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PART III

COLORADO STATE UNIVERSITY

TECHNICAL REPORT 211(d) PROJECT

AID/csd 2460

August 31, 1971

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I. SUMMARY OF CONTRIBUTIONS TO THE UNIVERSITY CAPABILITY

A review of the total 211(d) Grant program for FY 1970-71 leaves little doubt as to the effectiveness of the Grant in stirring the interests of GRA's and faculty and, thus, further increasing the capabilities of Colorado State University with regard to teaching, research, and service in the area of water resources as related to less developed countries.

A. New Staff Personnel

There have been a number of additions to our teaching staff having experience in water resources. Dr. Ronald Tinnermeier joined the Department of Economics staff in March 1971. From 1967 to 1971 he was in Peru as an Assistant Professor of Economics with the Agricultural Mission, and also spent a year at Bogota, Colombia, with the Land Tenure Center. Presently he is involved in both 211(d) and CUSUSWASH activities as well as teaching. Dr. Wayne Clyma joined the Agricultural Engineering staff in June 1971 and, at present, is working on salinity in irrigation water. He is also working with Professor George Smith on Integrated Management of Ground and Surface Water. Professor William W. Hansen joined the Civil Engineering Department in June. He is presently working on a mathematical model for the Indus Basin Development in Pakistan as well as other related research. Dr. Garth Jones joined the staff at CSU in August of 1970 as a Development Specialist in Public Administration and Economics. Dr. Jones has had considerable international experience, especially in the field of Public Administration, recently as Chief of Party, University of Southern California in Pakistan, and later as Chief of Public Administration Division, AID Mission to Pakistan. He has made an excellent contribution to CSU's participation in international and interdisciplinary activities. Maxwell E. Becker joined the CSU staff in March 1971, as a technical administrator. He is responsible for both the technical and administrative requirements for the 211(d) program, the Water Management Research Project in West Pakistan, the AIT Project in Thailand, as well as to assist in developing new projects and programs. He has had wide international experience in technical assistance, administration, and research, especially in the field of forestry during the past 17 years.

These men joined the faculty and staff on the basis that they want to be involved in water resources activities related to the needs of the less developed countries. CSU continues to correspond with many other highly qualified scientists, some of whom appear to be interested in the needs of less developed countries and may join the CSU staff at a later date.

B. Graduate Research Assistants

In all, 21 Graduate Research Assistants have benefited from Grant funds. The time element of the benefit for each GRA varied from ¼ to 7½ months. The GRA's attend the International Interdisciplinary Seminars and participate in both leadership of the meetings as well as discussions. Some participated in the field trip to Mexico, some in weekly project leaders' meetings, and all received faculty consultation and guidance on an interdisciplinary basis with regard to research programs and projects, course offerings, and special activities on problems and needs of the less developed countries. This resulted in graduate students taking courses in other disciplines outside of their field of specialty.

C. New Course Offerings

211(d) funds have, both directly and indirectly, had a bearing on new course additions and course reorganizations.

For example: The course Institutions and Economic Development: Latin America, was initiated by the Department of Economics to emphasize the role of institutions in the process of economic development as well as to emphasize the interdisciplinary aspects of the development process. Another course offered for the first time, Economic Analysis and Water Resource Development, was given in response to the growing interest in water resources at the graduate level at CSU and promotes interdisciplinary approaches to problems of water resources management. The course was offered without support of 211(d) funds which is another example of the entrainment effect mentioned in Part III of this report. Two new courses, Geography of Underdeveloped Areas, and Geography of Native Farming Systems, contain a wealth of material germane to the purposes and goals of the 211(d) program. Thomas Harblin of the Sociology and Anthropology Department introduced a new course, Industrialization and Urbanization in the Third World in selected underdeveloped nations.

In addition to the new course offerings above, the Department of Political Science plans to offer 9 new courses in the area of Public Administration and 4 within the area of Environmental Politics and Administration. Also, 4 other courses have been revised and strengthened. Here, again, the entrainment effect of course reorganization and new course offerings is apparent. The men primarily responsible for the above, Phillip O. Foss, Chairman of the Department; Henry P. Caulfield, Leo J. Cefkin, Garth N. Jones, John A. Straayer, Norman I. Wengert, and others, happen also to be actively engaged in the International Interdisciplinary Seminar program supporting the CSU/AID

Contracts and actively promoting interdisciplinary approaches to solving problems of the less developed countries.

D. Publications

211(d) Grant funding was used in publishing two reports. They are:

1. The Effect of Data Limitations on the Application of Systems Analysis to Water Resources Planning in Developing Countries, May, 1971, Author: L. Garcia-Martinez.

2. Check-Drop-Energy Dissipator Structures in Irrigation Systems, May, 1971, Authors: G. V. Skogerboe, V. Somoray, W. R. Walker.

E. Special Activities

1. Seminar

The International Interdisciplinary Seminar in Water Resources Management was conducted during the academic year 1970-1971, and met for two hours each week throughout the academic year. Faculty members from seven academic departments constitute the Program Committee which critically reviews the seminar program each year and develops the plan for its conduct for the succeeding year. The Chairman of the Committee is Professor Henry P. Caulfield, Jr. of the Department of Political Science. The list of papers presented at the seminars, speakers, together with other information is given in Section III of this report.

2. Water Resources Library

As a result of considerable basic bibliographical searching accomplished at CSU during the past several years, it is apparent that there is a considerable body of valuable water resources literature not readily available. Much of this literature is of a fugitive nature, i.e., reports and papers with limited distribution and difficult to obtain. To overcome this problem as well as to more effectively meet increasing international and national responsibilities in Water Management Research, it is proposed that the CUSUSWASH Universities participate in an inter-university agreement to establish a library system that will eventually make all types of water resources information, including interdisciplinary approaches to water management on a world-wide basis, more readily available.

3. Role of Universities in the Future

Shortly after the Land Grant Act was signed by President Lincoln, the Land Grant College for Colorado was created in Fort Collins to work with the people in the rural areas through its extension service programs, and to provide higher education for the common man. The Colorado Agricultural Experiment Station was also created at Fort Collins as an integral part of the college to conduct research and experiments on problems confronting the farmer. Colorado State University thus has a long-standing interest in and commitment to the problems of development--particularly in arid agricultural areas where water resources are in short supply or not yet fully developed.

This very practical beginning for what is now Colorado State University has continued to be the central theme, a strong program in research, education, and service. The primary thrust of this program is in water resources development, including agriculture, engineering, watershed management, geology, economics, and various aspects of the biological and social sciences. There are now well over 100 faculty and more than 300 graduate students from both the United States and abroad that are involved in various water resource programs of research, education, and service in the different departments of Colorado State University.

However, today CSU feels that the Land-Grant University--at least in Colorado, has largely achieved its initial goals of developing excellence in Agriculture and the Mechanical Arts as established by the Morrill Act of 1862. This Act provided services to areas of important need 100 years ago, but what are the areas of need today? Should the university in the second century of its existence expand its goals and horizons to become more instrumental in finding solutions to the current and future social and environmental problems of society both at home and abroad? To better answer these questions, CSU is planning a conference devoted to examing what new directions United States colleges and universities should take to serve more effectively as instruments of planned social change and how best to implement these new directions. The conference will have a dual theme:

1. The role colleges and universities in the U.S. are able to play, and should play, in planned international development.

2. The extent colleges and universities can fruitfully expand their original horizons and address themselves to other problems in this country and abroad such as urban social problems and the nature of the human environment.

The above topic provides a fertile seed bed for designing new plans and approaches by CSU and other universities to far better fulfill the objectives of the 211(d) Grant program in the future.

II. OBJECTIVES AND SCOPE

A. Objectives

The major objectives of the Grant program are to increase and expand the existing competence of Colorado State University (CSU) in water delivery and removal systems and in development of institutions which are relevant to the various aspects of optimum utilization of water resources.

B. Scope

1. Using funds from the Grant, Colorado State University continues to improve its level of excellence with respect to planning, development, management, and utilization of water resources with special emphasis on water delivery and removal systems and relevant institutional development related to the needs of the less developed countries. This is being accomplished through the following steps:

   a. Expanding the professional staff in the various departments of the University which are now involved, or which would like to be involved, in water resources activities related to the needs of the less developed countries.

   b. Expanding the number of graduate students in these departments from, or interested in, the less developed countries.

   c. Expanding departmental research programs and activities related to the needs of the less developed countries.

   d. Expanding course offerings in these departments--including interdisciplinary courses--which are related to the less developed countries.

   e. Expanding special activities, and initiate new ones, in the United States and abroad which are related to research, teaching, and service--e.g., seminars, exchange programs, institutes, conferences, and publications which are concerned with the less developed countries.

   f. Helping to alleviate the critical shortage of qualified professional personnel with international interests, experience, and expertise, and with cross-cultural insights.

   g. Expanding the capability to serve in advisory and consulting capacity to various individuals, government agencies, industries, business and other organizations

who have an interest in activities abroad. It would be understood, however, that substantial specific services in this area will be funded by AID and any other sponsoring agencies under separate contractual arrangements.

h. Improving understanding of the nature of the less developed societies, and finding ways and means of assisting them to resolve crucial problems relating to water resources development and management.

i. Developing an exchange of personnel and publications, and other programs of interaction, which will help to establish steady and effective lines of communication between Colorado State University and the less developed countries.

2. Types of Specialization in LDCs

a. Development of water supplies from various sources.

b. Conveyance, delivery, and drainage of water in open and closed conduits, including rivers, canals, irrigation ditches, tunnels, and pipelines.

c. Storage and use of water in reservoirs, both above and below ground.

d. Control and measurement of water in storage, and water being conveyed either for delivery or for drainage.

e. Control of erosion and sedimentation with respect to storage.

f. Use of wells as a source of water or for storage of water underground.

g. Use of systems engineering for development of optimum solutions to problems of water resources utilization.

h. Understanding social, economic, political, and cultural factors in technological change, and the processes of developmental change.

i. Analysis of prevailing social systems, their structural-functional characteristics within specific less developed countries to determine:

*The kinds of structural changes necessary for maximizing water resource development and management, including the use of necessary new inputs.

*The sources of resistance to these necessary changes, and

*Effective ways of dealing with social resistance.

j. To analyze specific organizational and administrative structures for agricultural development in specific less developed countries to determine needed changes for better water utilization in maximizing agricultural production.

k. To conduct economic analyses, including input response studies, and including the analysis of delivery and removal systems, to achieve efficient and economic allocation of water for agricultural purposes in selected areas of the less developed countries.

l. By use of systems analysis, develop case studies analyzing and documenting the above relationships in selected areas of the LDC's for instructional research, and training purposes in a multidisciplinary setting.

3. Plan of Operation

Some broad and continuously expanding aspects of the plan of operation used as a guide in managing Grant funds includes the following:

a. Obtaining and analyzing existing information on water delivery and removal systems related to the less developed countries.

b. Obtaining and analyzing existing information on development of institutions relevant to optimum utilization of water resources in the less developed countries.

c. Preparing plans for additional research programs which will increase the knowledge of methods, techniques, and procedures for optimizing the utilization of water resources in the less developed countries.

d. Increasing the breadth and depth of teaching and educational materials for the subjects of this proposal and for the situations in various less developed countries.

e. Soliciting especially well qualified graduate research assistants, from both the United States and the less developed countries, who expect to work in some aspect of international development upon completion of their training.

f. Expanding the water management research library collection, especially with respect to the water resources problems of the less developed countries.

g. Developing a program of student and faculty exchange with selected less developed countries.

h. Planning, initiating, and expanding an interdisciplinary seminar on development and the interrelationship of the many factors involved in development--especially in the less developed countries.

i. Conducting short courses, institutes, seminars, and other activities to stimulate other personnel to become more deeply and actively involved, and to help in continuing education for those already involved in various aspects of international development.

III. MAJOR ACCOMPLISHMENTS

CSU accomplishments may be characterized by their entrainment effect, the elements of which are fully described below. The manner of funding is also essential in determining the type and scope of accomplishments. The funding from 211(d) Grant at Colorado State University continues to be used very carefully in relatively small amounts to entrain other funds and personal time and effort from various sources that exist in the university structure and in various professional organizations. Also, the funding in small amounts stimulates the individual to entrain other funding and efforts to support and expand the interest and capability of personnel and organizations with respect to international development.

CSU accomplishments are also characterized by their interdisciplinary approach to international development involving technical, social and cultural factors. One aspect of this approach, and a very effective one, is developed through the International Interdisciplinary Seminar in Water Resources Management described in detail below.

On the basis of accomplishments thus far, it can be concluded that the 211(d) Grant funds for increasing institutional capability can serve as pump-priming money to entrain the time and effort of various faculty and graduate students together with funds from numerous other sources already existing in the university structure or which have the potential for being brought into the university structure.

A. Entrainment Effect

The 211(d) Program has charged CSU with the responsibility of involving not only the technical aspects but also the social science aspects of improving the capability of CSU to perform various functions beneficial to international development. We have taken the position that we can best improve our capabilities through improving our human resources, our various educational and research programs, and our service activities--all of which have been the assigned responsibilities of Land-Grant Institutions since they were first created more than 100 years ago. The various parts of this total effort consist of the following:

1. Providing new staff

The capability of CSU in international development is quite strong in some disciplines, but needs considerable strengthening in other disciplines. For this reason funds in small amounts have been provided to make it possible to employ several new staff members. Although the funds provided through the Grant have been a small percentage of the total necessary to employ and service these individuals, the funds have been used in such a way as to insure that

each individual employed has a capability in a technical area of concern to the LDC's and an interest in working in international development either in the United States or overseas, or both. By this means a small amount of money has been spent from the Grant and yet an individual with the desired qualifications has been obtained and paid for largely by funds which have been entrained from other sources.

2. Improving staff capability

Many of the existing staff members at CSU have exceptional capability in technical fields of interest under the 211(d) Grant Program. However, the efforts of most of these individuals have not been directed toward the area of international development. By using small amounts of funding from the Grant, it has been possible to get a rather large number of the faculty to direct their technical capability toward international development. Thus, the entrainment effect has also been used here to bring other funds to bear on the 211(d) Program.

