July 26, 1972

TO: WHOM IT MAY CONCERN

FROM: David H. Howells, Director

SUBJECT: Institute Report No. 58—"Perception of Water Resources Research, Dissemination, and Utilization of Research Findings"—by Dr. James M. Stewart, Department of Adult and Community College Education, and David H. Howells, Director, WRRI, North Carolina State University

The Institute has been intensively examining its program over recent years from the standpoint of communication between researchers and user groups, the identification of research needs, and the utilization of research findings. This report covers a two-year study of these areas of concern and is serving to guide and strengthen the Institute's program.

The report will be of value to persons interested in information dissemination, research application, and differences in perception of research and its utilization between the university community and user groups.

DHH:va
PERCEPTION OF WATER RESOURCES RESEARCH,
DISSEMINATION, AND UTILIZATION OF RESEARCH FINDINGS

by

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and

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May 1972

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ABSTRACT

The need for utilization of water resources research to meet the complex pressures placed on this resource continues to grow. Communication of research information between research workers and those responsible for water resources development and its subsequent use is increasingly important.

In North Carolina the Water Resources Research Institute is a major center for water resources research. Primary emphasis of the Institute has been directed to research with increasing recognition of the need to examine the communication and use of research findings.

A theoretical base for this study was developed from a review of the communication and adoption processes as viewed from three major perspectives: (1) the research development and diffusion perspective, (2) the social interaction perspective, and (3) the problem-solving perspective. From these perspectives a synthesis of their important features are incorporated into a state model for communication of water resources research.

Data collected from questionnaires to 154 university researchers and 146 research users in North Carolina were used to examine the following communication problem areas: (1) Institute communication with research-user groups, (2) perception of the Institute by research-user groups, (3) perception of research-user group roles, (4) research-user group interaction, (5) research dissemination and utilization, and (6) public understanding and educational needs.

Recommendations are made for the implementation of a communication model for water resources research.
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SUMMARY AND CONCLUSIONS

The effectiveness of water resources programs is largely dependent upon the use of efficient means of communicating and implementing new water resources technology. A major focus of this study was to measure similarities and differences in perception of research and the communication of findings between university researchers and users. A conceptual framework presented the interrelationship and influence of communication and adoption processes, social systems, and linkage upon dissemination and utilization of research.

Three models were used to describe different perspectives of how concepts in each framework are applied and implemented. These models were identified as (1) the research, development, and diffusion perspective, (2) the social interaction perspective, and (3) the problem-solving perspective. They provide three distinct points of view toward dissemination and utilization. Together, they provide a comprehensive picture of ways in which research findings are communicated and used. Transfer of research is not considered as a filtering-down process but, rather, a complex procedure involving a matrix of interrelated factors which influence the movement and ultimate use of research.

Drawing upon the perspective and conceptual framework, a communication model for water resources research was developed and used to examine communication factors which relate to the transfer of water resources research in North Carolina. Areas were identified for study which were considered to be critical in the present communication system. This framework also revealed possible gaps and needed modification in existing or potential communication programs.
Based upon the response of 154 researchers from senior colleges and universities in North Carolina and 146 research users in state agencies, industry, and consulting engineering firms, the study examined the key factors which influence the communication and use of research. While the study focused on communication relating to researchers and users, attention was also devoted to respondents' perception of the Water Resources Research Institute, factors relating to interdisciplinary work, perception of the type of research which universities should conduct, and their satisfaction with the public education program in water resources. The results of the study provide a base for recommendations and development of a program which would supplement and enhance the processes of communication and use of water resources information.

The principal conclusions are:

1. There is an unexpected degree of similarity in perception of research and communication of research findings by university researchers and users.

2. Despite a relatively high level of contacts between the Institute and researchers and users, communication with the Institute is still considered to be less than adequate.

3. The Institute is viewed as a major source of water resources information by over half of the users.

4. The majority of Institute reports are considered to be of excellent quality, a useful and practical source of information, and applicable to current needs. Research users were more positive in this opinion than university researchers.
5. The Institute should concern itself with the dissemination and utilization of research findings as well as research.

6. There is considerable uncertainty as to whether a proper balance in water resources research has been attained and whether the Institute program is at the level it should be.

7. The Institute is expected to provide guidance to the state's water resources research programs. While the overall support for this statement was strongly positive, it received somewhat more support from researchers than users.

8. The Institute research program is relevant to North Carolina's water problems.

9. Present procedures for the review and selection of research proposals are considered to be satisfactory.

10. While there is a definite gradation of opinion as to what is appropriate for university research, there is a very broad area of applied research and investigation for university and agency collaborative effort.

11. Problem-oriented research is a proper function of the university.

12. Research relevant to contemporary problems is not less satisfying to university researchers than basic research.

13. The present academic incentive system does not encourage interdisciplinary research and education.

14. Research users, in contrast to university researchers, believe that private industry should handle most of its own problem-oriented research.

15. State agencies need research assistance from the university.

16. Communication between university researchers, state agencies, and other users is not satisfactory at the present time. Users, however, expressed more satisfaction with communication than did university researchers.
17. There is a great amount of uncertainty on the part of both university researchers and users concerning attitudes governing interaction.

18. In the face of implied uncertainty as to who should take the initiative to encourage further interaction between university researchers and users, it is clearly within the mandate of the Institute to do so.

19. Research users, in contrast to university researchers, do not believe that the present flow of information between the two groups is adequate to identify additional research needs.

20. There is need to improve the flow of research findings to users.

21. Impersonal sources of research findings, such as reports and technical journals, are far less effective for users than for university researchers.

22. Special meetings of researchers and users for the review and discussion of research findings are far more effective than the usual reports, journal articles, and technical conferences for the dissemination of research findings to users.

23. Existing technical publications, published reports, and mass media are not considered sufficient to transfer research findings into practice.

24. Present media for information dissemination probably have their greatest strength in creating awareness of research findings rather than adoption.

25. The public in North Carolina does not have a good understanding of water-related problems.

26. While research users are evenly divided on this question, university researchers do not believe that state and local leaders are sufficiently concerned with proper management of water resources.
27. Greater public participation is a highly desired feature for setting public policy in resource management.

28. There is need for a university-sponsored public education program relating to water resources.
RECOMMENDATIONS

Based on this study, the following recommendations are presented:

A. The Water Resources Research Institute should adopt the communication model for water resources research as its basic framework for programming.

B. The Institute should move vigorously to strengthen the linkage role between the researchers and users. This role will help bridge the gap between research and its application.

C. In assuming a major role in communication and utilization of research findings, the Institute will need to develop an expanded dissemination and utilization program, paralleling its research efforts. To develop and coordinate this, it is recommended that the Institute have an associate director with extension responsibilities. This associate director with the aid of both the advisory and technical committees should develop a comprehensive program directed toward communication and research use.

D. To provide the technical support and competence required in an expanded program, joint staffing arrangements should be considered in the areas of agricultural water use, municipal and industrial water supply, water pollution control, water resource planning, and water conservation.

The joint staffing would have several functions. First, it would bring together a broad range of knowledge representing many different disciplines, thereby creating an environment conducive to interdisciplinary problem solving. Second, it would provide a direct tie with academic units in the university where the long-term strength of the Institute lies. Third, it
would enable a high degree of coordination and collaboration on numerous research efforts of common interest.

E. To insure that proper consideration is given to research use, each Institute project proposal should include a plan for the needed dissemination and utilization effort. Necessary funds for this should be specified in the research proposal. Implementation of this phase of the project can be accomplished by the researchers themselves or by a specialist who might perform this function for several projects.

F. The Institute should utilize additional resources to expand the number of conferences and workshops with specialized audiences to promote the direct interaction between researchers and users and to: (1) encourage the transfer of new technology, (2) gain empathy with user problems in research utilization, and (3) identify additional research needs.

G. The Institute should continue the publication of the following:
   1. The monthly newsletter
   2. Project completion reports
   3. Annual report and annual research program brochure
   4. The annual report of Water Resources Research Interest in the Colleges and Universities of North Carolina
   5. The annual Inventory of Active Water Resources Research Projects in North Carolina

H. Institute researchers should develop comprehensive lists of the potential users for specific research projects and design specialized reports and other media for dissemination to these audiences.

I. The Institute should explore the feasibility of greater involvement of the Advisory Committee with additional users to further delineate research needs and priorities.
J. The Institute should utilize actual demonstrations and other innovative techniques that would involve joint efforts of both researchers and users to put research into practice. Demonstration techniques would be productive in four major ways to:

1. speed the process of dissemination and utilization of research,
2. provide large returns for resources used,
3. serve as a valuable source for identifying needed research, and
4. provide the setting for close involvement and mutual support by researchers and users.

K. The complexity of many water resource problems requires interdisciplinary research efforts. Such efforts necessitate more, rather than less, expertise. It is recommended that the university examine its policies and awards systems for features which would support and encourage researchers to accept responsibilities for interdisciplinary efforts.

L. With additional resources the Institute should explore the following methods to create research awareness:

- Personal contact
- Newsletter
- Published reports
- Personalized brochures
- Conferences, workshops, and seminars
- Audio-visual aids
- Library use
- Demonstrations
- Research review sessions
- Articles in newspapers, journals, and trade publications

Multiple approaches are needed to create the important first step of awareness. Innovative approaches and creativity in disseminating water resources research should be encouraged.

M. To expand its dissemination efficiency, a close liaison should be maintained with a number of associations and organizations who can communicate new information.
N. It is recommended that mailing lists be maintained and utilized for selected mailings to at least the following groups with water-related interests:

- Consultants
- State and federal agencies
- Industries
- University researchers
- Extension specialists and county extension chairmen
- District soil & water conservation personnel
- Private and public conservation groups in the state
- City and county managers
- Executive directors of county and regional planning
- Public works directors

O. The Institute should maintain a modest film library of current water resource films for use by university and user personnel. In addition, a readily available listing of other films, their quality and content should be provided by the Institute.

P. The Institute should help identify, plan and initiate in-service training sessions and short courses for a variety of water resources-related personnel. University extension should actively participate and support such programs. Resources from a number of relevant university departments will need to be coordinated for these training sessions and short courses.

Q. The Institute should encourage and support a university public education program on water resource planning and management.
Chapter 1

INTRODUCTION

Problem

The purpose of this study is to examine those factors which influence the determination of water resources research needs and influence the movement and utilization of research findings.

The accelerated pace of environmental deterioration accompanied by rapid changes in technology makes it difficult for state agencies and other practitioners to keep abreast of the latest research developments. There is a distinct realization that a high priority has been given to development of water resources research without the corresponding concern for its utilization. Water resources problems facing the nation are of such a magnitude that research must be accompanied by improved programs for dissemination and application of the new knowledge. The Water Resources Research Institute of the Consolidated University of North Carolina, a center for water resources research, is the focal point in this study.

Background

The concern for improvement of the environment and the quality and quantity of life has created great public pressure to halt the deterioration of the nation's water resources. This concern for a number of years has resulted in a major expansion of research efforts on water-related problems. The Institute, established in 1965 as a unit of the Consolidated University, works closely with public agencies and the private sector in the formulation of a research program. Research efforts are geared to respond to state water resources problems.

The Water Resources Research Act of 1964 states that:
"It shall be the duty of each...institute to plan and conduct and/or arrange for a component or components of the college or university with which it is affiliated to conduct component research, investigation, and experiments of either basic or practical nature, or both, in relation to water resources and to provide for the training of scientists through such research, investigations, and experiments...grants shall be made on the basis of merits of the project, the need for the knowledge which it is expected to produce when completed and the opportunity it provides for the training of water resources scientists. The institute...shall make generally available information and reports on the projects completed, in progress, or planned under the provisions of this Act..."

The Water Resources Act was intended to bring about an increase in the research activities throughout the nation, and the results were to be widely disseminated among potential users for application to specific water resource problems. Banks and Wolfe (p. IV) reported:

"There is no question but that the $35,000,000 of federal funds which have been expended or committed since the passage of the Water Resources Research Act have resulted in a dramatic increase in the amount of water resources research underway throughout the United States, and that the results, if fully used, would make significant contributions to effective planning, design, construction, and operation of water projects, and to the efficient control, management and utilization of the nation's water resources."

The volume of water resources research is large and growing. The WRSIC Selected Water Resource Abstracts, for example, contain between eight and ten thousand abstracts each year. "Unfortunately, there often is a communication gap between the research workers and those responsible for water resources development" (Office of Science and Technology, 1969). The need for utilization of research findings to meet the water resource demands of the state is mounting.

In North Carolina there is a multiplicity of state agencies and researchers with an interest in water resources. In its 1970 report to the legislature, the Office of Water and Air Resources, North Carolina Department of Natural and Economic Resources (formerly the North Carolina
Department of Water and Air Resources), lists some twenty-eight agencies and departments with water resources responsibilities.¹

F. E. McJunkin in "Water Resources in North Carolina: An Inventory of Information and Data," 1968, lists twenty-six state, six private and twenty-eight federal agencies with water and related land resource activities. The WRRI 1971-72 report, "Inventory of Water Resources Research Interests in the Colleges and Universities of North Carolina," lists nine colleges and universities and twenty public and private agencies with interests in water resources research. With this diversity, questions arise as to the need for centralized responsibility for the dissemination of research findings and the desirable level of communication between university researchers and user groups.

