: New Jersey for Fiscal Year 1972," August 1972.

27. "Annual Report: Missouri for fiscal year 1972," Water Resources Research Center, July 1972.

28. "A Comparative Study of State Water Pollution Control Laws and Programs," M. S. Heath, Jr., North Carolina State University at Raleigh, January 1972.

29. "Coastscripts," A miscellaneous pamphlet containing various articles, Texas A&M University, August 1972.

30. "Texas Annual Report," Texas Water Resources Institite, Texas A&M University, July 1972.

31. "Annual Report: Connecticut," Fiscal year 1972, Water Resources Institute, University of Connecticut, July 1972.

32. "Selected Water Resources Abstracts," U. S. Department of the Interior, Office of Resources Research, Vol. 5, No. 15, August 1, 1972.

33. "Water for a Rapidly Growing Urban Community," Geological Survey Water-Supply Paper, F. R. Twenter, R. L. Knutilla, 1972.

34. "Ecological Impact of Surface Water Impoundments in the Great Plains Area," Dr. C. M. Cowan, University of Nebraska, August 1972.

35. "Snow Studies Using Thermal Infrared Measurements from Earth Satellites," J. C. Barnes, C. J. Bowley, Final Report, July 1972.

36. The Mechanism of Waste Treatment at Low Temperature: Part A Microbiology," S. M. Morrison, G. C. Newton, G. D. Boone, K.L. Martin, Colorado State University, August 1972.

37. "The Mechanism of Waste Treatment at Low Temperature: Part B Sanitary Engineering," J. C. Ward, J. S. Hunter, R. P. Johansen, Colorado State University, August 1972.

38. "Bacterial Movement Through Fractured Bedrock," S. M. Morrison, M. J. Allen, Colorado State University, July 1972.

39. "Water Supply and Waste Disposal Series," (Vol. 6 - Oxidation Ditch Sewage Waste Treatment Process) Staff Report, April 1972, U. S. Department of Transportation, Dr. H. W. Parker.

40. "Oyster Reef Sedimentation, Biloxi Bay Area, Mississippi," C. M. Hoskin, Water Resources Research Institute, Mississippi State University, July 1972.

41. "Eighth Annual Report Water Resources Research Center Minnesota," August 1972.

42. "Public Attitudes Toward Reuse of Reclaimed Water," W. M. Bruvold, School of Public Health; Berkeley, University of California, August 1972.

43. "Development and Management of Ground Water and Related Environmental Factors in Arid Alluvial and Carbonate Basins in Southern Nevada," R. L. Bateman, A. L. Mindling, R. L. Naff, H. M. Joung, University of Nevada System, January 1972.

44. "Books, Publications, Project Completion Reports, M. S. and Ph. D. Theses," Iowa State Water Resources Research Institute, June 1972.

45. "Community Productivity and Energy Flow in an Enriched Warm-Water Stream," R. L. Vannote, R. C. Ball, Michigan State University, Technical Report #27, September 1972.

46. "Land Systems Inventory," W. A. Wertz, J. A. Arnold, U. S. Dept. of Agriculture, Ogden, Utah.

47. "Water Center Organization and Management," G. L. Anderson, J. C. Frey, S. O. Ikenberry, Pennsylvania State University, February 1972.

48. "Water Center Organization and Mangement," (Appendixes) G. L. Anderson, J. C. Frey, S. O. Ikenberry, Pennsylvania State University, February 1972.

49. "Feasibility Study of the Exploitation of Electromagnetic Surface Wave Propagation for Mineral Prospecting and Mapping the Water Table," Final Report, E. Bahar, University of Nebraska, September 1971 - August 31, 1972.

50. "Role of Phosphorus in Eutrophication," A. F. Bartsch, National Environmental Research Center, August 1972.

51. "Freshwater Planarians (Turbellaria) of North America," Roman Kenk, Smithsonian Institute for EPA, February 1972.

52. "The Genus Argulus (Crustacea: Branchiura) of the United States R. F. Cressey for the EPA, February 1972.

53. "Freshwater Sphaeriacean Clams (Mollusca: Pelecypoda) of North America," J. B. Burch, University of Michigan for EPA, March 1972.

54. "Freshwater Polychaetes (Annelida) of North America," Nancy Foster, Dunbarton College for EPA, March 1972.

55. "The Freshwater Amphipod Crustaceans (Gammaridae) of North America, John R. Holsinger, Old Dominion University for EPA, April 1972.

56. "Aquatic Dryopoid Beetles (Coloeoptera) of the United States," H. P. Borwn, University of Oklahoma for EPA, April 1972.

57. Freshwater Isopods (Asellidae) of North America," W. D. Williams, Monash University for EPA, May 1972.

58. "Freshwater Leeches (Annelida: Hirudinea) of North America," D. J. Klemm, University of Michigan for EPA, May 1972.

59, "Crayfishes (Astacidae) of North and Middle America," H. H. Hobbs, Jr., Smithsonian Institutute for EPA, May 1972.