Staff capability has been increased by having individuals make trips to the LDC's to become acquainted first hand with the LDC's and their problems, by paying one or two months of his salary per year so that he will have time to direct his existing technical capability toward the problems of international development, by providing him a graduate research assistantship so that the faculty member is directing at least one graduate student toward the application of his technical field of specialization to international development, and by helping to make arrangements for various staff members to be consultants on problems of international development, both in the United States and overseas, with various agencies concerned with this effort. Again, the objectives of the Grant are accomplished largely by funds entrained from other sources.

3. Increasing or improving technical information

The capability of CSU to perform services in the field of international development is largely dependent upon the generation of additional or improved technical data and information regarding the various facets of international development. This is true not only in engineering and agriculture, but also in the social sciences with respect to the techniques of helping development actually to occur. To accomplish this objective, small amounts of money have been provided to various professors and programs where effort is already under way or could be initiated without large-scale funding from the Grant. Here again the intent is through the entrainment effect to stimulate a professor with existing technical capability to direct his efforts toward

international development. In some cases a graduate research assistantship is provided which will cause a graduate student and his professor to become heavily involved, both in the development of research and special studies and in publishing--to provide in the literature additional information required for better international development.

The 211(d) Grant has resulted in a number of papers and other professional publications being prepared in the general direction of international development which otherwise would have been prepared with a different approach or would not have been prepared at all. Small amounts of funding have also been used for the purchase of publications which bear upon some aspects of international development.

In each of the foregoing cases the entrainment effect is operating because the graduate research assistantship is not expensive and yet both the class work and the research of the graduate student is directed entirely toward international development, and the professor must be largely oriented in the direction of international development despite the fact that his funding is for only a small part of his total time. Likewise, the library and other parts of the university which purchase publications use their own funds to purchase additional publications on topics related to international development because they observe the extent of interest on the part of the faculty and the graduate students.

4. Strengthening organizational structure

Although accomplishing the objectives of the 211(d) Grant requires the expansion and improvement of human capability--both students and faculty--it is also of utmost importance that the necessary organizational structure be provided which will permit these individuals to be effective, both now and in the future. Such organizational structure includes various types of programs--academic, research, and service. The academic programs include combinations of courses which are designed around the theme which expresses the purpose of the 211(d) Grant. In all participating departments courses have been added and existing courses have been reoriented so that there is a heavy emphasis on international development and the technical areas of concern under the 211(d) Grant. This is true also of the research programs and other activities of a service nature. Assistance has been given to various "centers" and committees within the university structure to guide their activities into international development. The entrainment effect is in operation here because small amounts of funding have resulted in very largely directing the efforts of the entire organizational structure toward international development.

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ted during the academic year 1970-1971,
each week throughout the academic year.

Faculty members from seven academic departments--Agricultural Engineering, Agronomy, Civil Engineering, Economics, Fishery and Wildlife Biology, Political Science, and Sociology--constitute the Program Committee which critically reviews the seminar program each year and develops the plan for its conduct for the succeeding year. The Chairman of the Program Committee and the faculty member in charge of the conduct of the seminar is Professor Henry P. Caulfield, Jr., of the Department of Political Science and, up to August 1969, Executive Director of the Federal Water Resources Council, Washington, D.C.

2. Seminar Guidelines

Guidelines for conduct of the Seminar, which were adopted in the fall 1969, are still in effect. They provide that the purposes of the interdisciplinary seminar (with respect to water resources management generally, but especially in LDC's) are to:

a. Identify the factors involved in such management and their interrelationships;

b. Relate these factors and their interrelationships to optimum water resource utilization;

c. Develop models reflecting alternate strategies for achieving of one or more conceptions of optimum utilization of water resources;

d. Test these models in relation to the experience of practitioners and observers of water resources management;

e. Recommend research to test these models explicitly and in greater depth;

f. Enable through the seminar, in successive terms and years, the cumulative development of multidisciplinary and interdisciplinary knowledge of water resource management and the diffusion of such knowledge among members from all participating academic departments; and thus

g. Contribute to the achievement of increased levels of competence in water resources management among faculty at Colorado State University (CSU) in accord with the objectives of the Congress providing for institutional development programs through enactment of Section 211(d) in the Foreign Assistance Act of 1966 (P.L. 89-583) and of AID in making its Grant to CSU of May 23, 1969.

3. Types of Seminar Papers

a. Interdisciplinary seminar papers prepared by faculty-student teams on major interdisciplinary problems in water resources management.

b. Country by country presentations on cultural and institutional factors pertinent to water resources management with particular focus on change from traditional to modern agriculture.

c. Outstanding speakers on topics particularly pertinent to the concerns of the Seminar.

4. Interdisciplinary Seminar Papers Presented

a. "Fisheries, People, and Priorities," W. Harry Everhart, Professor, Department of Fishery and Wildlife Biology; Howard Alden, Associate Professor, Department of Recreation Resources; Charles W. Thomas, Professor of Engineering, Department of Civil Engineering; Thomas Van Valey, Assistant Professor, Department of Sociology and Anthropology; and Holmes Rolston, Assistant Professor of Philosophy, Department of Philosophy.

b. "Integration of Vector Prevention and Control into Multipurpose Management of Water Resource Development Projects," Dr. A. D. Hess, Assistant Director of Ecological Investigations Program and Chief, Fort Collins Laboratories, U.S. Public Health Service; Mr. Louis J. Ogden, Assistant Chief, Ecology and Control Unit, Zoonoses Section, Fort Collins Laboratories, U.S. Public Health Service; Mr. Fred D. Harmston, Assistant Chief, Biology and Control Unit, Arboviral Disease Section, Fort Collins Laboratories, U.S. Public Health Service. Opening discussion by Colin Webster and Ray Ericson, graduate students in the Department of Political Science and Department of Watershed Sciences, respectively.

c. "Optimal Timing of Water Application," Dr. Raymond L. Anderson, Research Economist, USDA Economic Research Service; Dr. Garth N. Jones, Professor, Department of Political Science; Dr. Bashir M. Malik, Post-Doctoral Fellow, Agronomy.

d. "Green Revolution: Farm Size, Mechanization and Employment," Dr. Huntley H. Biggs, Assistant Professor, Economics Department, and "Some Political and Social Consequences," Robert F. Schmidt, Graduate Research Assistant, Political Science Department.

e. "Modeling Water Quality in Rivers," John Hendrick, Graduate Research Assistant, Civil Engineering Department.

f. "Conjunctive Use of Ground and Surface Waters," Robert L. Longenbaugh, Assistant Professor, Department of Civil Engineering; Robert A. Young, Associate Professor, Department of Economics; and George E. Radosevich, Attorney and graduate student in Department of Economics.

g. "Dynamic Optimizing Model for Comprehensive River Basin Planning," Dr. Maurice L. Albertson, Professor of Civil Engineering; M. T. Chaudhry, Graduate Research Assistant, Department of Civil Engineering; John Davenport, Graduate Research Assistant, Department of Civil Engineering; and Dr. Archie D. Hess, U.S. Public Health Service.

h. "Land Classification," Dr. John O. Reuss, Associate Professor, Department of Agronomy; Mr. R. D. Heil, Assistant Professor, Department of Agronomy and Mr. J. Stuart Krebs, Assistant Professor of Geography.

i. "The Effluent Society: Water Reuse and Recycling," Dr. Albert G. Mercer, Associate Professor of Civil Engineering; Dr. David W. Hendricks, Associate Professor of Civil Engineering; and Mr. Noel Hobbs, Chief Planner, Denver Water Department.

5. Country by Country Presentations

a. "Cultural and Institutional Problems in the Transformation of Traditional to Modern Agriculture--Introduction to Forthcoming Country by Country Presentations," Linwood Hodgdon, Professor of Sociology.

b. "Transforming Traditional Agriculture: Schultz's Economic Model and a Critique of This Model," Professor Linwood Hodgdon, Professor of Sociology.

c. "Toward an Interdisciplinary Model of Development in Under-Developed Countries--Part I," Dr. Loyal M. Hartman, Professor of Economics.

d. "Toward an Interdisciplinary Model of Development in Under-Developed Countries--Part II," Dr. Loyal M. Hartman, Professor of Economics.

e. "A Classification System for Ideological Components in International Development," Robert Schmidt, GRA, Political Science Department.

f. "Cultural, Institutional and Agricultural Change in North Africa: Morocco, Algeria, and Tunisia," Dr. Hubert J. Morel-Seytoux, Professor of Civil Engineering.

g. "Development and Water Management in Mexico," Dr. Gene Wilken, Associate Professor of Geography.

h. "Problems of Development in Botswana," Dr. Leo Cefkin, Professor of Political Science.

i. "Water Resources of Thailand: Distribution, History and Institutions for Development," Edmund F. Schulz, Associate Professor, Civil Engineering Department.

6. Presentations By Outstanding Speakers

a. "The Bureau of Reclamation's Foreign Activities," The Honorable Ellis Armstrong, Commissioner, Bureau of Reclamation, Department of the Interior, Washington,D.C.

b. "The Role of the U.S. University in International Development," Dr. Erven Long, Associate Assistant Administrator, Office of AID Research and University Relations, Bureau for Technical Assistance, Agency for International Development, Washington, D.C.

c. "Dynamic Optimizing Models for Comprehensive River Basin Planning--The Results of the Harvard Water Program and Subsequent Developments," John Wilkinson, Director, Water Program, Arthur D. Little, Inc., Cambridge, Massachusetts.

d. "International Boundary and Water Commission, United States and Mexico," The Honorable J. F. Friedkin, United States Commissioner.

e. "Observations on African and Mekong Water Planning," Dr. Gilbert White, Professor of Geography and Director, Behavioral Science Institute, University of Colorado, Boulder.

f. "Regionalism and Development--Case Studies Drawn From South Asia," Dr. M. Rashiduzzaman, Visiting Professor of Political Science, Columbia University, New York (1971-72) and regularly, Reader in Political Science, Dacca University, Pakistan.

g. "The Changing Culture in Ceylon," Dr. Walpola Rahula, Buddhist monk and scholar from Ceylon.

h. "Some Experiences With Agricultural and Water Resources Programs in Developing Nations--Particularly Iran," Dr. Harold Frederiksen (Civil Engineer), Deputy Director of Engineering, Development and Resources Corporation, Sacramento, California.

7. Special Interests Presentations

a. "Emerging Conceptions of Developmental Assistance: Implications of President Nixon's Proposal," Dr. Garth Jones, Professor of Political Science, CSU.

b. "The Peace Corps and the Process of Modernization: Reflections of Returned Volunteers," John Davenport, Trust Territories, Public Works; Philip Hosterman, Afghanistan, Public Works; Karl Paasch, Kenya, Agriculture; and Colin Webster, Thailand, Public Health.

c. "Future Directions of the Land-Grant University at Home and Abroad," Dr. Maurice L. Albertson, Professor, Civil Engineering; Mr. Jan Carlson, Director, Student Activities, Student Center; John Davenport and Philip Hosterman, Graduate Research Assistants, Civil Engineering. Discussants: Dr. Garth Jones, Professor, Political Science; Dr. M. W. Felton, Assistant Director, Extension Service, CSU; Robert Schmidt, Graduate Research Assistant, Political Science.

8. Faculty-Student Field Trip To Lower Balsas River Basin Project, Mexico

In addition to planning the foregoing seminar program, the Program Committee reviewed the recommendations steming from the Faculty-Student Field Trip, June 5-7, 1970, to the Lower Balsas River Basin Project, Mexico (see p. C-31, Part III (Colorado) of CUSUSWASH Annual Technical Report for 1969-70, dated August 31, 1971) and agreed that a second trip should be undertaken. Accordingly, 16 faculty members and graduate students from seven different academic disciplines undertook the field trip to the Lower Balsas River Basin Project, March 16-24, 1971, with the financial support provided by the 211(d) Institutional Grant to CSU. Dr. Huntley H. Biggs, Assistant Professor of Economics and a specialist in Latin American economic development, was team leader. The principle objective of the Institutional Grant is to enhance the competence of CSU in the water management problems of the less-developed countries. It is recognized that institutional arrangements and cultural factors have a definite bearing on the water management problems as they exist in different countries. Because of the long history of Mexico in the development of water resources, it follows that a knowledge of the Mexican experience would enhance the understanding of water management problems as they exist in the context of a less-developed country. The institutional arrangements in Mexico for developing and administering water and land resources provide valuable lessons for those intending to pursue their professional interests in the less developed parts of the world. Also, the proximity of Mexico, which provides a distinct culture contrast, affords convenient and economical access for U.S. universities. With one exception, the 16 participants (five faculty and eleven students) in the field trip to Mexico were U.S. citizens interested in developing their professional competence to deal with water management problems in the less developed countries of the world. The total cost per participant was $300. (For a full report on this field trip see Section III, Travel.)

9. Seminar's Contributions Towards Grant Goals

The continued implementation of item eight of the Operational Plan for carrying out the Grant Agreement, the International Interdisciplinary Seminar in Water Resources Management which, upon its inception, was an entirely new approach to education in water resources management at CSU, is clearly contributing to the Grant's overall objectives of increasing the competence and expertise of CSU among U.S. research and educational institutions and "to improve its level of excellence with respect to planning, development, management, and utilization of water resources." More specifically, in terms of specific grant objectives, the Seminar has expanded the interest of professional staff and graduate students in several departments in water resource management generally, and in less developed countries. Its wide multidisciplinary composition has furthered the interdisciplinary approach to understanding and solution of management problems. It has improved understanding of the nature of developing societies and of effectiveness in assisting them through comparative treatment of national experiences in developed and less-developed countries in water resources management.