The Water Resources Research Institute has some direct linkage with university researchers, public agencies, and private groups. Major questions addressed in this study are: What is the extent and effectiveness of present contacts? What is the current flow of information from the Institute to potential users? Do both state agencies and university researchers perceive a need for a complete program for dissemination and utilization of new information? What role should the WRRI have in this regard? What are the major communication barriers to effective interrelationships between the information-generating and application systems in water resources?

Objectives

Based on the stated questions, the following major objectives are included in the study:

1. to review the present role of the WRRI in research utilization;
2. to review the concepts, models, and research relating to this field;
3. to determine the current patterns and effectiveness of the methods now being used to communicate information to potential users in North Carolina;
4. to determine specific communication barriers between university researchers and state agencies;
5. to determine differences in perception of the need for a complete dissemination and utilization program between the universities and state agencies;
6. to analyze the degree of interaction between university researchers, WRRI, and users;
7. to ascertain research and user group perception of the Institute's research and information program;
8. to determine how researchers and users perceive specific aspects of university research; and
9. to present operational recommendations for a research utilization system.
Chapter 2

CONCEPTUAL FRAMEWORK

The rapidly changing and increasingly complex nature of environmental needs in recent years has presented individuals in water resources with many problems. These problems have given rise to greater research without corresponding methods for transfer and use of these results. Central, then, is the need for administrators, specialists, and change agents in water resources to understand how research is disseminated and utilized.

A point of departure for the development of the conceptual framework is work drawn from the fields of sociology and psychology which relate to communication and adoption processes. Both processes use concepts which affect the dissemination and utilization of research information. To conceptualize the means through which research is transferred and utilized, the following processes and concepts are presented.

Communication Process

Research findings must be communicated from one person to another. Loomis (1960, p. 30) describes communication in organization as a "process by which information, decisions and directives are transmitted among actors and the way in which knowledge, opinions and attitudes are formed or modified by interaction." Fisher (1950, p. 103) pointed out that many people underestimate the importance of communication, its complexity, and its power. Communication is at the heart of all operations, and it encompasses all activities by which we influence others. Havelock (1960, pp. 11-29) stresses that "technological
advances in communication is one of the major forces in accelerating the rate of change in all aspects of living."

Communication makes interaction possible by providing some exchange of information and meanings. Because it is necessary and so essential to transferring knowledge and information, communication is a primary consideration in this study. If communication is to be effective, Bross (1953, pp. 147-148) indicates that information being communicated must be relevant, free from bias, repeatable and quantifiable. Berlo (1960, p. 12) emphasizes that "we communicate to influence--to affect with intent."

All models of the communication process include the five basic features--the sender, message, channel, treatment and receiver. Carpenter (1970, Figure 1) includes a number of related concepts in his communication model which are important in research dissemination and utilization.

The dissemination of information will occur through both the formal and informal channels of communication as new ideas are gained from the researcher and transferred ultimately to the users. This is a vital process and one requiring skills especially by the administrator and the change agents in the role of dissemination of the new ideas. Hicks (1967, pp. 305-306) says that people in any group communicate with a set of skills. The individual sending messages has attitudes that affect him in the way he communicates. An attitude exists when a person has some definite feeling toward himself, the other person or the subject matter being communicated. These attitudes are either positive or negative and seldom neutral. The change agent has knowledge of the communication process, the subject matter
Figure 1. Carpenter's Model of the Elements of Communication (Used by permission of Dr. Carpenter)
and knowledge of people. People communicate according to the influence of their environment and their sociocultural systems. Hicks further describes the person who is initiating the communication as one who "lives roles, occupies certain positions, commands certain status and prestige, performs certain functions and operates within certain relationships to his fellowmen."

Communication is not a one-way process. Information flowing from researchers to users is only part of a utilization cycle. To complete the cycle, feedback is needed. Communication of messages results in different responses by the receiver, and the knowledge of these responses is a form of feedback. Berlo (1960, p. 103) states it similarly when he says, "If a communication source decodes the message that he encodes, if the message is put back into the system, we have feedback."

Berlo (1960, p. 115) further indicates that feedback in the communication process is important since it provides the source with information concerning success in accomplishing his objective and is useful in analyzing effectiveness.

Griffith (1964, p. 173) expresses the fact that feedback is the input from the environment to the system to adjust and improve performance.

**Diffusion and Adoption Processes**

A key issue in this study is the spread of new research information or practices to and among potential users. Both the diffusion and adoption processes have major implications in conceptualizing how research becomes transferred and used.

Application of research knowledge is not achieved in a single step, but in a series of steps which may be reviewed as a process.
"It is clear that research alone is not enough to solve most problems; the research results must be diffused and adopted before their advantages can be realized." (Rogers, 1962, p. 3)

Research studies of many organizations reveal that effective means have been utilized in areas such as medicine, agriculture and education to obtain application by the practitioner.

Perhaps one of the finest examples of the development of knowledge and a planned system of full utilization occurs with agricultural extension service. Kelly (1969, pp. 38-39) echoes these sentiments with a statement about a full development and utilization program:

"A notable example of this is the land-grant university and the agricultural extension system. The land-grant colleges or universities were dedicated to doing applied research in the science of agriculture and the mechanic arts. These colleges and universities developed research programs in basic sciences as well as experimental stations for the development and refinement of knowledge-based technologies for use in engineering and agriculture. As the extension service developed, county agents were attached to the state land-grant college or university that received financial support from both state and federal governments. The county agent and his staff developed local organizations of adult farm men and women and of farm youth to provide both a channel toward informing consumers concerning new and better agricultural practices and toward getting awareness of unmet consumer needs and unsolved problems back to centers of knowledge and research."

It is important to realize the research which is being transferred often assumes the quality of an innovation. Innovations may be new ideas, products, and procedures. It may, for example, also involve new types of training of local leaders by the change agent which results in greater participation by the clientele in planning processes. This type of innovation may involve the introduction of new skills to leaders to develop group action, citizen participation in problem solving and decision making in water resources planning.
Everett Rogers (1969, p. 124) emphasizes that there are certain characteristics of a successful innovation. It must have relative advantages over previous methods and be compatible with present values, attitudes, and institutions. It must be simple enough for participants to make discrete decisions about it within their own frame of reference. The innovation must be capable of being implemented on an experimental or prototypical basis, and it must be discrete enough to be communicable and understood on its own merits.

The acceptance of a new innovation in the social system may be an individual or group decision. A decision to adopt a practice usually occurs through a sequence of events and influences operating through time. The adoption phenomenon of individuals is dependent upon a multitude of interrelated personal, social, and situational factors. An adoption of innovation relating to water resources often will require group decisions even though one individual may heavily influence the decision of the others. In water resources, before a state agency uses water resources research, some official has to accept the innovation and must have others in the organization participate in the decision to use the new process, idea or method.

The phenomenon is frequently termed diffusion. Rogers (1969, p. 12) indicates that there are at least four elements of diffusion: (1) there is an idea, innovation or concept, (2) the idea is communicated from one individual to another, (3) this activity occurs in a social system, and (4) it occurs over time.

Diffusion is basically the process in which new ideas, messages or innovations spread from person to person or system to system.
It is one thing for research information to spread, and it is quite another that it is actually used. There is a process by which the new information is actually perceived, internalized, and used by the clientele. Rogers (1969, p. 75) refers to this as the adoptive process involving five stages: (1) awareness, (2) interest, (3) evaluation, (4) trial, and (5) adoption. Figure 2 indicates the involvement of individuals at these various stages in the adoptive process.

During the awareness stage the clientele may hear about some new research finding but may not be motivated to take further action. Lionberger (1969, p. 43) indicates that mass media sources are useful in this early stage. The organization could utilize TV, newspapers, and publications in getting research information to large groups of potential users with the realization that this represents only an initial step.

It is in the next phase that individuals become interested enough in the new research innovation that they seek information about it. The person has heard something about the innovation and now is actively involved in obtaining more information.

It is in the next stage or evaluation stage that the individual decides whether or not to try the innovation, and during this stage close or intensive communication is important. A large number of researchers report the importance of personal sources of communication in this evaluation stage (Rogers, 1969, p. 99). It is through personal contact at this point that trust can be developed between the change agent and the research user, and greater amounts of information and ideas can be exchanged. During this time the change is more directly involved with the social system of the users.
Figure 2. Involvement of an Individual at Stages of the Adoption Process

A fourth stage which occurs in adoption process is the "trial stage," and it is here that the innovation is actually tried on a limited scale. A new monitoring system which has promise for statewide application may only be used on one river basin during this stage of adoption. The change agent must work extremely close and carefully during this stage so that the user can see the value of the innovation and not incur errors or problems of such magnitude that it would be rejected. Here, the decision is made to move ahead or reject the innovation. Many elements within the social system can have an effect on this decision. The innovation may be rejected as being too complicated, too costly, and undesirable often because of value judgments.

During the adoption stage, the users move from trial to full use of the innovation. Change agents would have to work closely with users to supply enough information to help with this transition and enough follow-through to, in fact, see that adoption and not rejection occurs.

Full dissemination and utilization of research also requires an understanding of social systems. An understanding of social systems is a vital part of the cognitive framework of change agents and the prospective users and necessary before effective communications of new research and innovations can occur.

"If we know what a society's culture is, including its particular system of values and attitudes, we can predict with a fairly high degree of probability whether the bulk of its members will welcome or resist a particular innovation." (Linton, 1952, p. 74)

The clientele or users of research information operate within a framework or social system, and professional change agents are also operating within their social system. University researchers,
professional water resources specialists and the users of research information all operate within separate frameworks or social systems.

<table>
<thead>
<tr>
<th>Researchers</th>
<th>Water Resources Specialist</th>
<th>Clientele or Research Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social System</td>
<td>Social System</td>
<td>Social System</td>
</tr>
</tbody>
</table>

Ultimately, linkage and integration of the social systems of the clientele or users and the social system of water resources research personnel becomes important. The degree of integration of the two systems is significant. Ryan (1969, p. 11) indicates that:

"The greater the integration of the system, the greater the possibilities are of maximum optimization of the system. The greater the optimization the more effective it will be."

Similarly, Havelock, et al (1969, pp. 11-21) use the term linkage which he states:

"simply signifies the degree of interpersonal or intergroup connection; the extent to which mutual communicative relations exist among two or more parties. The more linkages there are, the more effective will be the day-to-day contact and exchange of information; hence, the greater will be the mutual utilization of knowledge. Most importantly, the greater the number of overlapping linkages throughout the macrosystem of knowledge production and dissemination, the more frequent and the more effective will be the knowledge utilization by all."

The change agent in water resources will find it necessary to establish a functional relationship with the researchers as well as with the clientele. The degree of integration of the change agent and the researchers will be a measure of the effectiveness of each. Any technical report or research finding, regardless of how well written and prepared, has limited value without its ultimate application. Berlo (1960, p. 13) expresses the opinion that "too often writers think that their job is to write technical reports rather than to affect the
behavior of their reader." The change agent must become integrated into the clientele system for effective utilization to occur. The change agent plays an important role of linkage between researcher and research users.

Loomis (1960, pp. 4-5) says that a social system is composed of the patterned interaction of its members, and the structure of the social system may be described at any given point by analyzing a number of elements. These elements are: (1) belief (knowledge), (2) sentiment, (3) end, goal, or objective, (4) norm, (5) status role (position), (6) rank, (7) power, (8) sanction, and (9) facility. A knowledge of all of these elements and some skill in utilizing them becomes important to the ultimate effectiveness of the change agent. Some of the elements which are critical here and will be considered in some detail in this research are norms and role.

Norms of the social system become important to those who attempt to improve the process of transferring knowledge between systems. Norms are principles of right action binding upon members of a group or social system which guide or regulate proper or acceptable behavior. Loomis (1960, p. 16) states that norms are all the criteria for judging character or conduct of individuals and group action. He suggests that norms influence the range of goal choices and govern the selection and application of facilities to reach certain ends and goals. Rogers (1969, p. 56) defined norm as the most frequently occurring pattern of overt behavior for the members of a social system. He indicated that the social systems have norms which might be described on a continuum from the traditional which may discourage the adoption of new research to the modern which would actively seek out new innovation. Norms of
both the individual and the social system can be measured on a continuum from traditional to modern. Rogers (1969, p. 75) observes that "a social system with modern norms is more technologically developed, cosmopolite, literate, rational, and empathic."

Havelock, et al (1969, pp. 5-6), stress the importance of norms to dissemination and utilization:

"In order for innovation to be successfully presented to a group or to individuals who are closely anchored to a group, the norms and cohesiveness of the group must be known."

The transfer of research information must involve people who perform in certain roles. For example, any organization can be viewed as a social system which is made up of individuals who have multiple roles. Gross (1958, p. 6) states that role is a set of expectations or a set of evaluative standards applied to an incumbent of a particular position. The administrator, the researcher, and the user each have specific roles. Merton (1957, p. 116) indicates this when he declares that individuals have multiple roles and tend to organize their behavior in terms of the expectations assigned to each role.