10. Seminar's Planned Work For FY 1971-1972

The general plan developed by the Program Committee for conduct of the International Interdisciplinary Seminar on Water Resources Management in 1971-1972 calls for the following three types of seminar presentations:

a. Interdisciplinary Modeling of Water Management Problems Emphasis in the development of papers to be presented to the Seminar will be placed on rigorous construction of interdisciplinary models. Problems will be selected which appear to have good prospects of successful solution and that include variables from three or more academic disciplines. Recruitment of balanced faculty-student team to prepare approximately five such papers will be undertaken.

b. Theories of Modernization of Development of Less-Developed Countries. A faculty-student group especially interested in this subject will develop a program of presentations to cover selected models of modernization and development that have been developed by various scholars both in the United States and abroad.

c. Review of the Comprehensive Framework Study of the Platte-Niobrara Sub-Basin. This study is a part of the larger Comprehensive Framework Study of the Missouri River Basin (one of eleven such large studies now underway or recently completed in the United States) that has been recently completed by the Missouri Basin Inter-Agency Committee, which is composed of represen-

tatives of the several Federal departments and agencies and of the States that are concerned. A faculty-student group especially interested will undertake review of the Platte-Niobrara reports and prepare papers for presentation to the seminar. Criteria to be developed to guide the review will relate: (a) to the appropriateness of the study design, professional competence exhibited in conduct of the study, and the usefulness of the results in terms of the needs of the United States; and (b) to the usefulness of such an approach to planning water and related land resources use in less developed countries.

As in the first two years of the International Interdisciplinary Seminar, no academic credit will be given for participation by graduate students in the seminar itself. Nevertheless, it is expected that academic credit will be given by the departments concerned for participation in the preparation of the interdisciplinary papers that will be presented to the Seminar.

However, after reviewing the conduct of the Seminar for 1970-1971, the Program Committee decided that steps should be initiated to formalize the conduct of the Seminar within the administrative structure of the University, to obtain concurrence of the Faculty Curriculum Committee of the Faculty Council that the International Interdisciplinary Seminar in Water Resources Management be included among the regular course offerings for which academic credit is granted, and to have information about the Seminar included in CSU's General Catalog. The Program Committee plans to develop proposals along these lines and pursue acceptance of them during 1971-1972.

C. Other Accomplishments, FY 1970-1971

The total 211(d) Grant man-month input on the activity accomplishments by the participant disciplines indicated in Tables I and II, Section IV, amounted to 12.4% for the CSU faculty, while that of the graduate research assistants, including clerical and labor, reached a total of 24.9% on a 12-month basis. These figures decisively underscore the "entrainment" effect described in Section III.

Other CSU accomplishments, beside the International Interdisciplinary Seminar on Water resources Management, include the interdisciplinary activities of faculty and GRA's in accordance with the objectives of the 211(d) Grant program as follows:

1. Recruitment

Dr. Wayne Clyma joined the Agricultural Engineering staff in June 1971 and, at present, is working on salinity in irrigation water. He is also working with Professor George Smith on Integrated Management of Ground and Surface Water.

Professor William W. Hansen joined the Civil Engineering Department in June. He is presently working on a mathematical model for the Indus Basin Development in Pakistan and other related research.

Dr. Garth Jones joined the staff at CSU in August 1970 as a development specialist in Public Administration and Economics. Dr. Jones has had considerable international experience, especially in the field of public administration, recently as Chief of Party, University of Southern California, and later as Chief of Public Administration Division, AID Mission to Pakistan.

Dr. Ronald Tinnermeier joined the Department of Economics staff in March 1971. From 1967 to 1971 he was in Peru as an Assistant Professor of Economics with the Agricultural Mission, and also spent a year at Bogota, Colombia, with the Land Tenure Center. Presently he is involved in both CUSUSWASH and 211(d) activities as well as teaching.

The men joined the faculty and staff on the basis they want to be involved in water resources activities related to the needs of the less developed countries. CSU continues to correspond with many other highly qualified scientists, some of whom are interested in the needs of less developed countries and may join the CSU staff at a later date.

2. Faculty Research Activities

Research at CSU in the Department of Agricultural Engineering has been extended during FY 1970-1971 to include conveyance, control, and measurement of water in conveyance channels. The research efforts with respect to "Combination Check-Drop-Energy Dissipators" has been completed and the report is presently under final review. This report covers current concepts and procedures pertaining to design of these structures in irrigation conveyance systems, written by Gaylord V. Skogerboe, Venus T. Somoray, and Wynn R. Walker, was presented at the annual winter meeting of the American Society of Agricultural Engineers in Chicago in December 1970. In addition, parts of the draft of the final report were reproduced for distribution to students of AE 455, Irrigation Structures. Current research and analysis directed toward conveyance and measurement of water in conveyance channels in being undertaken by Mr. Tsu-Yang Wu, from Taiwan; Mr. Va-Son Boonkird, from Thailand; Mr. Ray S. Bennett, of the United States; and Mr. James H. Barrett, of Australia. Mr. Bennett has concluded data collection in the laboratory and is currently analyzing the data to develop rating curves for a wide variety of cutthroat flume sizes. Mr. Wu has also completed data collection on the hydraulic and rating effects caused by a longitudinal slope in the same cutthroat flumes. Both Mr. Wu's and Mr. Bennett's research are being closely coordinated to determine both the general relationship

of discharge rating in various flume sizes and the effects on these ratings caused by an imposed slope in the flume which is a common field occurrence resulting from uneven settlement in the foundation of the flume. Mr. Boonkird's work will be initiated during this report period relating to "Free Surface Subcritical Flow in Culverts." This area of research is an important area of needed evaluation because of the common occurrence of this regime of flow in culverts. In addition, the numerous culvert installations provide excellent water measurement structures, thus avoiding construction of standard measurement devices. Mr. Barrett has been working on developing criteria for analyzing various open channel constrictions found in irrigation distribution systems. Although the laboratory portion of his study will begin in July of 1971, he is currently completing an evaluation relating the Chezy and Manning channel roughness factors to the submerged flow equation developed by Professor Skogerboe at Utah State University. This will provide a basis for relating channel resistance in both the constricted and unconstricted open channel. To facilitate the data analysis required for Mr. Wu, Mr. Boonkird, Mr. Bennett, and Mr. Barrett, a submerged flow model has been developed by Mr. Walker of the Agricultural Engineering Department. The digital computer program has been used extensively during both Mr. Wu's and Mr. Bennett's research and has been shown to be a valuable tool. Mr. Barrett and Mr. Walker are currently developing a more comprehensive program to use in Mr. Barrett's analysis and which can be used to develop discharge ratings for submerged sections.

The departmental staff of Agronomy continues to investigate quality criteria for irrigation water on the Pakistan Water Management Project. This is closely coordinated with the educational program. In addition, field studies have been conducted at Fort Collins to evaluate irrigation and crop use efficiencies. Lysimeter facilities were used for precision measurement of evapotranspiration rates under varying meteorological conditions in order to relate potential and actual E.T. evapotranspiration. Data from outside sources were used to help evaluate the irrigation schedule methods under different climatic conditions. Some excellent data of this type is now available from other countries and needs evaluating.

Professor Biggs served as a team leader for the presentation on March 3 dealing with "The Green Revolution." In preparation, this team met six times to provide a background to the main topic. These sessions were devoted to the following talks:

October 8	"The Green Revolution: Requirements and Consequences." Professor Biggs, Department of Economics.
December 1	"An Interdisciplinary Approach to the Consequences of the Green Revolution," Group Participation.

February 4	"Economic Implications of the Green Revolution." Professor Biggs, Department of Economics.
February 15	"Political Consequences of Regional Economic Disparities." Rev. Robert Schmidt, Department of Political Science.
February 22	"Institutional Aspects of the New Seed-Fertilizer Technology," Professor L. Hodgdon, Department of Sociology.
March 1	"A Synthesis." Group participation.

Research continued in a number of fields and areas bearing the problems of development, including:

"Crop Climate Modification by Native Farmers" (draft now under review - Wilken).

"Resource Management and Farming Systems in East Africa" (proposal submitted to NSF in March, 1971 - Wilken).

"Tepetate, A Problem Soil in Mexico" (joint research by Wilken and Geology Department, funded by FIC 1970-71).

"Ecologic Implications by Economic Development" (paper in preparation - Wilken).

Professor Caulfield has continued his role as Chairman of the International Interdisciplinary Seminar in Water Resources Management, the implementation of item eight of the Operational Plan for use of the AID Grant. He serves as Chairman of the Program Committee for the Seminar composed of eight faculty members, implements the committee decisions by arranging for specific seminar presentations, chairs the meetings, and helps guide discussion to meaningful conclusions. In addition to his chairmanship of the International Interdisciplinary Seminar in Water Resources Management during 1970-1971, Professor Caulfield has participated in several of the meetings of the Council of U.S. Universities for Soil and Water Development in Arid and Sub-Humid Areas and is serving as a Consultant to the Water Section Resources at Transport Division, United Nations, in the preparation of draft paper on "Water Resources Policies." Professor Caulfield was a member of an international panel of experts which met in Buenos Aires, Argentina, in June 1970, and gave pertinent considerations to the topic of the paper. He is scheduled to attend the second meeting of the panel in Delft, Netherlands, to review the draft paper in September 1971. Dr. Garth N. Jones attended the Joint Utah State University/ Agency For International Development Conference held at Logan, Utah, August 17-24, on Institution Building. He chaired the Committee on the Pre-Planning Stage and drafted the final committee report. He also participated as a member of the Water Development Workshop Program of the Agricultural Development Council (ADC) and attended the first workshop session at Utah

State University, February 12-13, 1971; met with Harold Capener, Gilbert Levine and others at Cornell University on April 5 and 6, to develop research and training program on systems for water development in the less developed countries, and on April 7 discussed this proposal at ADC headquarters in New York. This activity was financed by ADC. Dr. Jones also presented a paper on December 23, 1970, to the senior scholars and professional staff of the East-West Center, Hawaii, on "Emerging Conceptions and Patterns of Development Assistance." His trip was independently financed. A research model for the evaluation of on-farm distribution systems was completed. This is based upon a simulation model developed by Raymond Anderson, ERS USDA, and Arthur Maass of Harvard University. It is proposed to test this model on one or more Southeast Asian irrigation systems, possibly those found in Indonesia and in the Philippines. The draft proposal has been completed. Preparation of titles for the CSU library acquisition on development administration and water management as well as a number of fugitive materials has already been turned over to the CSU library. In addition, for political science research, a large number of research items have been acquired, much of it of a fugitive nature.

While Sociology and Anthropology faculty time amounting to three and one-half months was provided by 211(d) funds, the actual time spent by the faculty (e.g. Drs. Dotson, Knop, Sardo, Van Valey and Vlachos) on aspects of the 211(d) in the department was twice as great. In addition, Dr. Linwood Hodgdon served as a department representative on the 211(d) Seminar throughout the academic year for which he was given one-half a month release time by 211(d) funds. The 211(d) project has stimulated professional interest in international development, particularly in natural resources, within the department. Likewise, the project has provided members of the faculty with a professional experience to acquire and broaden their knowledge of natural resource development on the international scene. The research of the program has been directed toward the following goals:

a. A continuation of the work towards creation of a data bank containing demographic and other information on the international and national level. Computer tapes for the State of Colorado as well as secondary census materials have already been acquired. Censuses of other countries are being collected systematically to the extent possible. The census of Venezuela is in CSU's collection, and arrangements are made to supplement our collection of Greek yearbooks with the Greek census returns of 1971.

b. Outlining some models on the impact of urbanization and industrialization on the quality of life. A problem of special interest has been the transformation of rural localities and the disappearance of farm land. A project has been initiated concerning economic and social costs and benefits of migration on selected Colorado communities.

c. Collecting information and works concerning models of water resources on both quantity and quality problems. Emphasis is placed on land use, natural resources availability, receptivity towards change and organizing schemes of systems approach. A paper has been submitted to the Rural Sociological Society entitled "Organizational Aspects of Irrigation Companies."

Special activities include:

a. A special monograph series, as well as a series of methodological notes, and a Newsletter. The methodological notes and monographs include such topics as: Simulation models and systems approach in natural resources (esp. water systems); demographic profiles and population projections; urban simulation and gaming; internal and international migration as factors in the developmental process; planned change and modernization with emphasis on the interplay between social and technological factors.

b. We are anticipating two monographs by July 1971--one dealing with the general population characteristics of Colorado (1970 Census). The other monograph will focus on international migration and will analyze the trends of emigration from Greece between 1950-1970 and the impact of the large population outflow on the prospects of Greek development. A third monograph is scheduled on "Natural Resources and Developing Countries," a joint effort of a number of Sociology faculty interested in problems of development and modernization.

Other activities include:

a. Providing the focus and a significant motivating force for a number of faculty and graduate students to turn attention to problems of developing countries, especially as they refer to the utilization of natural resources. It is expected that the data bank created, the expanded computer capability, the development of courses, seminars, and symposia, and all other training opportunities will provide the basis and at the same time reinforce the departmental commitment in the area of development.

b. The exchange of information and research plans in the area of natural resources and water management with a number of institutions and agencies abroad. Professional contacts have been made with the University of West Pakistan, Lyallpur; University of Sao Paulo, Brazil; and Pierce College, Athens. Efforts have also been made to initiate a study of "Metropolitan Intelligence Systems in Developing Countries." A lecture was given to the

Technical Chamber of Athens, Greece, and contact for future cooperation has been established with the Metropolitan Athens Water Company.

c. An exchange program has also been initiated with various population centers in the country and it is envisaged that regular contact and exchange will continue with various research organizations and centers, both in the U.S. and abroad.

3. GRA Research Activities

Four graduate research assistants, John Davenport, Alain Deredec, Philip Hosterman, Michael Schiefer in the Department of Civil Engineering are supported in part, and to a lesser extent seven GRA's, J. Duke, G. Lewis, G. Overacker, E. Rios, D. Taylor, R. Thaemert, and S. Doddiah (11 GRA's in all), are supported by the Grant to study water management and system analysis for the developing nations. An example of the type and scope of work accomplished by graduate research assistants as well as the effectiveness of the use of 211(d) funds for training and building interest in working with less developed countries on water resource development is the following research activities report by John T. Davenport.

"In fall quarter I expanded on some earlier work by Phil Hosterman and wrote a short paper with M. L. Albertson entitled, "LDC/CSU Development Worker Program. This paper outlined some possible ideas for CSU if it were to become much more intimately involved in international development than it is at present. A good percentage of these ideas stem from my own experiences in Peace Corps. However, writing this paper introduced me to some of the literature on development. I have continued to pursue this topic as one of my interests outside coursework.

During the academic year I attended nearly every 211(d) Interdisciplinary Seminar and was a participant in two of them. In one I was a panel member discussing the Peace Corps and in the other I presented the "LDC/CSU Development Worker Program" paper with Albertson and Hosterman.

From coursework from Charles Walter Thomas and Henry P. Caulfield, I have developed an interest in evaluation of water resource projects. This interest has been pursued inside and outside of coursework. I have studied specific evaluative criteria used by the U.S. government as well as the more general topic of technology assessment.

Over the spring break I traveled to the Balsas River Basin in Mexico with several students and faculty under the 211(d) Program. Here I was able to have many long conversations about development with Walter Illsley and other group members. I also observed several water resource development projects in a developing country setting.

In June I attended the two-week Water Resources Planning Seminar at Utah State University in Logan, Utah. This Seminar was very beneficial to me. The principal speaker, Mr. Aaron Wiener of Tahal, Israel, provided me with a wealth of new concepts with which to analyze water resource development in the Third World. Mr. Wiener also indicated to me that there may

be a place for me on a new research project that Tahal has with the World Bank. This project intends to investigate improving investment efficiencies for the World Bank in Latin American development projects. A particular focus will be on water resource projects.

During spring and summer quarters I have assisted M. L. Albertson and R. N. Hubbell in preparing for a Planning Meeting to be held September 3-5, 1971, at Estes Park. This meeting will lay plans for a conference in 1972 devoted to investigating new directions for the Land-Grant Universities with regard to international development. My efforts have consisted of helping draft letters and abstracting pertinent articles and books which deal with this subject.

I will attend the Planning Meeting September 3-5, 1971, and assist in tape-recording, note-taking, and other tasks to insure the meeting runs smoothly.

Beginning September 1, 1971, I will join Henry Caulfield and assist him with his O.W.R.R. Grant. This project intends to work on a methodology by which water resource planning policy can better be established and water resource projects can better be evaluated. The recent "Orange Books" of the Water Resources Council spell out the conceptual framework; and this project intends on making this framework implementable.

I expect my association with this project will be invaluable as far as backgrounding me further in water resource project evaluation. This project is, by necessity, a very interdisciplinary effort; and Henry Caulfield is an interdisciplinary person. To approach the field of evaluation, I must be able to analyze projects from several vantage points.

I expect my own dissertation will center on this topic of water resource project evaluation. At this time it seems that a good starting point would be to do some kind of post-audit analysis on an existing project. The purpose of this analysis would be to test out some of the findings of the O.W.R.R. Grant. The biggest problem will probably be the selection of a suitable project. An immediate task before me would be to study carefully all available literature on post-auditing.

There are three alternatives in doing this kind of study:

1. If Mr. Wiener decides for certain that I could join his project next summer (1972), I could perform this study in an international setting. The project will probably be located in Mexico City and may involve travel to one or more Latin American countries. Such a study would combine both my interests of evaluation and development. It could also strengthen the findings of the O.W.R.R. Project by subjecting them to an international analysis centering on development. This is the most desirable alternative to me. Further development of this idea must await word from Mr. Wiener.
2. If the project with Tahal doesn't materialize, I could possibly remain an additional year with Henry Caulfield and do this study with some U.S. project. This could be selected from the U.S. Bureau of Reclamation's files in Denver, for instance.
3. I could rejoin the 211(d) Project after one year and pursue the international development aspects of water resource project evaluation.

At this time my main concern is getting word one way or the other from Mr. Wiener. I expect to know more about this matter in mid-September after Henry Caulfield meets with Wiener in Delft, Netherlands.

I will continue to participate in the 211(d) Interdisciplinary Seminar during the coming year."

The following graduate students in the Political Science Department participated in the Interdisciplinary Water Management Seminar:

Robert Schmidt delivered a paper January 6, 1971, "Classification System for Ideological Components in International Development." Colin Webster participated in a panel on the role of Peace Corps in the development process February 17, 1971. Robert Schmidt participated in discussions on Green Revolution, March 3, 1971. Colin Webster participated in discussions chaired by Dr. M. L. Albertson exploring the role CSU may perform in the education of development personnel.

Other graduate student activities:

Colin Webster, a master candidate, divided his research time between Pakistan Water Management and preparation of an organization and management manual for irrigation companies. John Fly, a graduate assistant, despite the kidnapping of his father in Uruguay last August and the need for his services by his family in trying to obtain his father's release, continued under the supervision of Professor Caulfield a substantial program of study during 1970-1971 towards a M.A. degree and has drafted a preliminary design for a master's thesis pertaining to comparative political characteristics of developing nations. Mr. Fly plans to continue this academic program related to the 211(d) Program in 1971-1972.

Professor Biggs of the Department of Economics has taken the responsibility for supervising the study and research programs of the graduate students being funded under 211(d): Ph.D. candidate, P. Sananikone, and M.S. candidate, Larry Caswell. During the year, both students have regularly attended the International Interdisciplinary Seminar and actively participated in the team activities concerning the Green Revolution. Mr. Caswell and Mr. T. Harris, who will be funded as a GRA for FY 1971-72, represented the Department of Economics on the field trip to Mexico.

Mr. Caswell has completed the course requirements for the M.S. degree with emphasis on economic development and natural resources economics. He is currently working on his thesis entitled, "The Impact of Public Investment in Irrigated Agriculture on Mexican Economic Development," under Professor Biggs' supervision. This work should be completed by the end of the summer, 1971, but will require close supervision by Professor Biggs as part of his Grant responsibilities.

Mr. Sananikone is an outstanding Ph.D. student in the Department with an M.S. degree from the University of Colorado. Having completed the M.S. degree in November, 1970, he is pursuing course work for the Ph.D. degree with fields of specialization in economic development, natural resources economics, and international economics. Each of these fields

is essential in order for him to quality for holding a position in the Planning Commission of his home country, Laos. During the year, both graduate students have assisted Dr. Biggs in conducting research. Mr. Sananikone anticipates writing a dissertation on a development problem within the Southeast Asian area. During the summer, 1971, working under Professor Biggs' supervision, he will be investigating possible topics for his dissertation research.

The Department of Sociology is presently using the services of a GRA, Craig Brown, who has been working on population projections and is also helping in the computer analysis of the 1970 Census returns for the State of Colorado. He is also helping in the construction of a systems model for the analysis of natural resources. The group has already offered an assistantship to a foreign student from Greece who is going to help in a project on the impact of urbanization in developing countries on natural resources.

4. Course Changes

The Department of Economics offered a new course entitled EC 464, Institutions and Economic Development: Latin America. This course was initiated in direct response to the need for a course emphasizing the role of institutions in the process of economic development. The approach emphasized the interdisciplinary aspects of the development process, the majority of the class being noneconomics majors. Because of his experience and interests in Latin America, Professor Biggs selected this area as a case study. In addition, this course complements and places in perspective the contemporary economic problems analyzed in EC 466, Economic Development of Latin America. During the winter 1971, Professor Lee Gray offered for the first time a graduate course entitled, EC 542, Economic Analysis and Water Resource Development. This course was developed in response to the growing interest in water resources at the graduate level at Colorado State University. It was offered without the support of 211(d) funds, but it is directly supportive of the goals of the Institutional Grant among which is the promotion of interdisciplinary approaches to problems of water resources management. (A number of students from areas outside of economics attended the course.) Additionally, this course expands the Department's offerings within the Ph.D. field of specialization in natural resources economics. Not only does natural resources, as a field of concentration, have the largest number of Ph.D. candidates from economics, but also it has traditionally attracted many graduate students from departments outside of economics, thereby encouraging interdisciplinary research efforts. Dr. Gene C. Wilken introduced two new courses, "Geography of Underdeveloped Areas" (spring 1971) and "Geography of Native Farming Systems" (fall 1970), both of which contain substantial amounts of material germane to the purposes and goals of the 211(d) program. An additional series

of courses on problem environments is being developed by Professor Stuart J. Krebs to eventually include "Arid Lands", "Mountain Regions", and "Arctic or Polar Lands" (titles tentative). Investigation of settlement and development in these difficult environments will be of particular value in increasing the competency of CSU as a center for development studies.

The Department of Political Science has recently reorganized substantially the Political Science curriculum. Two new concentrations were developed, one in the area of Public Administration and the other in Environmental Politics and Administration. Nine (9) new courses will be added within the field of Public Administration. They are:

Public Personnel Administration
Administrative Systems and Analysis
Organization, Theory and Behavior
Problems of Public Financial Management
Comparative Development Administration
Administrative Law
Manpower Policy and Development
Executive Processes and Development
Administration of Financial Resources

Four (4) courses have been revised and strengthened in Environmental Politics and Administration. They are:

Current Environmental Problems
Legal Processes and Environmental Control
Politics and Policy in Natural Resources Administration
Politics and Policy in Water Resources Planning and Management

In addition to the above, the course on Politics of Development and National Building in the Area of Comparative Government has also been substantially changed and strengthened.

Dr. Thomas Harblin of the Department of Sociology and Anthropology initiated a new seminar entitled, Industrialization and Urbanization in the Third World, fall quarter, five credits. This seminar focused on the processes of industrialization and urbanization and their implications for change in selected underdeveloped nations (e.g. China, Latin-America, West Africa, etc.).

Dr. Linwood Hodgdon of the same Department continued to represent the Department in the 211(d) Interdisciplinary Seminar--International Water Resources Management. Dr. Hodgdon assumed major responsibility for planning the Seminar for the fall and winter quarters. In addition, he presented two papers, entitled:

"Cultural and Institutional Problems in the Transformation From Traditional to Modern Agriculture"

"Transforming Traditional Agriculture: Schultz's Economic Model and a Critique of this Model"

5. Workshop Activities

At the request of Dr. Wayne A. Schutjer, Director, Research and Training Network of the Agricultural Development Council, the Department of Economics sponsored a Workshop on Teaching Land Policy at Colorado State University, April 29-30, 1971. Personnel from the Department of Economics who have been active in the 211(d) Grant program included Ronald L. Tinnermeier, Gene C. Wilken, James A. Munger, and Kenneth C. Nobe. Raymond L. Anderson, Economic Research Service, USDA, stationed at CSU was also included. Other invited participants included faculty members in agricultural economics, resource economics and geography from The Pennsylvania State University, Michigan State University, University of Hawaii, Oklahoma State University, University of Massachusetts, University of New York (Amherst) and the University of Minnesota. Dr. Wayne Schutjer of ADC and Dr. Gene Wunderlick, ERS, United States Department of Agriculture, also participated. The general purpose of the workshop was to consider how graduate level education in the area of land policy can be made more useful to students from LDC's and to the U.S. students specializing in agricultural development. Thus, the workshop effort provided direct support to the CSU 211(d) Grant efforts.

6. Publications

a. Published research, including press items, are:

*Bibliography, Garth N. Jones and three co-authors--Shaukat Ali, Richard Barber and Jim Chambers. Planning, Development and Change: Bibliography on Development Administration, Honolulu, East-West Center Press, 1970.

*"Accounting and Budgeting Reform in Pakistan for National Development; Reconsideration of Fundamentals," Co-author Saiyid M. Hamid, NIPA/Karachi. In press, National Institute of Public Administration Journal, Karachi.

*John A. Straayer, "Public Problems and Non-Decision Making," Natural Resources Journal, July 1970. This article does not bear directly upon developing states, but is concerned with public water management.

b. Research in progress includes:

*Monograph, Garth N. Jones, "Monastery Model of Development: Towards a Strategy of Large Scale Planned Change": Under publication consideration.

*Pakistan Government and Administration. Materials collected, Garth N. Jones co-editor with B. A. Abbas and Rashiduzzaman. Awaiting political developments in Pakistan before finalizing draft for publication. A book of readings.

*Emerging Conceptions and Patterns of Development Assistance: Implication of President Nixon's Message. Draft completed by Garth N. Jones.

*Department of Administrative Science, Case Study in Planned Organizational Change in a Developing Society by Garth N. Jones. Under publication consideration, University of Southern California.

c. Other

*John A. Straayer conducted an "Institute on Local Water Management" in May 1971, with HUD financial support. This Institute involved no AID funds, but did have some additional payoff relative to the goals of the 211(d) Program.

*Professor Norman I. Wengert conducted a graduate level seminar of "Institutions for Metropolitan Water Resources Management," summer 1971. This related tangentially to the goals of the 211(d) Grant, but at no cost to US/AID.

*Professors D. W. Hill and R. L. Meek completed the final report of a four-year study entitled, An Exploration of Components Affecting and Limiting Policy-Making Options in Local Water Agencies. This research was funded by U.S. Office of Water Resources Research. While it relates only indirectly to overseas development, this research, in combination with activities supported by the State of Colorado and other sources, complements, and affords reciprocal intellectual support to the activities suported by US/AID.

D. Relationships of Accomplishments to Grant Program Objectives

The following examples and statements are given to show more clearly CSU accomplishments in Water Resources Management and their relationships to specified Grant program objectives given in Section II of this report:

One example of 211(d) fund use is that provided Professor Skogerboe, Department of Agricultural Engineering, which has allowed him to expand the number of graduate level students from less developed countries while at the same time gaining an appreciation for the irrigation practices in these countries. During the report period research has been accomplished which will serve to alleviate the needs these countries have concern-

ing water measurement, conveyance, and control. The course, AE 455, Irrigation Structures, which came as a direct result of the project, is to be offered again and will be strengthened by the research being completed. Probably one of the more important results accrued from the project thus far is the experience being obtained by working in this area. The investigators are better prepared to act in an advisory and consulting capacity, both to students and individuals or agencies who may be interested in service abroad. This was well demonstrated by the participation in the "Irrigation Practices Training Course" conducted by the Agricultural Engineering Department for the first time last year. Since the course is to be conducted again this year, the experience gained will be a benefit in handling the course.