The role of the change agent as perceived by the individual is one thing; how it is perceived by others in the social system may be quite different. The change agent is influenced by the university, officials, administrators, peers or co-workers, personnel in other agencies, and the clientele or users of water research information. Each of these groups will develop different concepts of the change agent's role. If these conflicting demands become too great, individuals may attempt to relieve the strain by deviation from institutionalized expectations (Bredemeier and Stephenson, 1962, p. 128). In a new and expanding
organization like the WRRI, roles may not be as clearly established and delineated. Under such conditions, some members of the organization may well experience role ambiguity as they try to adjust to the new roles. A change agent in a new job assignment, working with a diverse and often unclear clientele group, may easily find role ambiguity. An important consideration for the change agent is that he have a healthy understanding of his role and realistic expectations regarding change.

Utilization of Knowledge from Other Disciplines

A strong model for water resources research dissemination and utilization should be built only after a systematic study of the information available from many disciplines. Over one thousand studies relating to dissemination and utilization of information were reviewed in Havelock's (1969) work on the subject. The integration of this information and that from other areas and disciplines will be useful and meaningful in building a body of knowledge for this study. Guilliton (1962, p. 180) observes that space research and physical sciences are furnishing abundant evidence of the unity of knowledge. Achoff (1960, p. 6) emphasizes this when he states:

"We must stop acting as though nature were organized into disciplines in the same way that universities are. The division of labor along discipline lines is no longer an efficient one. In fact, it has become so inefficient that even some academic institutions have begun to acknowledge the fact."

The new program of dissemination and utilization for water resources research should reflect a synthesis of the best research findings and supporting theory.
FIGURE 3. The Research, Development and Diffusion Perspective

Major Points Stressed: Rational Process
Planning Necessary
Division of Labor
High investment pays off in quality, quantity, long term benefit, and capacity to reach mass audience.

Spokesmen: Henry M. Brickell, David Clark, Egon Guba
Prototypes: Industrial R&D, U.S. Agricultural Research and Extension System
Related Models

Havelock, et al. (1969, pp. 11-4-14) indicate several models used to describe dissemination and utilization or the transfer of knowledge. All of the models have as a basic starting point the communication act or movement of information from person to person or system to system. Three general categories are used by Havelock to classify the models: (1) the Research, Development, and Diffusion Perspective; (2) the Social Interaction Perspective; and (3) the Problem Solver Perspective.

Research, Development, and Diffusion Perspective

In many ways the Research, Development, and Diffusion Model, Figure 3, is a further elaboration of the basic communication act. Prototypes of this model are used in industry, defense, space and especially agriculture.

Havelock, et al. (1969, p. 11-5) elaborate on the Research, Development and Diffusion Model. First, there is the perspective of a rational sequence moving from research and development to packaging before dissemination occurs. Second, the model assumes the importance of large-scale planning which may involve logical events taking years to produce a particular message. Third is the recognition that there must be a division of labor and a separation of individual roles and functions. Fourth, the model assumes a clearly identified specific audience which will be receptive to innovation if it is delivered in the proper channels, in the correct way, and at the right time. Fifth, this model points to the fact that high initial development cost will result in even higher gain in long-run terms of efficiency, quality and capacity to reach the target audience.
Social Interaction Perspective

This model, Figure 4, is concerned with diffusion of innovations which are highly visible and specific; for example, new varieties of corn or a new drug. This model, according to Havelock, et al. (1969, p. 11-7), is based upon extensive empirical research, and it:

"assumes the existence of a diffusable 'innovation' as a precondition for any analysis of the diffusion process. The innovations which are chosen appear in a concrete 'diffusable' form, such as a type of fertilizer or a new prescription drug. The preference stems from the most outstanding characteristic of the social interaction perspective school, their thoroughly empirical research orientation: if the innovation is a stable element which we can easily identify as a constant, the task of measuring its flow through a social system over time is made considerably easier. This measurement of the flow is the primary concern of the social interaction theorists; they study the pattern of flow and the efforts of social structure and social relationships and groupings on the fate of innovations. Six major points can be derived from the theory and the considerable quantity of empirical research identified with this social interaction tradition. These are: (1) the importance of the social relations network, (2) the user's position in that network, (3) the significance of the informal personal relationships and contacts, (4) the importance of reference group identifications, (5) the essential irrelevance of size of the adopting unit, and (6) the differential significance of different types of influence strategies at different stages in the adoption process."

This model places emphasis on the importance of close interpersonal relationships necessary for innovations to diffuse within the social system. Merits of the innovations alone will not suffice; but rather, there is the need for complex social involvement and interaction. This model is concerned with the individual user's position in the social system and his probability of adopting an innovation. Figure 4 provides a view of the order in which certain individuals in the social system adopt innovations.

The Social Interaction Model reveals the importance of face-to-face interpersonal contacts and personal sources of communication to
Major Points Stressed: Personal Relationships
Group Memberships and Identities
Social Structure - Power and Influence Structures
Proximity, Cosmopolitanism
Opinion Leadership Structure

Spokesmen: Everett Rogers, James Coleman, Elihu Katz, Herbert Menzel, Richard Carlson, Paul Mort

Prototypes: Diffusion of innovations in farm practices, spread of new drugs among physicians.

Key: • Individuals in the social system.
     • Flow of new knowledge.
     • Formal organizational structures
adoption. Reference group identification is seen as important in diffusion of the innovation. Havelock, et al (1969, p. 11-9), indicate that "people tend to adopt and maintain attitudes and behaviors which they perceive as normative for their psychological reference group."

Rogers (1962, p. 102) stresses the importance of cosmopolitanism or degree to which the individuals in the system look to external sources of information as an important part of adoption. Cosmopolite information concerning innovations indicates these are coming from outside the system and are important for early adoption. Innovators, or the first to adopt, rely most heavily on these outside sources and have a cosmopolitan orientation which allows them to see relevance and value to innovations that others in the social system would not. Havelock, et al (1969, p. 11-9), perceive the importance of this by indicating that:

"A society which allows large numbers of individuals to maintain large numbers of diverse and overlapping reference group identification will be a very innovative society."

Problem Solver Perspective

The Problem-Solver Model, Figure 5, is built upon the assumption that knowledge utilization is a part of the problem-solving process of the user and his needs and need satisfaction. The process described in the model is a cyclic one which includes sensing and formulation of needs, identifying various resources, determining what knowledge can be used in the solution and attempts at solution of needs or need reduction. The cyclic effect assumes continuous efforts of problem solving (Havelock, et al, 1969, p. 11-11).

The problem-solver perspective has a relatively recent origin, but considerable energies are being given to it by such specialists as
FIGURE 5. The Problem-Solver Perspective

Major Points Stressed: The User's Need is the Paramount Consideration
Diagnosis is Part of the Process
The Outsider is a Catalyst Consultant or Collaborator but the User must find the Solution Himself or See it as His Own
Internal Resources should be fully Utilized
Self-initiated Change has the Firmest Motivational Basis and the Best Prospects for Long-Term Maintenance

Spokesmen: Goodwin Watson, Ronald Lippitt, Herbert Thelen, Matthew Miles, Charles Jung

Prototypes: Organizational self-renewal, mental health consultation.
Tippitt (1959), Miles (1966), and Watson (1969). From such efforts, the problem solver theorist, Havelock (1969, pp. 11-13), indicates five major points:

1. that the user's world is the only sensible place from which to begin to consider utilization;
2. that knowledge utilization must include a diagnostic phase where user is considered and translated into a problem statement;
3. that the role of the outsider is primarily to serve as catalyst, collaborator or consultant on how to plan change and bring about this solution;
4. that internal knowledge retrieval and the marshalling of internal resources should be given at least equal emphasis with external retrieval; and
5. that self-initiation by the user or client system creates the best motivational climate for lasting change.

Discussion of Models

In summary, the following three perspectives provided the conceptual basis for this study:

The research, development, and diffusion perspective takes a broad approach to dissemination and utilization from the initiation of an innovation and carries it all the way to adoption on a broad scale. It is exemplified best in the agricultural research and extension system. A variety of dissemination methods are used to obtain adoption of a readily identifiable innovation.

The social interaction perspective focuses upon the processes of adoption once an innovation has become known by the social system. Interpersonal relations are considered important and directly influence the rate of adoption. The stage of adoption and the media associated with each have been previously discussed under the concepts of diffusion and adoption.
The problem-solver perspective is concerned with the efforts on the part of users or receivers to satisfy their own problems or needs. Phases included in this perspective are problem awareness, diagnosis, search for and selection of a solution, planning for implementation, installation and evaluation, stabilization and possible diffusion to other groups (Havelock, et al, 1969, pp. 10-69-70).

It is clear that information alone is not sufficient for research dissemination and utilization. The successful communication of water resources research is a complex, interrelated process deeply involving researchers, linking systems, and users.

A synthesis of the three perspectives provides the basis for a model that is directly applicable to water resources research information at the state level. Each perspective is essentially an extension of the other. Each places emphasis upon certain aspects of the total process and views research utilization from differing vantage points. Together they present a comprehensive view of a total water resources research generation and utilization model depicted in Figure 6. The major focus of the model is communication and the two-way exchange of information which include dissemination of research findings and the feedback of user research needs.

Research development and diffusion can be viewed as a joint responsibility of university researchers and the Water Resources Research Institute. However, the Institute has greater responsibility for packaging and diffusion. The Institute further functions as a catalyst as it encourages and assists groups to identify needs and furnishes research information. Development and diffusion can also serve the role of linking agents and users, depending upon the problem under
FIGURE 6. A COMMUNICATION MODEL FOR WATER RESOURCES RESEARCH

Scientific Information Centers \rightarrow Public Information and Education \rightarrow OWRR \rightarrow Project Results \rightarrow Project Investigators

Universities \rightarrow WRRI \rightarrow Library Resources

Practitioner Conferences \rightarrow Research Needs

LINKING AGENT(S) *

Problems and Research Needs \rightarrow Research Findings

STATE AGENCIES

Problems and Research Needs \rightarrow Research Findings

OTHER PRACTITIONERS

*Dual appointment between the Institute, the University and/or the major state agencies.

Assistance in project design to insure relevance to problems and questions
consideration and the ultimate recipient of information in the communica-
tion chain.

Interaction occurs at any stage or with any of the groups in the model and is a continuous and cyclic process. Formal and informal inter-
action are vital for research findings to move to the users and to enhance the adoption of new research. Interaction and resulting feedback of research needs are important throughout the model as a reciprocal rela-
tionship or two-way flow of information. The user must understand the processes at work in the scientific community; and similarly, the scientific community must have empathy with the users' systems.

Problem-solving occurs within each group presented in the model. Steps involved in problem solving include awareness, diagnosis, search-
ing for and selecting a solution, planning for implementation and possible diffusion to other groups (Havelock, et al, 1969). Each group or organi-
ization must make the effort to identify and solve its problems using its own resources. If in the problem-solving process resources are not adequate, the group is encouraged to seek outside resources. The linkage agent performs an important function by stimulating and assisting each system to move through the various stages of problem solving. Linking agents can also assist each system to help delineate the outside resources and assistance available for the specific problems.

All systems in the model need to be mutually familiar with other problem-solving processes and exchange messages concerning needs, problems and solutions. Research utilization is a part, and only a part, of the problem-solving process which begins with a need and ends with the satis-
faction of that need.
In summary, the model incorporates the major features of the three theoretical perspectives. It provides for the flow of research information from the major sources of research through the linking structures to the users and subsequent feedback of needs.

Drawing upon the foregoing discussion of the dissemination and utilization process, the objectives of the study and the communication model for water resources research, the following major areas were investigated:

1. Institute Communication with Research-User Groups
2. Perception of the Institute by Research-User Groups
3. Perception of Research-User Group Roles
4. Research-User Group Interaction
5. Research Dissemination and Utilization
6. Public Understanding and Education Needs
Chapter 3
REVIEW OF EXISTING WATER RESOURCES INFORMATION EXCHANGE PROGRAMS

Investigations relating to communication of water resources information at the state level have been scant. Most of the investigations conducted within the framework of communication have been related to information exchange programs at the national level or national-to-state level.

Basically, the studies on information flows have given attention to the physical aspects of what technical information is transmitted to what groups and in what quantities. Only minimal attention has been devoted to the needs and problems associated with the communication of water resources information. The latter question is a central concern in this investigation.

Any program which is used to extend water resources information from the state-to-user level must utilize the valuable information exchange programs. This is essential if previous research is to be brought to bear on current needs and problems.

Information Dissemination Services

There are a number of information exchange and dissemination services and systems with major responsibilities for water resources research at the national level. Important information services include the Clearing House for Federal Scientific and Technical Information, the Science Information Exchange of the Smithsonian Institution, the National Referral Center for Science and Technology in the Library of Congress, and the Water Resources Scientific Information Center (WRSIC) of the Office of Water Resources Research, U.S. Department of the
Interior. WRSIC publishes *Selected Water Resources Abstracts*, maintains a current listing of water resources abstracts, and publishes an annual *Water Resources Research Catalog*. In its semi-monthly journal, abstracts of current and earlier pertinent monographs, journal articles, reports and other publication formats are included. Included in these documents are the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, and management of water. *Selected Water Resources Abstracts* is designed to serve the scientific and technical information needs of scientists, engineers and managers as one of several planned services of the Water Resources Scientific Information Center. The catalog is developed under contract with the Science Information Exchange, Smithsonian Institution. It provides summary descriptions of current research on water problems.