The competence of the Agronomy staff in international problems concerning water management has been increased considerably by participating in interdisciplinary seminars, from foreign members of the staff, including foreign visitors, and by contacts and linkages established through U.S. and international travel.

The Department of Civil Engineering, with use of 211(d) funds, has improved its level of excellence in planning, developing, managing and utilizing water resources as related to water delivery and removal systems including relevant institutional development associated with the needs of less developed countries. For example, Dr. Morel-Seytoux established many good contacts in North Africa and as a result an educational exchange program may be initiated. He also presented a paper at an International Conference in Israel. In addition, he gave a course at CSU on "Optimization of Large Scale Water Resources Systems Under Uncertainty," which is particularly relevant to underdeveloped countries.

During 1970-71, the Department of Economics Developed new courses specifically designed to enhance the knowledge of persons having professional interests in dealing with water management and related general development problems of the less developed countries; has actively participated in interdisciplinary efforts under the International Interdisciplinary Seminar; provided leadership in the organization and executive of a field trip for the purpose of analyzing the development process and problems in communities of the Balsas River Basin, Michoacan, Mexico; pursued research interests and publications in the area of economic development; supervised a graduate student's program of study and research; and sponsored an ADC Workshop on Teaching and Policy.

During the year the entire Political Science Department component has been strengthened--its faculty, curriculum, research capacity, development of new talent, and institutional linkages with U.S., national and international water-related agencies. Research undertakings have been facilitated

and the diffusion of water resource knowledge and technology abroad as well as in the U.S. has been increased. However, substantial funds from government agencies other than 211(d) appropriations were used to achieve these ends.

This year, the training opportunities for the Social Science's graduate students have been increased significantly through use of 211(d) funds, especially as related to establishing international and national data banks designed to provide continuously updated findings and materials related to the demographic and modernization characteristics of various nations as well as for regional units. Progress has also been made in using data banks to establish more effective sample designs of larger ecological units such as river systems, irrigation systems, etc., to be used for undertaking research on problems of development change. Also, information is now being collected on both quantity and quality of water resources, availability of natural resources, land use, including associated problems and schemes of systems approach as solutions. A special monograph series has been initiated which will deal with the above subject material.

E. Future Plans, FY 1971-72

The effects of past years planning, coordination, and integration of 211(d) Grant activities at CSU will come into sharper focus this year. Frequent interdisciplinary conferences, the International Interdisciplinary Seminar, semi-annual meetings, frequent contacts with the Project Leaders and personnel of the Project Office, all serve to constantly make the 211(d) program at CSU more effective, and more efficient with the passage of time. Some of the activities and plans considered for the future are as follows:

It is anticipated by the Agricultural Engineering Department that all of the graduate students working in this area during this period will complete their theses. Mr. Wu will complete his thesis by July 31, 1971, while Mr. Barrett will complete his by December 31, 1971. As presently anticipated, both Mr. Boonkird and Mr. Bennett will complete their theses during the early spring of 1972. We are planning on Mr. Albert Koenig arriving at Colorado State University to begin work on his M.S. program in January, 1972. Mr. Koenig would be given a graduate research assistantship under the 211(d) funding and would do his work on a topic regarding irrigation structures. The notes and handouts for the AE 455 class will be improved upon prior to the winter quarter of the 1972 school year. In addition, it is presently contemplated that the class will also be upgraded by student exercises using the computer program developed for the project so that experience can be gained and more sophisticated design can be made. In order to expand the research at Colorado State University, two papers concerning cutthroat flume studies have been submitted for presentation at the American Society of Agricultural Engineers' annual winter meeting in Chicago.

The Department of Agronomy plans to expand the competence of its staff, including arousing the interests and capabilities of graduate students in water management problems in the less developed countries. Emphasis will be placed on a) evaluation of water quality criteria for irrigation under a wide range of soil and crop conditions and, b) evaluation of irrigation and crop use efficiencies under various methods of irrigation scheduling.

Civil Engineering plans to continue the effort to obtain new faculty with an interest in overseas development of the underdeveloped countries and expertise in water resources development, planning, management, systems analysis and computer programming. Four new faculty are needed in this area. The Department will continue to upgrade and broaden present faculty in the water resources problems of the developing countries and increase competence in water management, systems analysis and design. To accomplish this, graduate students will be financed for specific projects presented by a faculty member and overseas travel for consultation with foreign officials and study of specific problems will be financed either in part or totally. Staff personnel will also continue to take part in seminars where problems associated with the development of water resources are presented.

The proposed plan of work by the Economics Department designed to further the objectives of the 211(d) Grant funds will be primarily focused in three areas: a) participation in interdisciplinary research activities under the International Development Seminar; b) research and publication on subjects dealing with problems of the less developed countries; and c) increased professional qualification through enhanced competency in quantitative methods for developmental planning. More specifically: Professor H. H. Biggs will design a research project, under the Water Management Project in Pakistan, for the purpose of testing some of the hypothesis developed in this article, "The Green Revolution: Farm Size, Mechanization, and Development." Professor Biggs will also supervise the thesis research efforts of three graduate students to be funded under the 211(d) Grant. Jim Sananikone will be doing preliminary research for his Ph.D. dissertation on the Mekong River Project. Tiffen Harris will be investigating possible M.A. thesis topics in the area of water resources management in developing countries. And Larry Caswell will also complete his M.A. thesis on "The Impact of Public Investment in Irrigated Agriculture on Mexican Economic Development." Firmer contacts with individuals and institutions in Mexico will be made based on contacts initiated in the spring of 1971 and hopefully will be repeated in the spring of 1972. Professors Wilken and Krebs of Geography will continue to participate in the Interdisciplinary Seminar. Professor Krebs will initiate courses on problem environments which will not only increase the quality of

instruction at CSU but will add measurably to his professional competence. Professor Krebs has had considerable research experience in Chile and elsewhere. Professor Wilken will complete a book entitled, "Geographic Aspects of Development" (title tentative). He will also continue research on resource management and native farming systems, with special reference to the role of these systems in the developing world. With the impetus provided by the 211(d) Grant program, Geography can expand and add valuable dimensions.

Over the next three years, building upon the previous five years of systematic development, the primary goal of the Department of Political Science is to strengthen further its capacity in the area of politics, planning and administration (management) of natural resources with special emphasis upon the development and the protection of water resources in the arid and semi-arid regions of the world. Recognizing that the solutions to this area are perplexing and difficult, that a number of countries are confronted with problems in this area and have established research centers, and that it often has an international dimension, a comparative approach is being followed which requires first hand knowledge of water development problems. Future plans, some of which have already been partially achieved, are as follows:

Faculty Development

*Secure three additional senior faculty members with established reputations (Norman Wengert, Henry Caulfield and Garth N. Jones joined the Department during academic years 1969-70 and 1970-71).

*Improve capabilities of at least five other senior and junior faculty members including Phil Foss, Duane Hill, Roy Meek, John Straayer, and Robert Lawrence who already have reputations in the area of water and resource politics, planning and administration.

Research Capacity

Enhance research capacity and produce studies in:

*Functional problem areas of water management and planning, particularly in agricultural societies.

*Development politics and administration, particularly in the regional areas of South and Southeast Asia and Africa.

*Institutional and organizational arrangements for responsible and efficient water resource use.

New Professional Talent

Produce yearly from five to ten graduate students in resource management and development.

Summary Note

The final purpose of the Department of Political Science is to establish within the next five years a unique center of excellence in developmental resource politics, planning, and administration. Considerable progress toward this end has been made with the acquisition of a mature and balanced faculty. The weak areas are now namely in the areas of curriculum and qualified American and foreign graduate students. Library materials need to be strengthened, particularly in certain regional areas. Rapid progress is being made in these areas and within the next two years the Department will be in a much improved position to play a more meaningful role in assisting U.S. and international agencies in constructive development programs.

The Department of Sociology and Anthropology, with respect to the 211(d) Grant program, plans to increase its overall competence and effectiveness in performing teaching, training and research functions related to international development, and, specifically to the development of natural resources and water management. The Department, therefore, will expand opportunities for the involvement of its faculty to deal with the substantive and research questions related to the preceeding aspects of development. It will raise the ability of its students (particularly at the graduate level) to understand and to acquire skills for dealing with planned technological change. The Department will broaden its course offerings in the areas of planned change, demography-ecology, evaluative research, etc., as related to the developing nations. Finally, the Department will increase the scope of its informational base on the social and cultural aspects of natural resources and water management within the context of international development. The budget request for the Department of Sociology and Anthropology for 1971-72 is entirely directed toward contributing to the continuation and strengthening of the Department's Demographic and Mocernization "Center". The concept of the "Center" within the department (described in previous pages) is viewed as increasing our competence in the area of development, including water management.

F. Travel

International and U.S. travel are indispensible activities in meeting the objectives of the 211(d) Grant program. Oftentimes such travel is accomplished at some cost to the traveler from at least several standpoints, 1) financial and, 2) other commitments on his time. However, the contacts and linkages made with other scientists and institutions of the world, as well as teaching and rendering research and other types of services, outweigh occasional losses of time and funds. To the

University scientists, these contacts are of far greater value than riding a plane and seeing "new sights." Furthermore, these contacts, linkages, and relationships, when taken as a whole, are of significant national importance--far greater perhaps than is generally recognized.

In the interest of fulfilling 211(d) Grant objectives and other AID contract agreements, the following CSU personnel have undertaken international and domestic travel:

1. International Travel

Dr. Maurice L. Albertson

Visited the Asian Institute of Technology, for which he is the Campus Coordinator, located at Bangkok, Thailand, for a period of five weeks. During that period he also visited West Pakistan where, as Project Director for the Water Management Contract, he reviewed the research project with AID Mission officials as well as the sociology project initiated with the West Pakistan Agricultural University. In addition, he visited the International Rice Institute in Manila where discussions were held regarding agricultural irrigation, water research engineering, soil and plant studies.

Dr. Bert L. Ellenbogen, Chairman, Department of Sociology and Anthropology
Dr. David M. Freeman, Assistant Professor, Department of Sociology and Anthropology

Visited Greek government officials and scholars in Athens for the purpose of discussing water management studies having a significant sociology component as well as establishing a center for research in water management and socio-economic development. They also visited West Pakistan where they helped to establish some sociological courses and research projects at West Pakistan Agricultural University as well as participated in water management research program discussions with government officials.

Dr. Manuel Alers-Montalvo

In July and August, 1970, Dr. Manuel Alers-Montalvo, Director of the Center for Latin American Studies, visited with officials from universities and other institutions of Peru, Venezuela and Costa Rica in regard to specific ways in which CSU could be of help to their institutions in solving problems in water resources management. Specifically to explore the possibilities of exchanges between faculty and students between these universities and CSU, as well as opportunities for collaborative research projects in the

social sciences, natural sciences and agriculture. In addition, Dr. Alers-Montalvo presented a paper at the Congress of Americanists in Lima, Peru.

Dr. Hubert J. Morel-Seytoux, Associate Professor, Civil Engineering Department

Dr. Morel-Seytoux visited several North African countries in June/July 1970, namely, Morocco, Algeria, Tunisia, and Lybia. As a result of this trip, a system of communications was established with competent persons in positions of responsibility. Hopefully, it will be possible to proceed with special studies of water resources development in North Africa in the near future.

Dr. Edmund F. Schulz, Associate Professor, Department of Civil Engineering

Made a round-the-world trip April/May of this year establishing linkages with more than 100 outstanding scientists and high government officials in India, Pakistan, Thailand, Taiwan, Japan, and Hawaii. Some of his activities included presenting a paper at the Symposium of Water Resources, Indian Institute of Science, Bangalore, India; consultation with hydrologists in the above listed countries regarding modernization of methods of acquisition and retrieval of hydrological data including ground water recharge experiments; discussions with agricultural engineers regarding consumptive use of water under the impact of multiple cropping practices; and acquiring data on optimum timing of irrigation on multiple cropping sequences through observing farming practices after harvesting crops--such data are essential to set up computer based simulation models.

Dr. John O. Reuss, Associate Professor, Department of Agronomy
Dr. Huntley H. Biggs, Assistant Professor, Department of Economics

During June 1970, a group from CSU took a field trip to Mexico to investigate the water projects in the Balsas Basin. The above named faculty members accompanied the group to determine whether such a trip might be beneficial to faculty and graduate students associated with the Water Management Project to repeat in following years. The final report recommended a future trip be scheduled. This was endorsed by the International Interdisciplinary Committee. Accordingly, a field trip was organized and accomplished during 1971 supported by 211(d) funds.

The report of this field trip taken in March of this year and prepared by Dr. Biggs is given below in its entire

context as an example of the entrainment effect of a small amount of money in furthering the goals of the Institutional Grant.

Interdisciplinary Team Field Trip To The Balsas River Basin, Michoacan, Mexico, by Huntley H. Biggs, Team Leader

Background: Being a semi-arid country, one of the key aspects of the Mexican development strategy has been the stimulation of regional progress through the construction of multi-purpose water projects. Perhaps no other LDC has had such a long history of water resource development experience as Mexico, even going back to pre-Columbian times. A number of River Basin Commissions have been established with the responsibility for promoting development in all of its aspects including health, education, agricultural production, irrigation works, electrification, and transportation. While most of the persons managing the River Basin Commissions are engineers, they are constantly faced with problems requiring interdisciplinary solutions.

One such Commission is the Balsas River Commission established as the Commission of Tepalcatepec in 1947. Fortunately, CSU has connections with an individual, Walter Illsley, who has been intimately associated with the development of this River Basin since its inception under President Lazaro Cardenas. Mr. Illsley received an M.A. degree in International Economics from Johns Hopkins University. He was in China from 1946-1953, part of his time being spent with the Agricultural Rehabilitation Program of the United Nations Relief and Rehabilitation Agency. For the past 16 years he has been living in Mexico practicing a weaving skill, which he acquired in China, and promoting community development projects on a voluntary basis. In addition, he has conducted several tours of U.S. university students and faculty in the Michoacan area of Mexico. These include Montana State University, Friends World Institute in Long Island, and Putney School in Vermont. Mr. Illsley is a person thoroughly familiar with Mexico's culture and her development problems as they exist both at the community and at the national levels. He is also one of those rare individuals who is capable of exchanging ideas with persons from all disciplines and from all social levels.

During June 1970, a group from CSU took a field trip to Mexico to investigate the water projects in the Balsas Basin with Walter Illsley. Two faculty members, John Reuss from Agronomy and Huntley Biggs from Economics, accompanied the group to determine whether such a trip might be beneficial to faculty and graduate students associated with the Water Management Projects. In that final report it was recommended that a field trip be organized for 1971 with the support of 211(d) funds.

Furthering the Goals of the Institutional Grant: One of the objectives of the Institutional Grant is to enhance the competence of CSU in the water management problems of the less-developed countries. It is recognized that institutional arrangements and cultural factors have a definite bearing on the water management problems as they exist in different countries. Because of the long history of Mexico in the development of water resources, it follows that a knowledge of the Mexican experience would enhance the understanding of water management problems as they exist in the context of a less-developed country. The unique institutional arrangements in Mexico for developing and administering water and land resources provide valuable lessons for those intending to pursue their professional interests in the less-developed parts of the world. Also, the proximity of this distinct culture affords a convenient and economical access for U.S. universities to an LDC.

In keeping with the philosophy of an interdisciplinary approach to water management problems, the team was composed of representatives from each of the departments receiving funding under the Institutional Grant. In this manner the viewpoints of many disciplines could be brought to bear on whatever was being observed or experienced in the field. As a result, penetrating observation could be made to enhance the learning experience.

An additional purpose of the trip was to make contacts with various Mexican educational institutions to learn of their interests and level of professional capabilities. It was anticipated that perhaps more permanent contacts could be developed for the future.

Finally, it was hoped that this experience would stimulate the graduate students to identify research possibilities either of a general nature or specifically with regard to Mexico. The identification of research problems would make the individuals put their formal classroom knowledge to work in approaching practical problems in the field.

Personnel: The Institutional Grant leaders in each department were requested to select one faculty member and two graduate students to participate in the field trip. The following guidelines were suggested for graduate student selection: 1) if possible, he should be a participant in the 211(d) Grant or the Water Management Project, 2) he should have a long-run professional interest in international research and development, and 3) if possible, he should be a U.S. citizen, as one of the primary objectives of the trip is to give the student exposure to the foreign culture and its associated developmental problems." The following persons went on the trip:

Agricultural Engineering:
- R. Bennett
- D. Buchleiter

Agronomy:
- J. Reuss (faculty)
- P. Copley
- J. Green

Civil Engineering:
- J. Davenport
- P. Hosterman

Economics:
- H. Biggs (faculty)
- L. Caswell
- T. Harris

Geography:
- G. Wilken (faculty)

Political Science:
- G. Jones (faculty)
- C. Webster

Sociology:
- L. Hodgdon (faculty)
- A. Rizwani
- C. Brown

Organization: The field trip was organized by H. H. Biggs, Economics. Prior to departure three meetings were held to provide background information:

March 1 - Organizational meeting to convey tentative itinerary, tourist cards and make financial arrangements.

March 5 - Professor G. Wilken (Geography), "Physical and Cultural Geography of the Balsas River Basin." Professor Wilken has had much field experience in Mexico and Central America.

March 8 - Larry Caswell, graduate student in economics, "Water Development and Regional Progress in Mexico." Mr. Caswell is writing his M.S. thesis on "The Role of Irrigated Agriculture in Mexican Development."

After the trip, two meetings were held to discuss and evaluate the trip. A representative from each discipline gave a presentation concerning the value of the trip from the viewpoint of its particular discipline, made recommendations, and pointed out several research possibilities. These meetings should prove useful for organizing future field trips.

Itinerary: The following is a brief itinerary followed by the group:

March 16 - Flight from Denver to Mexico City. Overnight train from Mexico City to Morelia.

March 17 - Visit to Tecnologico de Morelia, a school for training industrial engineers and technicians. Interview with the director of cultural development and the President of the Universidad de San Nicolas to discuss their academic programs and inform them of WATREMAN Program at CSU. Overland to Uruapan.

March 18 - Interview with Ing. Moriz, director of the Lower Balsas River Basin Commission Office. The development of the

Basin explained and projections for the future discussed, particularly the impact of the Villita Project on the development of the coastal area. Discussion ranged over topics from many disciplines. Afternoon trip to highland Indian villages to contrast development in indigenous and mestizo communities. Visited Capacuaro, a stagnating community, and Paracho, a progressive community specializing in handicraft manufacturing.

March 19 - Trip to the Tierra Caliente with stops and tours of major water projects: Zumpimito and Cupatizio. Toured an ejido (cooperative) melon packing plant under contract with a North American packer. Observed and discussed wet rice growing operation with an ejiditario.

March 20 - Visited ejido operation near Paracuaro. Fields very stony but ejido lacked access to credit for clearing. Visit to experimental station at Atunez where personnel explained efforts to acclimate dairy cattle from abroad to local conditions. At the Rio Balsas Commission Office at Villa Italia, discussed problems of crop planning with representatives of the Melon Growers Association, and problems of fertilizers and soil nutrients with local agricultural engineer. On trip to Playa Azul stopped to observe a number of slash-and-burn operations in various phases, and visited with subsistence peasant family.

March 21 - Trip to Las Penas. Observed rural school initiated by Walter Illsley and supported now by Commission. R.&R.

March 22 - Visited copra marketing cooperative at Melchor Ocampo which was formed to break the monopsonistic element in the market. Talk presented by Ing. Trujillo at Balsas Commission Office at Orilla concerning the Villita Dam Project that is under construction. Tour of the dam site and works. Observed experiment conducted by Ing. Casellejo to terrace mango trees, and thus, improve the productivity of hillside areas currently uneconomically exploited by slash-and-burn for maize production.

March 23 - Return overland to Uruapan and departure by train for Mexico City.

March 24 - Return from Mexico City to Denver.

Expenditures: Each individual received an allowance of $300 which covered the following expenses: round-trip air fare Denver to Mexico City; rail fare Mexico City to Morelia, and Uruapan to Mexico City; rental and gasoline for two vehicles (4½ days); stipend for Walter Illsley; and room and board for eight days in Mexico. This allowance was just sufficient to meet the above expenses.

Evaluation: Each of the departments submitted a report which included an evaluation, recommendations and possible research topics. The next two sections will be devoted to summarizing these comments. The individual reports are on file in the Project Director's Office. It is safe to say that the trip was successful in meeting its objectives.

Mexico is a semi-arid country which has recognized water supplies as a constraint to development and which has undertaken efforts to alleviate that constraint. The integrated approach to total development practical by the activities of the River Basin Commission is an unique one which has met with a high degree of success in the Balsas Basin. The group was quite interested in meeting the public officials at the Commission offices who daily are faced with development problems from many disciplines, and at many levels. While Mexico is a country that has embarked on the path of development, casual observation attests to the fact that the distribution of the fruits of progress have not been widespread, a fact of concern to government officials.

This trip affords an experience that is beneficial to persons with various backgrounds. It is particularly enlightening for U.S. students who have not had an experience in an LDC. For them it offers the possibility of seeing development problems, and specifically water resource development problems, in an institutional and cultural context similar to one in which they intend to pursue their professional careers. This acquaintance provides the individual the opportunity for becoming aware of areas in which further study and preparation is needed before accepting a foreign assignment.

For the student from an LDC, the trip gives exposure to an LDC which has attained some measure of success in developing water resources and is moving on the path toward total development. Many of the problems faced by Mexicans will be shared by the foreigner and institutions when he returns to his home. A knowledge of the Mexican development alternatives and institutional arrangements could be invaluable by providing beneficial comparative experience.

For the individual with international experience, Mexico offers an excellent basis for comparison. One of the most interesting aspects of the trip was the contribution made by faculty members who could make comparisons and contrasts from their own experiences in LDC's in other parts of the world.

It is doubtful that any other trip can afford one a broader experience in an LDC in such a short period of time. This is due primarily to the leadership of Walter Illsley. Because of his rare quality of being able to communicate with persons at all levels, the group was able to obtain the views of government officials in responsible developmental decision-making positions, subsistence peasants, middle-class

ejiditarios and businessmen. Mr. Illsley is truly a practitioner and agent of development whose long experience in Mexico and intimate acquaintance with the region made the trip truly an enlightening experience for all, regardless of age, international experience, or formal training. This trip offers a valuable learning experience at very little cost.

Recommendations: 1. Advance preparation. Many individuals suggested that greater efforts be made to provide the group with an advance knowledge and background before departure. Therefore, it is suggested that during the winter quarter a seminar for credit be offered which would acquaint field trip personnel with various aspects of Mexico. There are a number of books which have been recently published that would be useful in this regard dealing with such subjects as: water resource development in the Balsas Basin (Barkin and King), federal development policy (Wilkie), economic development (Reynolds), and agricultural development (Venezian and Gamble). The seminar would be an interdisciplinary seminar, bringing materials together from many areas focused on the Mexican example. CSU's Center for Latin American Studies could provide a pool of faculty resources, from any discipline, many with experience in Mexico. Because of his professional background (M.A. in Latin American Studies) and field experience (Argentina), Professor Biggs from Economics may be a candidate for providing the major leadership for this seminar.

Attempts should be made to provide for more structured discussions in the field. These would be focused on field observations, calling upon contributions from each of the disciplines attending. Upon return, a series of meetings should be held in order to put into perspective the various experiences encountered by the group.

2. Association with Mexican institutions. Contacts have been made during the past two years with educational institutions in the region. The orientation of the University of San Nicolas at Morelia is toward the Humanities, Law and Medicine. As a college of the University at San Nicolas, the Agrobiology College at Uruapan, insited in 1970, trains agricultural technicians. Because of its lack of laboratory facilities, there is practically no research being conducted. Thus, the possibilities of initiating a cooperative research effort with a CUSUSWASH institution seems improbable in the near future. However, it does seem reasonable to explore the possibilities of initiating a cooperative program on a more modest basis at the outset. For example, members of their faculty or well-qualified students could enroll in courses at a U.S. university hich are vitally needed to promote research at the College. Once a few individuals receive such training, a modest research program may be initiated with CUSUSWASH.

This would call for placing some U.S. personnel at the College in Uruapan, not only to assist in the research, but also to provide instruction to faculty and students. Such an effort would make a vitally important contribution to the instructional and research program at this College.

A second contribution that such a program would make is to encourage graduates of the program to undertake field research in the rural areas where their contributions can be great rather than seeking employment in the urban areas. This is one of the strongest arguments for developing a cooperative program with a college that draws its students from an agrarian region and focuses its efforts on solving problems of a regional nature, rather than seeking a program with a metropolitan institution.

3. Participation of other CUSUSWASH Universities. It is hoped that the experience of CSU will stimulate the other CUSUSWASH Universities to participate in this program in the future. This field trip offers an excellent opportunity for faculty and students from the various universities to become acquainted with each other and to share their professional interests. The cross-fertilization and interchange would be most beneficial in furthering the aims of the mutual cooperation among the various institutions in the CUSUSWASH.

2. U.S. Travel

The following CSU personnel attended the listed conferences and meetings:

George Smith to Nebraska: Applied Mathematical Programming in Water Resources

J. Anderson and M. Sonnen to CSU: Urban Water Institute

Donald Taylor to Boston: Engineering Foundation Conference and ASCE headquarters

Garth Jones to Salt Lake City: Regional Conference on Institution Building

John Straayer to Los Angeles: 1970 American Political Science Meeting dealing with political research in developing countries

M. L. Albertson to Bozeman, Montana: Symposium on Interdisciplinary Aspects of Watershed Management

Scott Tucker to Vail, Colorado: A.W.W.A. and W.P.C.A. Annual Conference - presented paper on "1970 Urban Water Systems Institute"

D. M. Ogden to Miami: Council of Colleges of Arts and Sciences

M. L. Albertson to Roanoke, Va.: Universities Council on Water Resources

Scott Tucker to Washington, D.C.: Water Polution Control Federation Conference

M. L. Albertson to Washington, D.C.: ICID 5th Technical Conference

M. L. Albertson to Boston: Formal Dedication of Water Resources and Hydrodynamics Laboratory at M.I.T.

M. L. Albertson to Miami: Irrigation and Drainage Specialty Conference

E. C. Vlachos to Washington, D.C.: Meeting of Society for International Development

R. L. Anderson to Tucson: CUSUSWASH Meeting on Integrated Approaches to Water Resources Problems

B. L. Frantz and M. L. Albertson to Washington, D.C.: Review of 211(d) program with AID officials

M. L. Albertson to Phoenix: ASCE Meeting on Water Supply for Irrigation and Drainage

Wynn Walker to Chicago: Annual Meeting of American Society of Agricultural Engineers

G. N. Jones to Syracuse: Workshop of the Comparative Administration Group of American Society for Public Administration

J. L. Cefkin to New York: United Nations Conference

J. A. Straayer to Phoenix: Deliver paper to the American Academy for Advancement of Science

M. L. Albertson and E. C. Vlachos to Toronto: Semi-Annual Meeting of the Council Members of the Society for International Development

J. Davenport, P. Hosterman, D. Bennett, A. Karplus, P. Fawkes and Bidwell to Logan: Water Resources Planning Seminar

G. Linkages With Scientists and Institutions

With regard to CSU's commitments to 211(d) Grant program, the faculty and GRA's are asked to make a record of each linkage established while attending meetings or conferences abroad or in the States, as well as linkages made in an advisory or other capacity. This information will be collected at the Project Office and maintained in a central file for ready reference and analysis.