The Science Information Exchange receives approximately 100,000 unpublished summaries each year which identify who is planning what research, where, and how supported by federal departments and agencies and many from state, university, private granting and commercial organizations. Inquiries are answered regarding information about research planned or in progress. It is designed to bridge the gap between start of research projects and their subsequent publication several years later, thus complementing the work of libraries and documentation centers that deal with the published results of research.

The National Referral Center for Science and Technology maintains a listing of the organizations and institutions which are doing research or collecting data on water and water-related subjects. The center, as the name implies, provides a listing of organizations which can supply information on a specific question. The center does not attempt to supply
technical information. The Directory of Information Resources in 1966 lists better than 750 organizations involved with research and collecting data on water and water-related subjects.

The Office of Water Resources Research of the United States Department of the Interior is the federal office which administers federal funds for the fifty-one state Institutes. OWRR's primary information dissemination in addition to the services of WRSIC include the development of the Annual Report, Research Reports, and state-of-the-art reports. The publication, Research Reports, is issued quarterly and lists all research reports submitted by Institutes and other participants in the OWRR program.

The North Carolina Water Resources Research Institute Information Program

The needs for research information in North Carolina are presently being addressed with workshops, conferences, seminars, a newsletter, public appearances, publishing of research reports and answering information requests. Currently, the Institute mails 1150 monthly newsletters containing information on water resources research, planning and management, legislative developments, and a listing of publications and reports received at the Institute during the month. Recipients of the newsletter are federal, state, and local agencies, university personnel, consulting engineers, special interest groups, county extension chairmen and others who have an interest in water-related research. A total of fifty-two research reports (1971) have been published. Mass media are used to call attention to on-going research and project completion reports deemed to be of interest to the public.

Figure 7 illustrates the Institute's communication patterns which influence its directorate. Part of this study will determine the quality
Figure 7. Description of the Communication Exchanges Which Influence the Directorate of WRRI

President of The University of North Carolina
Vice President of The University of North Carolina
WRRI Board of Directors

Technical Committee
Advisory Committee
Existing Extension Services
Consulting Engineers
State Agencies with Water Resource Interests
Local Government
Other Institutes
Marine Sciences

DIRECTOR
WATER RESOURCES
RESEARCH INSTITUTE

Research Agencies
University Researchers
Federal Information Dissemination Services
Federal Water Resource Agencies - EPA, USGS, CE, SCS, TVA, OWRR
Other Federal Agencies

University Department Heads and Deans
Industry

Special Interest Groups, e.g., C.C.N.C., NCWLF, and LWV

Frequent Communication
Occasional Communication
and quantity of communication flow from the Institute as perceived by university researchers and practitioners.

**Evaluation of OWRR Study**

A search of the WRSIC *Selected Water Resources Abstracts* indicated only one entry relating to communication of water resources research information to potential users. This was a study undertaken by Banks and Wolfe (1969) in which an analysis was made of the information exchange programs of OWRR. This study, "A Plan for a Comprehensive Water Resources Research Information Exchange System," involved an analysis of the effectiveness of the OWRR and fifty-one state Water Resources Research Institutes in obtaining information on water resource problems and disseminating the results of their research projects.

Included in the study was a user awareness survey to which 113 individuals in state and inter-state agencies, city water departments, and consulting engineers in forty-six states and Puerto Rico responded. A summary of these 113 respondents revealed that the OWRR and state Institutes had not been effective in their research information exchange efforts. According to Banks and Wolfe (1969, p. 106):

"Among all these potential user groups, 40 percent had had no contact whatsoever with OWRR. Only 49 percent of these potential users were able to name a water resource project sponsored by OWRR in their home state. Only 21 percent were able to name an OWRR-sponsored project in some other state, and only 14 percent were able to name an OWRR research project the results of which they had used in their work. More than half, 53 percent, of the potential users felt that there were problems which required study which were not being investigated."

The Banks and Wolfe study was heavily weighted toward engineers and public works and was basically concerned with awareness. It failed to deal adequately with the communication problems between state Institutes and potential users.
According to Banks and Wolfe (1969, p. 23) the User Awareness Survey revealed that there is better communication between state Institutes and potential users than between OWRR and potential users. However, communication at the state level was not found to be adequate to keep all user groups aware of current findings.

**Federal Agency Sources of Water Resources Information Operating in North Carolina**

The principal federal agencies which make significant contributions to dissemination of water resources related information in North Carolina are the Environmental Protection Agency, Geological Survey, the Corps of Engineers, Soil Conservation Service, Tennessee Valley Authority, and the Office of Water Resources Research.

The Environmental Protection Agency is an independent federal agency with responsibility in the fields of air and water pollution control, solid wastes, radiological effects, and pesticides. It provides wide distribution of research and demonstration project completion reports; has recently initiated a technology transfer program; maintains a water quality data storage and retrieval system (STORET); provides many training opportunities at its regional laboratories; and utilizes all forms of mass and specialized communication media in support of its nationwide program.

The Geological Survey is a branch of the Department of the Interior, USGS has major responsibilities for data collection and computation of streamflows, surface water and ground water supplies, water quality records, major flood and drought and other hydrologic studies. Published reports from USGS are distributed to major state agencies, libraries, planners and others who have interest in water resources data of North Carolina.
The Corps of Engineers has responsibilities for planning, directing and constructing many single and multiple-purpose works for the federal government. The Corps maintains the nation's navigable waterways and is heavily committed to water development and navigation. It has an extensive research and development component. At the request of local leaders, comprehensive studies are made of river basins for flood control and other water resources needs. The results of these studies are distributed to major water resources agencies, and public meetings are held to present major findings and suggested action. Access to the Corps' publications can be gained through its district offices.

The Soil Conservation Service, an agency in the United States Department of Agriculture, provides both technical services and information on soil and water-related problems in rural and urban areas. Soil maps, soil treatment, land runoff, study results, and other technical information important to water management and use are prepared and distributed by the Soil Conservation Service. Under provisions of Public Law 566, the Watershed Protection and Flood Prevention Act of 1954, the Soil Conservation Service provides technical and financial assistance to watershed areas. Flood prevention, water supply, recreation development, wildlife protection and reduction in pollution are considered in watershed studies. Results of these studies are readily available from the Soil Conservation Service.

The Tennessee Valley Authority is engaged in a wide range of research efforts directed toward conservation and development of resources. Research results are disseminated in the Tennessee Valley areas and to the major water resources agencies in the states where TVA has responsibilities.

The Office of Water Resources Research, an extramural research agency of the U. S. Department of the Interior, sponsors a wide range of
research through state institutes, universities at large, public agencies, and private firms. Its principal information arm is the Water Resources Scientific Information Center which was covered earlier in this report.

**Inventory of Published and Unpublished Information on Water Resources Data of North Carolina**

The McJunkin report contains a very extensive and comprehensive listing of published and unpublished information relating to the broad subjects of "water resources" and "North Carolina." The major impetus for this publication was the effort "to compile and assemble, in a single publication, a comprehensive inventory and index to all significant printed information and data relevant to North Carolina's water resources" (McJunkin, p. v). This report includes those publications and other materials from federal, state, and other sources which are oriented to North Carolina problems. Approximately one thousand copies of this report were distributed to libraries, state agencies, universities, departments, consulting engineers, and planners. This publication should be considered an essential reference for those who are engaged in any aspects of research, planning, design and construction, management or education in water resources in this state.
Chapter 4

METHODS AND PROCEDURES

Data for this study were generated from questionnaires administered during the summer of 1970 to university researchers and research users directly concerned with water resources.

Methodology

The selection of the population, development of the instrument used in the survey, pretesting of the instrument, procedures used to collect the data, and analysis of the data are presented in this section.

Population

This study involves two major groups with interest in water resources: the university researchers and the research users. A description of these groups follows:

1. All of the university professionals in ten North Carolina universities who have expressed an interest in water-related research were used as the population for this study. A list of 237 individuals was compiled by the Water Resources Research Institute through direct contact with researchers and cross-checked by heads of departments to determine those individuals with direct interest in water resources. This information is published annually in WRRI Report No. 3 titled Water Resources Research Interests in the Colleges and Universities of North Carolina.
2. All water resources research users in North Carolina including state agency personnel, professionals, practitioners, consulting engineers, and industry officials with interests in water resources research which could be identified by direct contacts and by cross-checking with heads of state agencies and other practitioners were included as the population. The users included 211 professionals with interest in water resources. The WRRI newsletter mailing list of research users was also used to complete the list.

Preparation of the Instrument

Two questionnaires, one for the university researchers and one for the users, were developed for this study. These were used to examine various aspects of communication which are consistent with the research objectives stated earlier. The questionnaires are rather comprehensive and include data beyond that used in this study.

The respondents were asked in section two of the questionnaire to indicate the extent to which they agreed or disagreed to statements by giving their response based on a five-point, Lickert-type scale as follows: strongly agree - 5; agree - 4; uncertain - 3; disagree - 2; and strongly disagree - 1.

In other sections of the questionnaire, subjects were asked to respond in a different way depending on the nature of the statement. For the selection of type of research which the university should be conducting, respondents selected from a scale of very appropriate to very inappropriate. In indicating the contacts with the Institute,
respondents selected from a scale of never to frequently. Other questions were open-ended or required the selection of an appropriate response. The survey instruments used in this study are reproduced in the Appendices.

Pretesting of the Instrument

The university instrument used was pretested for clearness, reliability and validity by fifteen university researchers at VPI. These researchers were not included in the survey. State agency personnel at the South Carolina Water Resources Commission pretested the state agency questionnaire. As a result of the pretest, slight modifications were made in the questionnaires to improve their clarity.

Collection of Data

The data for this study were obtained by mailed questionnaires during the months of July and August 1970. An introductory letter explaining the purpose of the research, its importance, its confidential nature, and the necessity for return of the completed forms was attached to the questionnaire. The follow-up letters were mailed at ten-day intervals. Copies of these letters and the questionnaire are shown in the Appendices.

Of the 239 questionnaires mailed to university researchers, 156 (65 percent) were returned. There were 211 questionnaires mailed to state agencies and practitioners of which 146 (69 percent) were returned.

Analysis of Data

Responses to the items in the questionnaire were transposed to electronic data processing cards and were analyzed at the North Carolina State University Computing Center.
To facilitate an easier grasp of the information by the reader, the responses of individuals to statements using the five-point, Lickert-type scale were collapsed to agree, uncertain, and disagree.
Chapter 5

FINDINGS AND DISCUSSION

The purpose of this section is to present, analyze and interpret findings with respect to communication between university researchers and users. This information will provide additional knowledge and understanding of existing conditions and will be a foundation from which to determine if there are needs for changes in methods and procedures for transferring water resources research information.

The format used for presenting the findings will be (1) an introductory discussion of the research focus, (2) the presentation of the data, and (3) interpretation.

Institute Communication with Research User Groups

Communication and linkage are a prime consideration in research utilization. Effective contact and exchange of information will enhance the mutual utilization of research. Havelock, et al 1969, indicate the greater the number of overlapping linkages which exist between systems the more frequent and effective will be the research utilization by all.

In the Communication Model the Institute is performing a linkage function. This phase of the research examines the degree of contact made by the Institute with both researchers and users.

Numerous methods of communication are used by the Institute. The important ones include personal visits, telephone, correspondence, Institute reference room, participation in a variety of conferences and meetings, publications, and a monthly newsletter. For an additional review of the Institute's information program, see page 31 of this report.
Table 1 summarizes the level of contacts between WERI and the respondents. Nine different types of contacts were given and respondents checked the one which indicated the frequency of their contacts with the Institute. For contacts (a) through (e), the response of "seldom" equaled one to two contacts per year, a response of "occasionally" equaled three to five contacts per year, and the response of "frequently" represented six or more contacts per year.

For the contacts (f) through (i), the response of "seldom" equaled one contact, "occasionally" equaled two contacts, and "frequently" equaled three or more contacts per year.

The data in Table 1 indicate that the leading methods of communication between university researchers and the Institute were through receipt of publications, correspondence, and telephone communication. With the users, the major contacts were through receipt of publications, correspondence, participation in workshops and seminars, and telephone communication. More than three-fourths of the respondents considered the contacts to be helpful.

One of the significant differences noted in the level of interaction is the higher contact with users in conferences, workshops and other meetings. This can be accounted for by the emphasis of the Institute on meetings involving users. A higher proportion of those attending Institute workshops and conferences are users rather than researchers. In all instances, however, both groups are represented.

Slightly more of the users, 81 percent, compared with 74 percent of the researchers received copies of the Institute's monthly newsletter.