Forms have been prepared. One form is for listing information regarding scientists of competence in water management, and the other for recording institutions of competence in water management. These forms are given to CSU personnel and are returned to the Project Office upon completion. Note the many linkages established in the previous Section F, International and U.S. travel. The linkage information in the Project Office files is organized, in the main, under the following headings:

1. Linkages with Scientists and Institutions by Countries. The following are examples:

   Pakistan

   a. West Pakistan Agricultural University, Lyallpur

      Dr. M. A. Kazi, Dean, Faculty of Agricultural Engineering & Technology

      Dr. Haider Ali Chaudhari, Dean, Faculty of Agricultural Economics & Rural Sociology

      Dr. Ali Muhammad Chaudhari, Head, Department of Farm Management

      Dr. Muhammad Rafique Raza, Head, Department of Rural Sociology

      Etc.

   b. Directorate of Agricultural Engineering, Lyallpur

      Mr. Abdul Hamid Chaudhary, Director

      Mr. Roshen Ali, Assistant Agricultural Engineer

      Mr. Aziz, Research Engineer

   c. Punjab Agricultural Research Institute, Lyallpur

      Dr. Saeed Ahmad, Director

      Mr. Hayat Bhatti, Agricultural Chemist

      Mr. Muhammad Nasin, Assistant Agricultural Chemist

d. Other Pakistani Institutions with which we have linkages are:

Agricultural Development Bank of Pakistan

Agricultural Development Corporation

Agricultural Research Council, Pakistan Secretariat

Pakistan Administrative Research Council, Lahore

Agricultural Research Institute, Hyderabad

Agricultural Research Institute, Peshawar

Board of Economic Inquiry, Peshawar University

Bureau of Statistics, Department of Planning and Development, GOP, Lahore

Director of Nutrition and Research, Ministry of Health, Labor and Social Welfare, GOP, Islamabad

Economic Affairs Division, Secretariat, Rawalpindi

Irrigation Research Institute, Lahore

National Economic Council, GOP, Rawalpindi

National Institute of Public Administration, Karachi

National Science Council, Karachi

Pakistan Academy for Rural Development, Peshawar

Pakistan Academy of Sciences, Islamabad

Pakistan Forest Research Institute, Peshawar University

Pakistan Institute of International Affairs, Karachi

Planning and Development Department, GOP, Lahore

Social Science Research Center, University of the Punjab Lahore

West Pakistan Institute of Management, Karachi

West Pakistan Water and Power Development Authority, Lahore

Etc.

Thailand

CSU has been closely connected with the Asian Institute of Technology (formerly SEATO Graduate School of Engineering) for the past 11 years. The President of the Institute is from CSU as are 12 other faculty members. During the 10 years of its existence, the enrollment of students has climbed from an initial group of 19 students to the present level of over 200 representing 19 countries. To date 357 students have received the Master of Engineering degree; the list is comprised of students from Afghanistan, Hong Kong, India, Korea, Malaysia, Pakistan, Philippines, Taiwan, Thailand, Turkey, and Vietnam. Dr. Maurice L. Albertson, in 1959 as Director of CSU Research Foundation, was Head of the Operational Survey team to establish the engineering graduate school. He has served as Campus coordinator for the School since its inception in 1959 and has had a major role in selecting U. S. supporting staff personnel and in obtaining funds and equipment.

CSU linkages through the AIT Board of Trustees alone cover many Asian countries at high levels of government and private sectors. A few are listed as follows:

Dr. Puey Ungphakorn; Governor Bank of Thailand, Bangkok

Dr. Kamhaeng Balangkura, Secretary General Office of the National Education Council, Bangkok

Mr. S. Y. Dao, Secretary General Council for International Economic Cooperation and Development, Taipei

Colonel Ir. Kuntoadj, Technological Institute, Bondung, Indonesia

Dr. Oscar Mapua, President, Mafrua Institute of Technology, Manila, Philippines

Dr. M. A. Rashid, Vice Chancellor, East Pakistan University Engineering & Technology, Dacca

Mr. J. A. Richards, Ministry of Education, Kuala Lumpur, Malaysia

Dr. Bui Tien Rung, Saigon, Vietnam

Mr. Chang Chieu Kiat, Deputy Director of Education, Ministry of Education, Singapore

Dr. A. R. Zubair, Vice-Chancellor, West Pakistan University of Engineering and Technology, Lahore

Etc.

Other Countries

Omitted

2. International Institutions On Irrigation And Drainage

Through Dr. Maurice L. Albertson, CSU has had and continues to maintain a direct linkage with the International Commission on Irrigation and Drainage with the main office in New Dehli, India. Dr. Albertson served for two (2) years as Chairman of the Executive Committee of the U. S. National Committee on Irrigation and Drainage. He has also served for approximately five (5) years as a member of the Permanent Paper Committee. Dr. Albertson remains as an exofficio member of the above committees, attending the meetings and serving as an advisor.

CSU has maintained linkages with the following institutions in varying degrees of magnitude:

Austrian National Committee on Irrigation and Drainage (I & D)
Australian International Committee on I & D
Irrigation Department, Burma
Canadian International Commission on I & D
Directory of National Productivity Centers in Asian Productivity Organization, including International Commissions on Irrigation and Drainage in:

Japan, Dominican Republic, Ecuador, France, Germany, Ghana, Great Britain, Guyana, Hungary, India, Indonesia:

Directory of intergovernmental organizations other than U.N. including International Commissions on I & D in:

Iran, Irag, Israel, Italy, Lebanon, Malawi, Malaysia, Mexico, Morocco, North Nigeria, Peru, Philippines, Senegal, Spain, Sudan, Surinam, Swaziland, Syria, Thailand, Turkey, U.A.R., Uganda, Venezuela, Vietnam and Zambi.

3. A Partial List of Overseas Participation During the Past Two Years By CSU Staff Personnel (Direct Linkages)

University of the Andes Watershed Management Exchange Agreement, Merida, Venezuela

International Atomic Energy Agency, Vienna, Austria

Systems Approach to Analysis of Hydrologic Processes and Environments, University of Hawaii

*Faculty of Veterinary Science, University of Nairobi, Kenya

International Symposium on Pesticide, Tel Aviv, Israel

Interdisciplinary Study of Water Resource Development Programs in area of Michoacan, Mexico

Africa Ecology Study, East Central & South Africa

Educational and Scientific Organizations of Peru, Venezuela and countries of Central America

NATO Institute, Ramsey, Isle of Man

International Symposium on Hydrometry, Koblenz, Germany

International Biological Program, Kenya; Rome

International Ornithological Congress, The Hague, Netherlands

Meteorological Institute of Hamburgh

Escola Superior de Agricultura, Lauras, Brazil

Market Advisor to Government of Panama

International Study on Ethiopia, Kenya, Tanzania, Zambia, Malawi, Rhodesia and Botswana

Wildlife Study in Iran

Snake Venom Research, Southeast Asia

Professor of Physics, University of Antioquia, Medellin, Colombia, Zoologist Studies, Austria

Consultant in Operation of Computer Services and Systems, Philippines

*CSU has staffed more than 6 faculty members including many more on short term assignments on this project designed to assist in Africanization of the Faculty of Veterinary Science.

4. A Partial List of Foreign Student Directly Connected To Our Research Projects

Name & Home Institution	Department	Degree
*Kahn, Hamidur R. Pakistan Univ. of Engineering & Technology Dacca/Pakistan *Mr. Kahn received his M.S. from AIT in Bangkok	Civil Engr	PhD
Kahn, Saeed Ahmad West Pakistan Agricultural University/Pakistan, Lyallpur	Economics (arrive Oct.)	M.S.
Kahn, Muhamad Jamell West Pakistan Agricultural University/Pakistan, Lyallpur	Economics	M.S.
Rizwani, Abdur-Rehman University of Punjab Lahore, Pakistan	Sociology	PhD
Deredec, Alain School of Hydraulic Engr. Faculty of Science Groenoble, France	Civil Engr	M.S.
Lemma, Wendin-Agegnehu Awasha Valley Authority Ethiopia	Civil Engr	PhD
Chaudry, Mohammad Talib West Pakistan Water & Power Development Authority, Lahore	Civil Engr	PhD
Doddiah, Suresh National Institute of Engr Mysore, India	Civil Engr	M.S.
Mahmood, Khalid Punjab College of Engr & Technology/Pakistan, Lahore	Civil Engr	PhD
Nazar, Ata Kabul University Kabul, Afghanistan	Civil Engr	M.S.
Worku, Debebe Ethiopia-Haile Selassie I University/Addisa Abba	Economics	PhD

Name & Institution (cont'd)	Department (cont'd)	Degree (cont'd)
Tuffour, Samuel Ghana-University of Ghana, Legon	Civil Engr	PhD
Garcia, Luis E. University of San Carlos Guatemala	Civil Engr	PhD
Monadjemi, Mehdi University of Tehran Tehran, Iran	Agronomy	PhD
Chaughtai, S. A. University of Punjab, Lahore	Economics	

Foreign students enrolled at Colorado State University early in 1971 numbered 337 representing 60 foreign countries. The largest representatives come from the following geographical areas:

Canada---35	Africa---30
West Indies--- 3	South Asia---53
Latin America---41	S. E. Asia---22
Europe---25	Far East---82
Mid-East---37	Pacific--- 9

H. Total Outreach Water Management Research

In sections of this report regarding "entrainment effects" and "linkages" most of the material presented related specifically to 211(d) funding. This included, of course, international and domestic travel.

The above, however, does not reveal the total thrust or outreach of CSU, using other than AID funding, in the field of water management research. CSU faculty acting in the capacities of consultants, advisors, and the like, made the following international and domestic contacts during the period, July 1, 1970 to June 30, 1971:

1. International Contacts

Funding from sources other than AID provided funds for 96 official international trips by CSU faculty on invitational and consultation bases. Twelve (12) trips were paid in part or wholly by AID funds for a total of 108 trips. Out of this total, 45 trips or 42% were related to some aspect of water management research. Participating CSU faculty on some of these international consulting trips are as follows:

a. From 30 May to 25 September 1971, Dr. Vujica Yevjevich, Civil Engineering Department, accomplished the following:
   - *With NSF as the sponsoring agency and CSU as the U.S. coordinating academic institution, consulted with officials of the University of Sarajevo and other institutions of Yugoslavia regarding implementation of the new cooperative research project between USA and Yugoslavia on karst hydrology and karst water resources.
   - *Lectured at the Technical University of Lund, Sweden.
   - *Submitted a paper on a) "Significant Tests of Periodicity in Hydrologic Time Series," and b) was Secretary of Meeting of the International Group on Stochastic Hydrology at the International Symposium on Mathematical Models in Hydrology held in Warsaw, Poland.
   - *Attended the Assembly of the International Association for Scientific Hydrology in Moscow, USSR, and IUGG Symposia, presenting a paper on "Sources of Stochasticity in Geophysical Processes" and activily participating in the Assembly of IASH.

b. 13 October to 5 November 1970, Dr. Daryl B. Simons, Associate Dean of Engineering, consulted with Brazilian officials in Rio de Janeiro regarding a Meteorological/Hydrological Field Program in 1972.

c. 5 November to 23 November 1970, Dr. Daryl B. Simons, Associate Dean, College of Engineering, traveled to

Dacca, East Pakistan, to consult with World Bank officials on possible geomorphology and hydrology studies in East Pakistan.

d. 19 October to 31 October 1970, Dr. E. V. Richardson, Administrative Engineer, Atmospheric Science, consulted with Brazilian agencies regarding facilities and support for a Meteorological/Hydrological Field Program to be conducted in Rio de Janeiro in 1972.

e. 5 November to 23 November 1970, Dr. E. V. Richardson, Civil Engineering, accompanied Dr. Daryl B. Simons, above, to East Pakistan.

f. 1 January to 22 January 1971, Professor S. Karaki, Civil Engineering, continued discussions with World Bank officials on developing research contacts for geomorphology and hydrology studies in East Pakistan.

g. 10 September to 29 September 1970, Professor Gaylord V. Skogerboe, Agricultural Engineering, presented a paper at the International Symposium on Hydrometry at Koblenz, Germany; also participated in meeting at the Hydraulic Research Station at Wallingford, England

h. 17 September to 3 October 1970, Professor Everett C. Nickerson, Civil Engineering, was an active participant in NATO Advanced Study Institute on Air/Sea Interaction; also consulted with Cambridge University personnel on Fluid Mechanics, Great Britain.

i. 14 September to 4 October 1970, Professor George N. Van Dyne, Natural Resource Ecology, gave papers on grassland ecology studies at Symposia in Ugandi; Kenya; and Rome, Italy.

j. 14 August to 7 September 1970, Dr. Robert E. Dils, Dean of Forestry and Natural Resources, presented a paper on Forest Influences and Watershed Management at United Nations/USSR Invitational Seminar held at Moscow, USSR.

k. 13 August to 20 September 1970, Dr. Daryl B. Simons traveled to Lahore and Rawalpindi, West Pakistan, to investigate possibilities of CSU participation in a study of comprehensive water research project on the Ganges River.

l. 19 August to 5 September 1970, William Williamson, Office of Education Media, visited Pakistan to film educational film, "Land Forming for Irrigation."

m. 9 January to 20 January 1970, Dr. V. Yevjevich, Civil Engineering, Chairman of U.S. participation for the

U.S.-Japan Bilateral Seminar in Hydrology; also gave a paper.