A small percentage, two percent of the researchers and four percent of the users, indicated they had no contact with the Institute during
Table 1: Percentage Distribution of Respondents' Level of Contacts with the WRRI

<table>
<thead>
<tr>
<th>Type of Contact with the WRRI</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>None</td>
</tr>
<tr>
<td>a. Visited by the WRRI director</td>
<td>Univ, Res.</td>
<td>154</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>68%</td>
</tr>
<tr>
<td>b. Telephoned by WRRI director</td>
<td>Univ, Res.</td>
<td>154</td>
<td>54%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>69%</td>
</tr>
<tr>
<td>c. Written by WRRI director</td>
<td>Univ, Res.</td>
<td>154</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>57%</td>
</tr>
<tr>
<td>d. Visited the Institute</td>
<td>Univ, Res.</td>
<td>154</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>78%</td>
</tr>
<tr>
<td>e. Telephoned the Institute</td>
<td>Univ, Res.</td>
<td>154</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>68%</td>
</tr>
<tr>
<td>f. Wrote the Institute library</td>
<td>Univ, Res.</td>
<td>154</td>
<td>47%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>65%</td>
</tr>
<tr>
<td>g. Used the Institute library</td>
<td>Univ, Res.</td>
<td>154</td>
<td>74%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>81%</td>
</tr>
<tr>
<td>h. Participated in seminars, workshops, conferences &amp; other meetings supported by the Institute</td>
<td>Univ, Res.</td>
<td>154</td>
<td>60%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>50%</td>
</tr>
<tr>
<td>i. Received publications (other than newsletter) from Institute</td>
<td>Univ, Res.</td>
<td>154</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>145</td>
<td>34%</td>
</tr>
</tbody>
</table>

<sup>a</sup>For responses (a) through (e) "seldom" equaled 1 to 2 contacts, "occasional" equaled 3 to 5 contacts and "frequently" equaled 6 or more contacts per year. For contacts (f) through (i), "seldom" equaled 1, "occasionally" equaled 2 and "frequently" equaled 3 or more contacts per year.

The majority of the respondents, 83 percent of the researchers and 77 percent of the users, considered contacts with the Institute to be a useful means of keeping abreast of water resources.
research. Under existing conditions with limited resources, the Institute is restricted in its level of communication.

Perception of the Institute by Research-User Groups

The Institute, as an intricate part of the Communication Model, has a major role to play in providing part of the linkage mechanism between the research system and the user groups. The perception and evaluation of the Institute by these groups provide indications of how they will accept and utilize it.

General

Data were obtained to determine the respondents’ appraisal of the Institute. Specifically, statements in Table 2 were directed to respondents to determine how they perceived the Institute and its relative involvement in water resources research.

Table 2. Perception of the Institute—General

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The Water Resources Research Institute is viewed as a major source of water research information.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>Disagree</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>26%</td>
</tr>
<tr>
<td>b. The Institute should confine its energies to research and let other organizations concern themselves with utilization of research results.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>78%</td>
</tr>
</tbody>
</table>

Slightly over half of the users (Table 2) viewed the Institute as a major source of water research information. The higher percentage given
by users probably results from the Institute's directing more of its information to the needs of that group. Researchers tend to draw upon a wider range of specialized sources for basic technical information and would be less dependent upon sources such as the Institute.

More than three-fourths of all respondents indicated that the Institute should concern itself with the utilization of research findings as well as research.

Over three-fourths of the respondents also registered a desire to be better informed on the Institute's research program. This would suggest a need to investigate new possibilities for communication of research information and an intensification of some of the methods now being employed.

Quality of Institute Reports

The Institute has published more than fifty different reports. They include research completion reports, workshop proceedings, a periodically revised assessment of water resource problems and research needs, and two publications which are revised annually. These latter are: (1) Water Resources Research Interests in the Colleges and Universities of North Carolina, and (2) Inventory of the Active Water Resources Research Projects in North Carolina.

The number of research reports printed varies from 250 to 1000 copies, depending on the expected demand. Copies of reports are distributed to other state Institutes, state and regional libraries, state and federal agencies, and to members of the Advisory and Technical Committees, faculty, private industry, and special interest groups on a selective basis. Single copies of all publications are free to individuals and agencies within the state. A uniform charge of $2.50 per copy
is charged for all out-of-state requests except for agencies and institutions with whom free exchange arrangements have been worked out. Requests for Institute reports average approximately eighty per month in addition to the routine distribution of 175 copies of each report.

Publications impose a substantial demand on Institute personnel and fiscal resources, and every reasonable step needs to be taken to assure high quality and usefulness. An evaluation by research faculty and users is an obvious means of determining whether these objectives are being met or if corrective actions are necessary.

The following section contains research findings which provide an evaluation of reports published by the Institute. Statements were directed to respondents to measure their perception of the quality, usefulness, and relevance of the reports.

Table 3. Perception of the Quality of Institute Research Reports

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Disagree</td>
</tr>
<tr>
<td>a. The majority of the Institute research reports appear to be of excellent quality.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>6%</td>
</tr>
<tr>
<td>b. The published reports of the Institute are a useful and practical source of water resource information.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>5%</td>
</tr>
<tr>
<td>c. The research information coming from the Institute has no immediate application to current needs.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>69%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>73%</td>
</tr>
</tbody>
</table>
The findings in Table 3 reveal that less than one out of ten respondents disagreed with the statement that the majority of Institute reports are of excellent quality. Approximately three-fourths agreed that published reports are a useful and practical source of water resource information. More than two-thirds indicated that research information coming from the Institute has immediate application to current needs.

The results indicate a highly favorable general perception of current Institute reports. More investigation is needed, however, to determine the actual usage of individual publications and possible detailed improvements. In another section of the questionnaire, for example, a high majority of respondents expressed the need for additional information from the Institute.

Questions on the frequency of updating of periodically revised reports and the possible better use of funds for shorter "popularized" versions of some reports for broader distribution to users remain unanswered.

The Institute does place particular emphasis on preparing the summary, conclusions and recommendations section of its reports in a language which will be useful to many users. In addition, a short letter accompanies many reports distributed in North Carolina presenting the findings and broader implications of the research.

Among the users of water resources research there are wide gradations of technical background. For example, an individual's technical knowledge would be expected to vary considerably between the policy makers, executives, scientists, and technicians. Yet, research reports are frequently written for a trained scientific audience and peer approval. The reports also contain considerable technical details
and data associated with the research. While these are essential, a question should be raised as to whether the reports are the appropriate publications or communication media to create the needed research awareness among the broad range of users. It is not very realistic to expect the technical research reports to fit the wide range of potential users.

**Allocation of Funds**

Program formulation and budgeting are a function of Institute management. Decisions with respect to research and administration are made by the Director and the Technical Committee following recommendations by the Advisory Committee. All actions take place within a policy framework established by the Board of Directors. The key criteria are relevance, scientific merit, and priority of need.

Approximately 87 percent of Institute funds has gone to research and 13 percent to administration. The latter includes newsletters, seminars, workshops, and conferences associated with program development and dissemination of research findings.

Respondents were asked to express a choice among various options for the utilization of new funds which may become available. The questions and responses are shown in Table 4.

More than one-half of the respondents (Table 4, item a) were uncertain if a proper balance of research had been funded. The problem here may be that respondents were not fully acquainted with the range of research projects or uncertain as to what constitutes a balanced program.

There was also a high amount of uncertainty when respondents were asked if projects were in keeping with the actual needs in the state. Results here would indicate a need to strengthen communication despite
Table 4. Perception for Present and Future Institute Programming

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. There appears to be a proper balance in the research areas being funded by the Institute.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>Disagree</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>16%</td>
</tr>
<tr>
<td>b. Present funding of projects by the Institute is not in keeping with the actual water resources research needs in this state.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>16%</td>
</tr>
<tr>
<td>c. None of the funds need to be used to identify the principal research needs.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>69%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>67%</td>
</tr>
<tr>
<td>d. Some funds should be used by the Institute to obtain greater utilization of research presently available.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>6%</td>
</tr>
<tr>
<td>e. The Institute should utilize some funds to improve the dissemination and utilization of water resources research to potential users.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>141</td>
<td>3%</td>
</tr>
</tbody>
</table>

the fact that the Institute's report on Water Resource Problems and Research Needs in North Carolina has been prepared and widely distributed from the onset of the program.

While some administrative funds have been used to seek dissemination and utilization of Institute research, it has not received the same churk as the research phase of the program. Three-fourths or more of the
respondents indicated in (d) that some funds should be used by the Institute to seek utilization of research presently available and approximately the same percent in (e) indicated that it should improve the dissemination and utilization of water resources research to potential users. In response to both (d) and (e), the users placed more emphasis on the use of funds for dissemination than the university group.

Function and Relevance

The WRRI works closely with the North Carolina Office of Water and Air Resources, other agencies, and its twenty-five-man Advisory Committee in the formulation of a research program directed toward state water resource problems. Several statements were provided to determine how respondents evaluate the Institute and its research efforts (Table 5).

Over half of the respondents were uncertain that the Institute's function in water resources research was at the proper level. On the other hand, there was a large majority of respondents who indicated that the Institute should provide guidance to the state's water resources research programs. Highly significant also in Table 5 is the fact that two-thirds or more saw the Institute's research program as relevant to this state's water problems. Despite the fact that the program is considered relevant, over half of the respondents are uncertain if the needed research studies are being undertaken. This uncertainty may be (1) an outgrowth of limited knowledge of the full range of research, (2) lack of opportunity to participate in the selection of research studies, or (3) simply that not enough research work is being undertaken.
Table 5. Perception of the Institute's Function

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
<th>Disagree</th>
<th>Uncertain</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The Institute's function in water resources research is about at the level it should be.</td>
<td>Univ. Res. 154</td>
<td>40%</td>
<td>52%</td>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users 146</td>
<td>33%</td>
<td>58%</td>
<td>7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. The Institute should provide guidance to the total state's water resources research program in the future.</td>
<td>Univ. Res. 154</td>
<td>4%</td>
<td>14%</td>
<td>82%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users 146</td>
<td>12%</td>
<td>17%</td>
<td>71%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. The Institute research program is relevant to this state's water problems.</td>
<td>Univ. Res. 154</td>
<td>1%</td>
<td>32%</td>
<td>67%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users 146</td>
<td>4%</td>
<td>27%</td>
<td>69%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. The Institute does not appear to be deeply concerned with current water resource problems and research needs.</td>
<td>Univ. Res. 154</td>
<td>79%</td>
<td>18%</td>
<td>3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users 146</td>
<td>73%</td>
<td>18%</td>
<td>9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Do you feel the needed water resources research studies are being undertaken?</td>
<td>Univ. Res. 153</td>
<td>23%</td>
<td>54%</td>
<td>23%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Users 143</td>
<td>14%</td>
<td>58%</td>
<td>28%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Procedure for Selection of Research Proposals

University researchers are encouraged to submit research proposals to the Institute for both the annual allotment and matching grants programs. To facilitate this the Institute maintains a current listing of approximately 250 faculty members in the state's senior colleges and universities who have expressed an interest in water resources research. All of these receive announcements of invitations for proposals and
copies of the Institute report on water resource problems and research needs to focus attention on priority research needs. All prospective research faculty are invited to discuss their ideas for proposals with the Director prior to submission.

When proposals are received, they are distributed to appropriate members of the Advisory Committee and others among the research user groups for comment as to relevancy, need for the work, and research plan. They are simultaneously distributed to the Technical Committee which will ultimately make the decision as to which proposals will be considered for funding. Within the Technical Committee, proposals are submitted to subcommittees of specialists in the subject areas involved for in-depth reviews and to other members for general review. When a sufficient number of specialists are not available from the Technical Committee, they are sought from faculty members at large.

When the Technical Committee meets to take action on proposals, they are first briefed by the Director on the responses from the Advisory Committee and other non-university reviewers. The subcommittee members then make their comments and recommendations. This is followed by general discussion which leads to the selection of proposals and assignment of priorities. All proposals submitted to the Office of Water Resources Research undergo a further review and selection process at the federal level.

The statements in Table 6 were asked to determine how respondents evaluated the project selection procedures. The uncertainty with which many researchers responded to (a) regarding the procedures for handling proposals indicates some lack of knowledge of how the proposals are processed and how final decisions are achieved. Some of this may be
Table 6. Perception of Procedures for Selection of Research Proposals

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The proposals submitted from this department for new research are given adequate consideration by the Institute.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>7%</td>
</tr>
<tr>
<td>b. The use of a Technical Committee by the Institute to review projects submitted and recommend those to be funded is a satisfactory method of project selection.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>3%</td>
</tr>
<tr>
<td>c. Copies of research proposals to funding agencies other than the WRRI should be sent to the Institute on an information-only basis to facilitate coordination.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>14%</td>
</tr>
</tbody>
</table>

*These statements were directed only to university researchers,

inherent in the fact that because of limited funds actual selection of proposals by the Technical Committee often involves funding of less than half of the proposals submitted.

Despite this uncertainty as to the selection process, each group agreed that the Technical Committee is an acceptable method of project review and selection.

One of the functions of the Institute is to coordinate water resources research within the Consolidated University of North Carolina. This has been attempted on a voluntary basis with the expectation that faculty
members would recognize the ultimate benefits to all concerned. The principal mechanism for this has been the annual inventory of active research projects underway in the state. This provides immediate reference to related work and the personal contacts necessary to coordinate new proposals. The inventory serves a coordinating role throughout the state—among all senior colleges and universities—as well as within the Consolidated University.

There is little problem with the coordination of that research which is funded through the Institute. Many faculty members and research administrators freely cooperate by calling other proposals to the attention of the Institute. Some do not. A question which frequently arises is, "Would it be helpful to arrange for the automatic referral of copies of non-Institute proposals to assure the avoidance of overlap and duplication of work?" Sixty-one percent of the respondents in Table 6 agreed that this should be done. Only 14 percent of the remainder disagreed. This roughly approximates the actual experience of the Institute in this regard. While occasional problems could be avoided by requiring such referrals, it is believed that the coordination function is being adequately served on a voluntary basis and that the situation will improve in an atmosphere of mutual cooperation and service.

Perception of Research-User Group Roles

The degree of congruity that exists between university researchers and users and the degree of mutual understanding of the other system contributes to the functioning of the communication model for water resources. Agreement or disagreement over role perception has important implications to functioning of the model. Major disagreements over role perception can constitute a communication barrier.
Appropriateness of University Research

There is a wide range of opinion concerning the classification of research as to "basic" or "applied." For this reason, the Institute has used such terms as "problem oriented" and "relevant" to describe its research emphasis. Even here, there is the question of what is appropriate research for the University in contrast to the public water resource agencies. See Table 7. Respondents were asked to check each of the following examples as to the degree to which they believed each represents the type of water resources research a university should be conducting.

Table 7. Appropriateness of Water Resources Research for a University

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Temperature response of aquatic ecosystems</td>
<td>Univ. Res.</td>
<td>151</td>
<td>98%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>140</td>
<td>96%</td>
</tr>
<tr>
<td>b. Collection of temperature data on N.C. streams and coastal waters</td>
<td>Univ. Res.</td>
<td>151</td>
<td>98%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>141</td>
<td>96%</td>
</tr>
<tr>
<td>c. Simulation model for optimal location of steam-electric generator plants</td>
<td>Univ. Res.</td>
<td>151</td>
<td>79%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>141</td>
<td>72%</td>
</tr>
<tr>
<td>d. Effect of low-flow augmentation from federal reservoirs on downstream water temperatures</td>
<td>Univ. Res.</td>
<td>151</td>
<td>81%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>140</td>
<td>83%</td>
</tr>
<tr>
<td>e. Suggested standards for N.C. streams &amp; coastal waters</td>
<td>Univ. Res.</td>
<td>151</td>
<td>76%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>141</td>
<td>62%</td>
</tr>
<tr>
<td>f. Fisheries distribution in response to thermal pollution</td>
<td>Univ. Res.</td>
<td>151</td>
<td>93%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>140</td>
<td>73%</td>
</tr>
</tbody>
</table>
The traditional role of the university has been a supportive one of conducting basic and applied research for water resource user groups. The user agencies have, on the other hand, emphasized data collection and interpretation for regulatory planning and action-oriented efforts.

In the questionnaire a number of examples of research listed in Table 7 were provided to offer a range of choice from research traditional for the university to some that could be considered traditional for user agencies. Example (a) represents a rather complex area of research which both groups clearly recognized as appropriate for the university. Examples (c) and (d) represent studies which might be undertaken by agencies if they had the resources; but since they do not, they are generally recognized as appropriate for a university. On its surface (e) may appear to represent fairly clear-cut investigations which the agencies are equipped to carry out or some respondents may have assumed no need for further research. Actually, this represents an area of great complexity with which the universities are uniquely equipped to deal. Example (f) represents rather clear-cut sampling and data collection which agencies could handle. Yet, three-fourths of the users and an even higher percent of university researchers indicated it as appropriate for the university.

Example (b) in Table 9 is clearly data collection; yet, 50 percent or more considered it appropriate for the universities.

The response, while showing definite gradation of opinion as to what is appropriate for universities in research, left a very broad area of applied research and investigation for university and agency collaborative effort.
Closely related to the specific types of research is the frequently debated question of which has priority in the university—problem-oriented or basic research. The solution to many North Carolina water resources problems dictate the need for both. Water resource problems do require tremendous amounts of research which have utility for the practitioners. Such effort must be supported by basic research, but some balance of the two types is needed. It is the preferential rating for one type of research at the expense of another that can be a major source of concern for those with interest in water resources.

In Table 8 the items are designed to determine if there are substantial differences in the preference given to the various areas of research by university members and practitioners and how respondents perceive the university role with respect to the applied and basic research.

Table 8. Perception of the Role of Applied and Basic Research in the University

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Problem-oriented research is a proper function of the university.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>5%</td>
</tr>
<tr>
<td>b. When compared to basic research, the problem-oriented type should receive a lower priority.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>51%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>51%</td>
</tr>
<tr>
<td>c. Research relevant to contemporary problems is less satisfying than basic research.*</td>
<td>Univ. Res.</td>
<td>154</td>
<td>84%</td>
</tr>
<tr>
<td>d. Given the opportunity, most researchers in water resources related fields would not do more problem-oriented research.*</td>
<td>Univ. Res.</td>
<td>154</td>
<td>44%</td>
</tr>
</tbody>
</table>

*These statements were included only in the university researchers survey.
The respondents left little doubt of their position on these statements. Nine out of ten indicated that problem-oriented research is a proper function of the university.

Slightly more than half gave a higher priority rating to problem-oriented research. Responses to statements (c) and (d) indicate that most researchers consider problem-oriented research as satisfying as basic research and would do more of it if given the opportunity.

The results tend to indicate that some of the charges that university researchers are heavily biased toward basic research are not well founded. In fact, very similar attitudes were expressed by both research and user groups on the value and importance of problem-oriented research.

**Interdisciplinary Research**

The complexity of many water resources research problems requires cooperative work by scientists from a variety of different disciplines. Water resource planning, nutrient removal from waters, and toxic metals in water are examples of interdisciplinary research areas. Despite the need for interdisciplinary research, there are definite problems in actual implementation. One factor which might influence this would be the attitudes of university department heads and their control of certain positive or negative sanctions. The statements in Tables 9 and 10 seek to determine how research faculty members perceive incentives for interdisciplinary research in terms of traditional discipline-oriented academic departments.

The response to statements (a) and (b) in Table 9 indicates that less than half of the researchers view academic incentives and attitudes of heads of departments as positive forces for interdisciplinary work.
Table 9. University Perception of Incentives and Attitudes Relative to Interdisciplinary Research

<table>
<thead>
<tr>
<th>Statement*</th>
<th>Total N</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Academic incentives for faculty researchers are conducive to involvement in interdisciplinary research and education programs.</td>
<td>154</td>
<td>38% 19% 43%</td>
</tr>
<tr>
<td>b. The present attitude of heads of departments are conducive to increased interdisciplinary effort.</td>
<td>154</td>
<td>31% 31% 38%</td>
</tr>
</tbody>
</table>

*All statements were directed to university researchers.

Table 10. Perception of Academic Rewards for Participation in Interdisciplinary Research and Education

<table>
<thead>
<tr>
<th>Work Incentive*</th>
<th>Total N</th>
<th>Effect of Interdiscipline Research and Education on Work Incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Positive (+)</td>
</tr>
<tr>
<td>a. Prestige</td>
<td>154</td>
<td>48%</td>
</tr>
<tr>
<td>b. Rank</td>
<td>154</td>
<td>14%</td>
</tr>
<tr>
<td>c. Advancement</td>
<td>154</td>
<td>20%</td>
</tr>
<tr>
<td>d. Salary</td>
<td>154</td>
<td>18%</td>
</tr>
<tr>
<td>e. Security</td>
<td>154</td>
<td>19%</td>
</tr>
<tr>
<td>f. Enjoyment of Work</td>
<td>154</td>
<td>69%</td>
</tr>
<tr>
<td>g. Recognition</td>
<td>154</td>
<td>56%</td>
</tr>
</tbody>
</table>

*All work incentives were directed to university researchers.

See Table 10. Significantly, the researchers do perceive interdisciplinary research and education as providing strong positive benefits for enjoyment of work, recognition and prestige. A large percentage of respondents indicated that interdisciplinary research would have "little effect" on rank, advancement, salary, and security. These four represent
important factors for individuals. The conclusion drawn here is that incentives are not now being used to encourage interdisciplinary research and education.

The implementation of interdisciplinary research will require positive support and encouragement by university department heads. Threatening conditions or feelings of insecurity need to be removed. Use of such positive incentives as official recognition, advancement, and active encouragement from department heads is essential.

By necessity, more research in water resources will be interdisciplinary and involve many disciplines within a university and greater cooperation between universities. Thus, those research departments which actively encourage and seek joint participation with other disciplines will benefit.

**Non-university Research Sources**

The Water Resources Research Institute funds are used to finance water resources research in senior colleges and universities in North Carolina. There is, however, a considerable amount of research conducted in industry, public agencies and through private sources. Most state agencies and small industries do not have the resources in personnel or facilities to conduct their own research. The statements in Table 11 were posed to determine the respondents' perception of non-academic sources conducting water resources research.

Responses in Table 11 indicate that both groups recognize the fact that there is a need for research support and assistance from the university. However, over half of the users in statement (a) indicate that industry should handle most of its own problem-oriented research.
Historically, there has been a greater demand for water resources research than could be or is handled by all funding sources. Less than half of the research requested through the WRRI could be funded in 1971. With need for research exceeding the available resources, many respondents may recognize the need and responsibility for industry to conduct more water resources research.

Responses (b) and (d) give indications that the majority of both groups disagree that state agencies and organizations are potentially capable of handling their own problem-oriented research. However, a slightly higher percentage of users than researchers signified that state agencies should do this work.
The need for research assistance from the university is quite clear by both groups with their negative responses to statement (c).

Research-User Group Interaction

The perceived quality and level of interaction between the major systems in the communication model are indicative of the information flow between the systems. Interaction directly between researchers and users through a variety of means will also enhance the mutual transfer of information. In this phase of the research an evaluation of how the individuals perceive the interaction between the two groups is studied.

The interaction and communication between university researchers and users in water resources vary but have not been considered optimal. The two groups frequently communicate indirectly through the use of journals, reports and occasionally in conferences and technical seminars.

An important consideration here is whether there are inherent barriers which would restrict interaction between the groups. Table 12 delineates some of the factors which are possible sources of problems of interaction. The focus here is on the relative freedom of interaction.

A great amount of uncertainty is expressed in (a, b, c, d, & e) of Table 12 by one-third to one-half of the respondents relating to interaction between researchers and users. The uncertainty may stem from unawareness of the present contacts between groups, a perception that problems do exist, or lack of uncertainty in the relationship.

In no instance was there a clear majority response which would indicate that there was a desirable existing climate conducive to free interaction. Fewer than 20 percent in either group considered communication to be satisfactory.
Table 12. Perception of the Interaction Between University Researchers and Users

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Disagree</th>
<th>Uncertain</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Individual practitioners &amp; water-related agencies feel free to contact the university faculty to request needed research in water-related areas.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>25%</td>
<td>51%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>23%</td>
<td>44%</td>
<td>33%</td>
</tr>
<tr>
<td>b. Potential users of water resources research in public agencies &amp; private practice find it relatively easy to communicate directly with university researchers.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>42%</td>
<td>45%</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>39%</td>
<td>31%</td>
<td>30%</td>
</tr>
<tr>
<td>c. Generally, the university faculty encourages practitioners and water-related agencies to contact them.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>22%</td>
<td>40%</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>23%</td>
<td>35%</td>
<td>42%</td>
</tr>
<tr>
<td>d. There is no hesitancy on the part of university researchers to freely contact the public water resources agencies and practitioners to identify research needs.(^a)</td>
<td>Univ. Res.</td>
<td>154</td>
<td>34%</td>
<td>35%</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>58%</td>
<td>36%</td>
<td>6%</td>
</tr>
<tr>
<td>e. Communication between university researchers and public water resource agencies or practitioners is satisfactory at the present time.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>58%</td>
<td>36%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>51%</td>
<td>33%</td>
<td>16%</td>
</tr>
</tbody>
</table>

\(^a\)Only the University Researchers were asked to respond to this statement.
The problems of the researchers' uncertainty in interaction may stem from not knowing which users to contact, inadequacy of time, expecting the users to make their needs known, or simply a feeling that they are already involved in the most important research efforts. On the other hand, research users may be confronted with problems of not knowing the research specialists to contact, lack of time, and some uncertainty of the exact research problem.

The Institute's annual Inventories of University Research Interests and Research Projects are designed to place in the hands of users the names of researchers in water resources and a description of their research. This, however, represents a rather impersonal approach; and without some other contacts to establish a rapport, users will still be hesitant to make the contact.

The complexity of water resource problems makes it necessary that there be some interaction simply to identify the research problem and the disciplines which need to be involved to undertake the research. The Institute has been active in the role of an intermediary in helping to meet the problem of research need identification and bringing together the various disciplines to do the needed research.

The ambiguity of response reveals that the university encourages contact but, yet, does not feel free to take the initiative in interaction. There is a clear uncertainty as to who should take the initiative or leadership role. There is the possibility that agency leaders could exercise greater influence to bring about the needed interaction and influence attitudes.

As can be seen from statement (a) in Table 13, nearly three times as many in the user group compared to researchers perceived that the present
flow of information was not adequate to identify additional research needs. The response to statement (b) disclosed that nearly three out of four of both respondent groups feel the need to improve the flow of water resources research information to practitioners. Responses to both statements indicate a particularly high level of concern about the inadequacy of communication to identify needs and supply users with research information.

Table 13. Perception of the Adequacy of Communication Between Researchers and Users

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>Yes</td>
</tr>
<tr>
<td>a. Is the present flow of information between university researchers and potential users of water resources research information adequate to identify additional research needs?</td>
<td>Univ. Res.</td>
<td>153</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>143</td>
<td>14%</td>
</tr>
<tr>
<td>b. Do you feel there is a need to improve the flow of water resources research information to practitioners or users?</td>
<td>Univ. Res.</td>
<td>154</td>
<td>72%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>143</td>
<td>75%</td>
</tr>
</tbody>
</table>

Research Dissemination and Utilization

The true value of a research program is the research produced, disseminated, and used. Emphasis here is placed on an evaluation of the effectiveness of current methods for the dissemination and utilization of research findings.

Traditionally, researchers and users have relied heavily upon scientific and technical journals, technical reports and similar types of media for new research information. The effectiveness of some of the
sources of scientific information are frequently debated. The Institute, with its small staff, has relied heavily upon publication of project completion reports and the use of technical seminars and conferences for dissemination of findings.

Table 14 reports the effectiveness of selected methods used by university researchers to disseminate research information. The rating scales were high, moderate and low. The university researchers rated the methods for both practitioners and other researchers. The users were only asked to evaluate information dissemination for other users or practitioners.

Table 14. Effectiveness of Methods Employed by University Researchers to Disseminate Their Findings

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Publication of individual technical reports or papers</td>
<td>U.Res. Users</td>
<td>138</td>
<td>11%</td>
<td>41%</td>
<td>48%</td>
<td>145</td>
<td>50%</td>
<td>36%</td>
<td>14%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Publication in scientific &amp; technical journals or magazines</td>
<td>U.Res. Users</td>
<td>133</td>
<td>12%</td>
<td>33%</td>
<td>55%</td>
<td>148</td>
<td>76%</td>
<td>20%</td>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Technical seminars and conferences</td>
<td>U.Res. Users</td>
<td>140</td>
<td>30%</td>
<td>57%</td>
<td>13%</td>
<td>146</td>
<td>39%</td>
<td>51%</td>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Review findings with practitioners and potential users in special meetings</td>
<td>U.Res. Users</td>
<td>139</td>
<td>77%</td>
<td>18%</td>
<td>5%</td>
<td>142</td>
<td>25%</td>
<td>35%</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Only the university respondents were asked to rate the effectiveness for other researchers.

The impersonal sources of dissemination (a) and (b) in Table 14 were generally rated moderate to low in effectiveness for practitioners. Personal approaches like special meetings with potential users (d) were given
a higher rating. The reverse is true for researchers. For their own use, researchers cited the scientific and technical journals and technical reports and papers as the most effective methods of obtaining information.

Several factors are probably involved as to why the users and researchers rely on different sources of information. The researchers tend to specialize in their areas of research and spend a greater amount of time studying and searching for research data from a large number of sources. On the other hand, the users normally have needs covering a broad spectrum of subjects and are limited in time for detailed study in each area. The users' needs frequently have attached to them a sense of urgency requiring a total package of information rather than isolated bits and pieces of research. The more personalized sources of information allow for more interaction and usually more detail for the user who seeks to apply the findings. Highly valuable to the actual utilization of research is the establishment of rapport and confidence with information sources which is possible through interaction.

In contrast to Table 14 which contains examples of communication methods which respondents were asked to evaluate for dissemination of research, Table 15 contains statements which sought to elicit from respondents their perception of the use and value of communication methods for actual adoption or use of research.

Similar to the ratings provided for specific media are some perception statements in Table 15 relating to specific types of media for the transfer of research findings into practice.

Existing technical publications, published reports, and mass media were not considered sufficient to transfer research findings into practice. The majority of respondents generally see research journals,
Table 15. Evaluation of Use and Value of Journals and Other Publications for Adoption of Technology

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Disagree</td>
</tr>
<tr>
<td>a. Existing technical publications, published reports and mass media are sufficient for the transfer of most water resources research findings into practice.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>58%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>58%</td>
</tr>
<tr>
<td>b. Research journals, technical and trade publications are the most frequently used source of current water resources research information.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>7%</td>
</tr>
<tr>
<td>c. Generally, papers published in research and technical journals present research findings in such a way as to facilitate utilization of the information by water resources agencies or other practitioners.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>64%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>45%</td>
</tr>
</tbody>
</table>

technical and trade publications as the most frequently used sources of research information, though only a few view these sources as presenting findings in such a way as to facilitate their utilization.

The findings reveal that many existing means of disseminating information are perceived as inadequate for most users. These media probably have their greatest strength in creating awareness of research rather than actual adoption.
Public Understanding and Educational Needs

Continuation of water resource programs supported by public funds is heavily dependent upon an informed citizenry. All systems represented in the communication model have a role in creating citizen understanding. In this section respondents' perceptions of public understanding and educational programs are presented and analyzed.

Public understanding and citizen participation are becoming increasingly important for development and support of comprehensive water resources programs.

A number of water resources agencies and organizations are attempting to create better public understanding with some educational output. These include the North Carolina Departments of Natural and Economic Resources and Public Instruction. Civic organizations which provide educational information on water resources include the League of Women Voters, Soil and Water Districts, North Carolina Wildlife Federation, and the Conservation Council of North Carolina.

Even though there are many agencies and groups providing information, the evidence is quite clear that the public's understanding and participation in water resources planning and management is extremely low. Table 16 includes statements relating to respondents' perception of public understanding and educational needs.

A majority of the respondents believe that the public does not have a good understanding of water-related problems. There is considerable agreement that public participation is highly desirable in setting policy in resource management. In statement (b) a higher percentage of users than researchers agrees that state and local leaders are sufficiently concerned with proper management of water resources. However, with both
Table 16. Perception of Public Understanding and Educational Needs Relative to Water Resources

<table>
<thead>
<tr>
<th>Statement</th>
<th>Resp. Group</th>
<th>Total N</th>
<th>Response</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The public in this state has a good understanding of water-related problems.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>88%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>86%</td>
<td>4%</td>
</tr>
<tr>
<td>b. Generally, the state and local leaders in this state are sufficiently concerned with proper management of water resources,</td>
<td>Univ. Res.</td>
<td>154</td>
<td>60%</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>45%</td>
<td>41%</td>
</tr>
<tr>
<td>c. Greater public participation is a highly desired feature for setting public policy in resource management.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>10%</td>
<td>77%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>14%</td>
<td>74%</td>
</tr>
<tr>
<td>d. There is no need for a university-sponsored public educational program relating to water resources.</td>
<td>Univ. Res.</td>
<td>154</td>
<td>85%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Users</td>
<td>146</td>
<td>79%</td>
<td>9%</td>
</tr>
</tbody>
</table>

groups, over half of the respondents perceive that state and local leaders are not being sufficiently concerned. In statement (c) there was an almost identical response with a high percentage of both groups agreeing that greater public participation is a highly desired feature for setting public policy in water resource management.

Less than 10 percent of all respondents agreed with statement (d) that there is no need for a university-sponsored public education program on water resources. Closely related to this point is information published in the Institute's Report No. 47. In that report, titled "Perception of Water Resource Information Sources and Education Needs by Local Officials and Special Interest Groups," there was an expression by
82 percent of 554 respondents that there is not an adequate public education program on water resources in North Carolina.

There is no evidence that any agency or group in the state is providing leadership and guidance for a comprehensive public education program in water resources. This, perhaps more than any other reason, accounts for low public understanding. The respondents indicated there is need for a university-sponsored public education program in this field. Yet, there has also been a lack of leadership in development and implementation of a public education program in the university community. A number of departments at several universities have been involved in educational work in water resources, but no department has assumed responsibility for a comprehensive public education program. University extension has taken some initial steps in air resources and is proposing the development of a program for water as a part of a comprehensive effort in environmental quality.
BIBLIOGRAPHY


Carpenter, William. 1970. Communication Model, Department of Agricultural Information, N.C. State University, Raleigh, N.C.


APPENDIX A

UNIVERSITY QUESTIONNAIRE
Dear Sir:

As a member of the university community with interest in water resources, you are being asked to participate in a survey that will provide valuable knowledge relating to water resources research and information. The results of this study will be helpful in strengthening future university water resources research and information programs in North Carolina.

I am interested in your own opinions, ideas, and knowledge. The questionnaire will require only a few minutes to fill out; there are no "right" or "wrong" responses, and you can complete the questions without looking for any references.

Because the sample is very small, your response is vital to the completion of the study. Information obtained from the questionnaire will be kept strictly confidential.

The term water resources, as used throughout this questionnaire, refers to a complete system covering many uses of water including domestic, industrial, waste disposal, agriculture, recreation, natural beauty, forests, wildlife, fisheries and transportation. It also is concerned with flood control, land drainage, erosion control, flood plain zoning and other aspects of water resources planning and management.

Please recheck to make sure no questions have been omitted. Place the completed questionnaire in the enclosed, stamped envelope and mail as soon as possible.

Thank you for your assistance and cooperation.

Sincerely yours,

James M. Stewart

Enclosures

Note: Similar letter sent to users.
GENERAL INSTRUCTIONS

1. We are most grateful for your participation in the completion of this questionnaire.

2. You will find that each section can be completed rather quickly. Most of the questions can be answered by a simple check mark or the recording of a code letter or number. Please read the instructions at the beginning of each section before answering the questions.

3. Please answer all questions. Some of the statements are stated positive while others are negative. The important point is that you give your best appraisal to each statement being considered.

4. If you have difficulty in answering any question, please give us your best estimate or appraisal. You may wish to clarify your answer by making a comment in the margin or on the back.

5. Please do not place your name anywhere on the questionnaire. Your response will be anonymous. We are interested only in the composite responses of university researchers in the water resource related areas.

6. When you have completed the questionnaire, please recheck to make sure that no questions have been omitted. Please seal the completed survey form in the attached envelope and return it to the Institute Director.

7. Thank you again for your contributions.
SECTION I

1. In which university are you now working? 

2. How many years have you worked at a university? 
   _______ years

3. How many years have you worked at the university in which you are now employed? 
   _______ years

4. In what school are you employed? 
   
   1. Agriculture and Life Sciences  
   2. Engineering  
   3. Combination Engineering & Agriculture and Life Sciences  
   4. Forest Resources  
   5. Liberal Arts  
   6. Physical Sciences and Applied Mathematics  
   7. Textiles  
   8. Arts and Sciences  
   9. Graduate School  
   10. Public Health  
   11. Marine Sciences  
   12. Social Sciences  
   If other, please indicate ____________________________

5. Please indicate your major area of water resource research interest. 

6. Which of the following best describes the nature of your work? (Please check one) 
   
   1. Teaching  
   2. Research  
   3. Extension  
   4. Teaching and Research  
   5. Research, Teaching and Extension  
   6. Research and Extension  
   7. Teaching and Extension
SECTION II

Various researchers hold different views as to what should be the function and role of the University. In this section we are interested in your reaction to the statements as they relate to the University as a whole.

Please read each of the following statements carefully and indicate the extent to which you agree or disagree by placing the appropriate response code that best represents your feelings in the blank beside the statement. There are no right or wrong answers; just indicate your personal reaction.

<table>
<thead>
<tr>
<th>Response Code</th>
<th>Your Response</th>
<th>Code</th>
<th>Response</th>
<th>Your Response</th>
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</thead>
<tbody>
<tr>
<td>5</td>
<td>Strongly Agree</td>
<td>2</td>
<td>Disagree</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Agree</td>
<td>1</td>
<td>Strongly Disagree</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Undecided</td>
<td></td>
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</table>

7. Problem-oriented research is a proper function of the university.
8. When compared to basic research, the problem-oriented type should receive a lower priority.
9. It appears logical that industry should handle most problem-oriented research.
10. The public service role of the university is secondary to other functions.
11. Although neither can be ignored, it is relatively more important for research workers to have the approval of potential research users rather than their university colleagues.
12. Research relevant to contemporary problems is less satisfying than basic research.
13. Generally, researchers are not given enough freedom in determining the major research emphasis and direction in which they may work.
14. Water resource agencies generally have ample opportunity to voice their opinions on needed research.
15. Most university researchers feel relatively sure that the public agencies hold their work in high esteem.
16. Most organizations and agencies are potentially capable of handling their own water research problems.
17. Generally, most organizations and agencies do not need research assistance from the university.
18. The public in this state has a good understanding of water-related problems.
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<tbody>
<tr>
<td>5</td>
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<tr>
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<td>2</td>
<td>Disagree</td>
</tr>
<tr>
<td>1</td>
<td>Strongly Disagree</td>
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</table>

19. Generally, the state and local leaders in this state are sufficiently concerned with proper management of water resources.

20. Greater public participation is a highly desired feature for setting public policy in resource management.

21. There is no need for a university sponsored public educational program relating to water resources.

22. There should be no reluctance by members of any water-related agency to call on the university for its broad research needs.

23. State water resources agencies should handle their own problem-oriented research.

24. Given the opportunity, most researchers in water resources related fields would not do more problem-oriented research.

25. Within the present university rewards system (tenure, salaries, academic rank) there is greater incentive for faculty involvement in basic rather than problem-oriented research.

26. Individual practitioners and water-related agencies feel free to contact the university faculty to request needed research in water-related areas.

27. Generally, the university faculty encourages practitioners and water-related agencies to contact them for needed research.

28. There is no hesitancy on the part of university researchers to freely contact the public water resources related agencies and practitioners to identify research needs.

Many researchers differ in their opinions of the role that the university should play in communicating research findings to the potential users. This would be expected. You are asked to give your response to the following questions:

29. It is not of major concern to most researchers that their findings be disseminated and utilized by practitioners.

30. Communication between university researchers and public water resource agencies or practitioners is satisfactory at the present time.

31. The "universities" major obligations are those of teaching and conducting research, compared to extension activities.
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<tr>
<th>Response Code</th>
<th>Your Response</th>
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<tbody>
<tr>
<td>5</td>
<td>Strongly Agree</td>
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<td>3</td>
<td>Undecided</td>
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<tr>
<td>2</td>
<td>Disagree</td>
</tr>
<tr>
<td>1</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

32. The efforts now being made to communicate information on water resource research findings appear reasonable and adequate.

33. A complete program of applied research should include a system for dissemination, utilization and obtaining feedback from practitioners.

34. Since the university in most instances is supported by public funds, it is obligated to offer its services to those problem areas of broad public concern.

35. While there has been a great amount of discussion about extension-type programs in the past, most of the effects have been overrated.

36. Conferences and other means of face-to-face contact between university researchers and practitioners should be increased to improve mutual understanding of water resource problems and research needs.

37. Potential users of water resources research in public agencies and private practice find it relatively easy to communicate directly with university researchers.

38. Existing technical publications, published reports and mass media are sufficient for the transfer of most water resources research findings into practice.

39. Water resources research findings differ from other forms of research and should be handled differently.

Professional people often receive information from many sources which is helpful in the performance of their responsibilities. The types of materials received and used vary among individuals.

40. Research journals, technical and trade publications are the most frequently used source of current water resources research information.

41. Faculty members are avid readers of research and technical journals.

42. Closer communication between researchers and public agency personnel to transfer current water research findings is not desirable.

43. The current systems of communication of research information in the field of water resources is adequate to meet the present needs of water resources agencies and practitioners.

44. Generally, papers published in research and technical journals present research findings in such a way as to facilitate utilization of the information by water resource agencies or other practitioners.
The WRRI sponsors a variety of water resources research. Differences of opinion may exist on the types of projects funded and the methods used for selection.

_45._ There appears to be a proper balance in the research areas being funded by the Institute.

_46._ Present funding of projects by the Institute is not in keeping with the actual water resources research needs in this state.

_47._ The majority of the Institute research reports appear to be of excellent quality.

_48._ More personal contacts with the Institute would be a helpful means of obtaining current water resources research information.

_49._ The Institute research program is relevant to this state's water problems.

The WRRI supplies information on water resource research. Individuals vary in their appraisal of this information. Please indicate your feelings to the following:

_50._ The Water Resources Research Institute is viewed by researchers as a major source of water research information.

_51._ The published reports of the Institute are a useful and practical source of water resource information.

_52._ The Institute should confine its energies to research and let other organizations concern themselves with communication and utilization of research results.

_53._ The Institute does not appear to be deeply concerned with current water resource problems and research needs.

_54._ A complete program including dissemination, utilization and obtaining feedback of water research problems is not needed at this time.

_55._ There is a need to be better informed of the research findings of the Institute sponsored projects.

_56._ The research information coming from the Institute has no immediate application to current needs.

_57._ The proposals submitted from this department for new research are given adequate consideration by the Institute.
Faculty members of my department are reluctant to suggest changes in research programs being conducted by the Institute.

Additional efforts by the Institute will not be useful for communication of research information to users.

It is more important that we make better use of existing water research information than to generate more of it.

The use of a technical committee by the Institute to review projects submitted and recommend those to be funded is a satisfactory method of project selection.

The Water Resources Research Institute's major functions include the development and coordination of a research program directed toward meeting the broad water resources research needs of the state. It provides funds for specific research efforts to meet these needs. If additional funds were provided to the Institute, it is important to know how you feel these funds could best be utilized to effectively and efficiently meet the state's future water resource problems.

Additional funds could be most effectively used to supplement departmental efforts in water-related research.

None of the funds need to be used to identify the principal research needs.

Some funds should be used by the Institute to obtain greater utilization of research presently available.

The Institute should utilize some funds to improve the dissemination and utilization of water resource research to potential users.

The Institute's function in water resources research is about at the level it should be.

The Institute should provide guidance to the total state's water resources research program in the future.

Interdisciplinary research and education involves the association of a number of individuals from several disciplines in a close working relationship to conduct complex research studies and educational programs.

Academic incentives for faculty researchers are conducive to involvement in interdisciplinary research and education programs.

The present attitude of heads of departments are conducive to increased interdisciplinary effort.
An important function of the Institute is to coordinate water resources research within the State of North Carolina.

The annual inventory of research projects provides up-to-date information concerning on-going research. Copies have been sent automatically to all faculty who have expressed an interest in water resources research.

The Institute also tries to keep abreast of proposed research as a part of its coordinating function.

70. The Annual Inventory of Active Water Resources Research Projects is a useful coordinating mechanism.

71. The Annual Report of Water Resources Research Interests in the Senior Colleges and Universities of North Carolina serves no useful purpose.

72. Copies of research proposals to funding agencies other than the WRRI should be sent to the Institute on an information-only basis to facilitate coordination.

73. There is a wide range of opinion concerning the classifications of research as to "basic," "applied," and so forth. For this reason, the Institute has used such terms as "problem oriented" and "relevant" to describe its research emphasis. Even here, there is the question of what is appropriate research for the University in contrast to the public water resource agencies. Please indicate with a check following each example the degree to which you believe each example represents the type of water resource research a university should be conducting.

<table>
<thead>
<tr>
<th>Response Code</th>
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<tbody>
<tr>
<td>5</td>
<td>Strongly Agree</td>
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<tr>
<td>4</td>
<td>Agree</td>
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<tr>
<td>3</td>
<td>Undecided</td>
</tr>
<tr>
<td>2</td>
<td>Disagree</td>
</tr>
<tr>
<td>1</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>

a. Temperature response of aquatic ecosystems
b. Collection of temperature data on N.C. streams and coastal waters
c. Simulation model for optimal location of steam-electric generator plants
d. Effect of low-flow augmentation from federal reservoirs on downstream water temperatures
e. Suggested standards for N.C. streams and coastal waters
f. Fisheries distribution in response to thermal pollution
74. Please indicate if you feel that by participating in interdisciplinary research and education you would be positively (+) or negatively (-) affected in the following areas. (Please check the columns which you feel appropriate.)

<table>
<thead>
<tr>
<th>Positive (+)</th>
<th>Little Effect</th>
<th>Negative (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Prestige</td>
<td>2. Rank</td>
<td>4. Salary</td>
</tr>
<tr>
<td>7. Recognition</td>
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</table>

Comment: _____________________________

SECTION III

Contacts with the Water Resources Research Institute

75. Which of the following contacts have you had with the WRRI during the past year? (Example: Director visited me twice during the past year to discuss water research related problems, I participated in a seminar sponsored by WRRI, etc.) Circle the item in the column which best describes the frequency of these contacts.

<table>
<thead>
<tr>
<th>Kind of Contact with the WRRI</th>
<th>Degree of Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never 1</td>
</tr>
<tr>
<td>1. Visited by the WRRI director</td>
<td>0</td>
</tr>
<tr>
<td>2. Telephoned by the WRRI director</td>
<td>0</td>
</tr>
<tr>
<td>3. Written by the WRRI director</td>
<td>0</td>
</tr>
<tr>
<td>4. Visited the Institute</td>
<td>0</td>
</tr>
<tr>
<td>5. Telephoned the Institute</td>
<td>0</td>
</tr>
<tr>
<td>6. Wrote the Institute</td>
<td>0</td>
</tr>
<tr>
<td>7. Used the Institute Library</td>
<td>0</td>
</tr>
<tr>
<td>8. Participated in Seminars, Workshops, Conferences, and other meetings supported by the Institute</td>
<td>0</td>
</tr>
<tr>
<td>9. Received publications (other than newsletter) from the Institute</td>
<td>0</td>
</tr>
<tr>
<td>10. Other Contacts (Specify)</td>
<td></td>
</tr>
</tbody>
</table>
76. Have you ever had an opportunity to submit a research request to the Water Resources Research Institute:
   1. Yes  2. No  3. Uncertain

77. In general, how helpful have all the above contacts been in helping you to keep abreast of water resources research efforts?
   1. Very helpful  4. Of little help
   2. Helpful      5. Not helpful
   3. Some help

78. What major changes would you suggest to improve the effectiveness of the Institute to serve the university researchers?

1.

2.

3.

79. Please indicate the name, nature or title, from memory, of a research project completed or now underway which was sponsored by the Water Resources Research Institute.


80. Do you desire to be better informed about the Water Resources Research Institute research program?

   1. Yes  2. No  3. Not sure

81. What is your general opinion of the publications, other than the newsletter, which you receive from the Water Resources Research Institute?
   1. Excellent  3. Fair  5. Have not received
   2. Good       4. Poor  any publications

82. How could the Institute improve its publications excluding the newsletter? Please check appropriate answers.
   1. Have reports reviewed by prepublication committee.
   2. Give more attention to preparing publications for specific audiences.
   3. Include a summary of additional research needs highlighted by the current research project.
   4. Include examples for application of research findings where appropriate.
   5. Other

83. Do you receive the Institute's monthly newsletter? 1. Yes 2. No

84. How would you evaluate the Institute's monthly newsletter?
   1. Highly effective  3. Minimally effective
   2. Moderately effective  4. Not familiar
85. What suggestions do you have for improving the Institute newsletter?

_________________________________________________________________________

86. Do you have any suggestions for improving the communications program of the Water Resources Research Institute?

Please check (✓) one response.

___ 1. Have more conferences, seminars to present research results.

___ 2. Maintain a newsletter containing brief notes on research findings.

___ 3. Distribute copies of all completed research reports.

___ 4. Develop methods of explaining and interpreting research results to users and obtaining feedback.

___ 5. A combination of all of the above.

___ 6. None of the above.

87. What other suggestion do you have for improved communications?

_________________________________________________________________________

88. Please list the most important technical magazines to which you subscribe containing water resource research information.

_________________________________________________________________________

89. How interested are you in water resources research? Please check (✓) one response.

___ 1. Highly interested

___ 2. Moderately interested

___ 3. Little or no interest

90. Have you ever participated in public hearings in water planning or management called by state or federal agencies?

91. Do you feel the needed water resources research studies are being undertaken?

   1. Yes  2. No  3. Uncertain

92. Is the present flow of information between university researchers and potential users of water resources research information adequate to identify additional research needs?

   1. Yes  2. No  3. Uncertain
93. Who has the major responsibility for initiating communication between the university researchers and public water resources agencies or practitioners? (Please check one.)

- 1. University researchers
- 2. Public water resource agencies or practitioners
- 3. Dual responsibility of a and b
- 4. Water Resources Research Institute
- 5. Other

94. Do you feel there is a need to improve the flow of water resources research information to practitioners or users?

1. Yes     2. No     3. Uncertain

95. Please evaluate the effectiveness of the following methods employed by university researchers to disseminate their findings. Use the following scale numbers to evaluate the methods for both practitioners and other researchers.

High - 3
Moderate - 2
Low - 1

<table>
<thead>
<tr>
<th>For Practitioners</th>
<th>For Other Researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Publication of individual technical reports or papers</td>
<td></td>
</tr>
<tr>
<td>2. Publication in scientific and technical journals or magazines</td>
<td></td>
</tr>
<tr>
<td>3. Technical seminars and conferences</td>
<td></td>
</tr>
<tr>
<td>4. Review findings with practitioners and potential users in special meetings</td>
<td></td>
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</tbody>
</table>

You have completed the questionnaire. Please go through once again to insure that your answers are clear and no items have been omitted except in cases where instructions indicated that you did not have to answer. Place the questionnaire in the pre-addressed, stamped, envelope and mail.

THANK YOU FOR YOUR PARTICIPATION
APPENDIX B

SECTION I OF THE USERS' QUESTIONNAIRE

OTHER SECTIONS THE SAME AS UNIVERSITY QUESTIONNAIRE
SECTION I

1. This survey is being sent to selected officials and members of the following organizations or groups; please check below the one in which you are affiliated.

   ___ 1. The State Board of Health
   ___ 2. Department of Water and Air Resources
   ___ 3. Wildlife Resources Commission
   ___ 4. State Planning Division - Department of Administration
   ___ 5. Department of Conservation and Development
   ___ 6. Department of Local Affairs
   ___ 7. State Department of Agriculture
   ___ 8. Consulting Engineer
   ___ 9. Industry

   Other ____________________________

2. Number of years employed in the above organization or group? Years ______

3. Have you served on any committee for the Water Resources Research Institute?  ___ Yes  ___ No  If yes, please indicate in what capacity. ______________________________

4. Which of the following best indicates your major area of responsibility?

   ___ 1. Administration and Supervision
   ___ 2. Planning
   ___ 3. Research
   ___ 4. Education
   ___ 5. Design
   ___ 6. Sales and Marketing

   Other please indicate ______________________________