2. Domestic Contacts

Funding from sources other than AID provided funds for 120 official domestic trips. Twenty-three (23) trips were paid in part or wholly with AID funds for a total of 143 domestic trips. Out of this total 113 or 79% were related to some phase of water management research. Participating CSU faculty on some of these consulting trips within the confines of the U.S. are as follows:

a. 29-30 June 1971, Professor Ralph J. Kotich, Range Science Department, participated in the Multi-State Workshop in Soil and Water Management at Kansas State University.

b. 29 June to 9 July 1971, Dr. Duane W. Hill, Civil Engineering Department, completed research work for Task 7 of the OWRR Project on Metropolitan Water Intelligence Systems.

c. 20 June to 25 June 1971, Dr. Norman A. Evans, Environmental Research Center, participated in the American Water Resources Association Conference at Cornell, N.Y.

d. 20 June to 23 June 1971, Professor Marshall S. Moss, Civil Engineering Department, gave lectures at Washington, D.C. on Urban Water Systems for the World Bank.

e. 30 May to 2 June 1971, Dr. V. Yevjevich, Civil Engineering, delivered a lecture to the International Symposium of Stochastic Hydraulics at the University of Pittsburgh.

f. 12 May to 15 May 1971, Professor Henry P. Caulfield, Jr., Political Science Department, met with OWRR officials to discuss "Development of Techniques for Estimates of the Potential Water Resources Development in the Western Region of the U.S. for the Achievement of National and Regional Goals.

g. 11 January to 15 January 1971, Professor David W. Hendricks, Civil Engineering Department, presented a paper on Water Reuse Systems Analysis at the American Society of Civil Engineer's National Meeting on Water Resources at Phoenix, Arizona.

h. 12-13 January 1971, Dr. A. R. Chamberlain, President of CSU, presented a paper at the American Society of Civil Engineer's National Water Resources Engineering Meeting, Phoenix.

i. 19-20 November 1970, Professor C. H. Wasser, Range Science Department, participated in a conference on "Conflicts in Water Resources Planning--What Are the Remedies?" held at the University of Texas.

j. 19-20 November 1970, Professor Henry P. Caulfield, Political Science Department, presented a paper on "Institutional Arrangements for Water Resources Management," at the University of Texas.

k. 18-20 November 1970, Professor B. R. Sabey, Department of Agronomy, represented CSU at the Western Soil and Water Research Committee Meeting held at Salt Lake City, Utah.

l. 5-7 November 1970, Professor Henry P. Caulfield, Political Science Department, participated in Water Center Technical Committee to develop techniques for estimating potential of water resource development.

m. 1-4 November 1970, L. Russell Freeman, Research Associate, Department of Agricultural Engineering, consulted with representatives of water pollution control agencies in California relative to "Data Acquisition Systems in Water Quality Management."

n. 1-4 November 1970, Professor Henry P. Caulfield, Political Science Department, consulted with several federal agencies in Washington, D.C., on water management research programs and also attended Water Resources Conference at Miami.

o. 2-6 November 1970, Professor Gaylord V. Skogerboe, Department of Agricultural Engineering, presented a paper at the 1970 ASCE Irrigation and Drainage Specialty Conference held in Miami.

p. 1-3 November 1970, Associate Professor J. J. Hanan, Department of Horticulture, gave a paper at the annual meeting of American Society for Horticultural Science on "The Repercussions from Water Stress."

q. 4-10 November 1970, Dr. Daniel M. Ogden, Jr., College of Humanities and Social Sciences, presented a paper to ASCE Irrigation and Drainage Division in Miami.

r. 25-30 October 1970, Professor Gaylord V. Skogerboe, Department of Agricultural Engineering, presented a paper at the Sixth American Water Resources Conference held at Las Vegas, Nevada.

s. 25-30 October 1970, L. Russell Freeman, Research Associate, Department of Agricultural Engineering,

presented a paper on water quality at the Sixth American Water Conference held in Las Vegas.

t. 25-29 October 1970, David M. Hendricks, Associate Professor of Civil Engineering presented a paper at the Annual American Water Resources Meeting held in Las Vegas.

u. 26-28 October 1970, Dr. Norman A. Evans, Environmental Resources Center, participated in the annual meeting of the American Water Resources Association, Las Vegas, Nevada.

v. 26 October to 1 November 1970, Professor Norman Wengert, Political Science Department, gave a paper at a meeting of the American Water Resources Association in Las Vegas; also participated in a conference at the Water Center in Los Angeles.

w. 25-30 October 1970, Thomas L. Huntzinger, Graduate Research Assistant, Department of Agricultural Engineering, presented a paper at the Sixth American Water Resources Conference held in Las Vegas.

x. 25-29 October 1970, George E. Radosevich, Research Associate, Department of Economics, attended Sixth American Water Resources Conference held in Las Vegas.

y. 8-10 October 1970, Professor Henry P. Caulfield, Political Science Department, actively participated in the Western Directors Meeting on Water Resources Research, Title II Proposal held in San Francisco.

z. 4-6 October 1970, Dr. E. V. Richardson, Department of Civil Engineering, met with officials of the Central Nebraska Public Power and Irrigation District regarding erosion problems.

aa. 15-17 September 1970, L. Russell Freeman, Research Associate, Department of Agricultural Engineering, represented CSU at the Second annual meeting of Regional Research Project W-107, "Management of Salt Load Irrigation Agriculture," held at Vernal, Utah.

bb. 14-19 September 1970, Roy Edmonds, Research Assistant, Department of Sociology, collected data for a research project on consolidation of irrigation systems.

cc. 23-27 August 1970, Dennis R. Linden, Department of Agronomy, presented a paper on "Ground Water Recharge as Affected by Surface Management and Vegetation," at the annual meeting of the American Society of Agronomy held in Tucson.

dd. 18-21 August 1970, Robert Longenbaugh, Assistant Professor, Department of Civil Engineering, attended the ASCE 18th Annual Specialty Conference on Hydraulics at the University of Minnesota.

ee. 2-7 August 1970, Dr. Hans L. Teller, Watershed Science, participated in a Watershed Symposium held at Bozeman, Montana.

ff. 26 July to 2 August 1970, Dr. Hubert J. Morel-Seytoux, Department of Civil Engineering, participated in the Fifth International Conference on Water Pollution Research held in San Francisco.

gg. 26 July to 3 August 1970, Dr. H. W. Shen, Department of Civil Engineering, participated in the ASCE Engineering Foundation Research Conference on Sediment Erosion in Urban Areas at Deerfield, Mass.; also discussed project matters with National Science Foundation, Washington, D.C.

hh. 22-30 July 1970, Dr. Daryl B. Simons, Associate Dean, College of Engineering, presided at the ASCE Meeting of Regulation and Stabilization of Rivers, including task committees, held at New Orleans.

ii. 20-23 July 1970, L. Russell Freeman, Research Associate, Department of Agricultural Engineering, attended the National Symposium on "Data and Instrumentation For Water Quality Management," held in Madison, Wisconsin.

jj. 16-17 July 1970, Robert Gilham and Philip Hamaker, Research Associates, Department of Agronomy, on Consultation on irrigation research at USDA Field Station, Scottsbluff, Nebraska.

kk. 28-30 June 1970, Dr. J. Paul Tullis, Assistant Professor, Department of Civil Engineering, consult and finalize details of program for Institute on Closed Conduit Systems at Los Angeles.

IV. EXPENDITURES

The actual and estimated expenditures for fiscal year 1970-1971 in the line item categories are stated in Table I. These expenditures are through 30 June 1971 and include all outstanding encumbrances as of that date. This table also reports the names and number of man months allocated to each department for both faculty and graduate students.

Table II shows the total actual and estimated expenditures in line item category for the first two years of the 211(d) Grant. This report shows the expenditures in comparison with the original budget. The amount reflected in faculty salaries has resulted in financial support for initiation of new courses, assistance in organizing and participation in the International Interdisciplinary Seminar, and salary support for international travel.

The expenditures listed in line item V covers clerical expense, office materials and supplies, as well as computer costs for faculty and graduate students' research projects.

Line item III (Travel) does not include outstanding encumbrances in the amount of $8,662 for transportation costs issued on GTR's to be billed by AID/Washington. Sufficient funds are being withheld in the total budget to cover the costs.

The proposed budget allocations for fiscal year 1971-1972 will continue as proposed in the original budget plan as outlined in Table III.

TABLE I

TOTAL EXPENDITURES FOR 1970-1971
ON AID 211(d) GRANT

Item	Man Months	Expenditures	Total
I. FACULTY SALARIES			
Administration			
M. L. Albertson	1 3/4		
L. Scott Tucker	3 3/4		
M. E. Becker	3/4		
		7,747	7,747
Agricultural Engineering			
G. Skogerboe	1 1/2		
W. Walker	1		
		3,175	
Agronomy			
J. Reuss	1		
		1,292	
Civil Engineering			
Morel-Seytoux	1		
E. V. Richardson	1		
G. Smith	1/2		
R. Hansen	1/4		
G. Palumbo	3 1/2		
L. Stanfel	1		
		8,766	
Economics			
H. Biggs	3 1/3		
R. Tinnermeier	3/4		
G. Wilken	2		
		9,148	
Political Science			
H. Caulfield	2		
G. Jones	3		
		7,543	
Sociology and Anthropology			
K. Berry	3/4		
T. Harblin	1		
L. Hodgdon	1/2		
E. Vlachos	1		
		4,633	
		34,557	34,557
			42,304

Item	Man Months	Expenditures	Total
II. GRADUATE RESEARCH STIPENDS - CLERICAL - LABOR			
Agricultural Engineering			
J. Barrett	5 1/2		
R. Bennett	7 1/2		
V. Somoray	2 1/2		
		7,800	
Agronomy	-		
Civil Engineering			
J. Davenport	3 1/2		
A. Deredec	3		
S. Doddiah	1/4		
J. Duke	1 1/2		
P. Hosterman	4 1/2		
G. Lewis	1 1/2		
G. Overacker	1/4		
E. Rios	1		
M. Schiefer	3		
D. Taylor	1 1/2		
R. Thaemert	1 1/2		
Clerical-Labor	7 1/2		
		15,062	
Economics			
S. Allen - Clerical	1		
L. Caswell	6		
P. Sananikone	4 1/2		
		6,252	
Political Science			
H. Bidgood	3/4		
J. Fly	4 1/2		
C. Webster	1		
Clerical-Labor	3 3/4		
		4,312	
Sociology and Anthropology			
M. Brown	6 3/4		
Clerical - Labor	1/2		
		2,868	
Watershed			
R. Bassett	1 1/2	750	
			37,044
CONSULTANTS			7,568
PERA			4,269

Item	Expenditures	Total
III. TRAVEL		
International*	3,839	
U.S. Travel	15,631	
		19,470
IV. EQUIPMENT		3,118
V. OFFICE EXPENSE		
Clerical		
Labor		
Misc. expense		
Telephone, Xerox, etc.		
Computer Time		
		18,737
VI. LIBRARY AND PUBLICATIONS		
Brochure Mailing	282	
Library	906	
		1,188
GRANT TOTAL		$133,698

*Outstanding incumbrance on travel issued on GTR's to be billed by AID/WASHINGTON - $2,132.

TABLE II

TOTAL EXPENDITURES THROUGH 30 JUNE 1971
ON AID 211(d) GRANT

Item	Total Budget Two Years	Total Expenses Two Years
Salaries	$ 91,000	$112,095
Graduate Research Assistantships	91,000	55,184
Travel	27,500	29,895
Equipment	19,000	3,331
Office Expense and Computer Time	19,000	33,472
Library and Publications	7,000	7,005
Totals	$254,500	$240,982

TABLE III

DETAILED BUDGET (in $1,000's)

	Year 1	2	3	4	5	Total
Salaries						
Professors: 80 months at $2,000	24	28	32	36	40	
Ass't. and Assoc. Professors: 80 months at $1500	18	21	24	27	30	
Total						280
Stipends						
M. S. candidates: 40 years at $3,000	18	21	24	27	30	
Ph. D. candidates: 40 years at $4,000	24	28	32	36	40	
Total						280
Travel						
24 trips to South and S. E. Asia at $1,500	6	7.5	7.5	7.5	7.5	
11 trips to So. Am. and Africa at $1,000	1	2	2	3	3	
40 trips in U. S. at $150	1	1	1	1	2	
1500 days per diem at $18	4	5	6	6	6	
Total						80
Equipment	10	9	8	7	6	40
Office expense and computer time	9	10	10	10	11	50
Library and publications	3	4	4	4	5	20
TOTALS	118	136.5	150.5	164.5	180.5	750

V. WORK PLAN AND BUDGET FORECAST

A. Special Library Facilities

As a result of considerable basic bibliographical searching accomplished at CSU, the Project Leaders of the Water Management Research group mentioned some months ago, the ever increasing need for collecting and making available all types of literature on Water Management Research and on Water Resources generally. It has been increasingly apparent that there is considerable valuable water resources literature not readily available. For example, at CSU in comparison to the total literature available in the United States and other countries of the world, our experience suggests that there exists an inadequate amount of water resources literature. In addition, some of this literature is scattered throughout the CSU library sometimes making it difficult and time consuming to search through masses of material to find the information sought. Even after some information is found, the searcher often has little or no idea as to the validity of the study or report with relationship to the total picture.

CSU feels that the bulk of useful articles on water resources are of a fugitive nature. That is, much of the material is illusive as the items are either mimeographed (or related form) or exists in small quantities. Typical of fugitive type literature is that produced by state and federal agricultural experiment stations, and by similar national institutions in the international field; and by private engineering firms, management consulting firms, and by other institutions both in the United States and in foreign countries. It appears that little of this type is indexed in the normal run of abstracts or references.

CSU believes also that an interdisciplinary approach to solving water resources problems both on the domestic and international scene, requires special library facilities having a central classification scheme based on water resources world-wide. Other purposes may be served too, such as the possibility of receiving sizable personal collections that might be given for use by such a special type library. A special collection could be of great assistance to scholars in becoming intimately acquainted with the literature, thereby giving them more creative time for research and a far better basis for analysis.

We are aware of the necessity to become associated first with other institutions having outstanding water resources library facilities such as the U.S. Bureau of Reclamation, and the Library of Congress. The University

of California at Berkeley has an excellent special collection of about 100,000 cataloged items on Water Resources. In the international field, India has a special collection of about 200,000 items located at the Headquarters Office of the International Commission on Irrigation and Drainage, New Delhi, India. What CSU will do with regard to establishing a water resources library will depend largely on the results of a study of the above named institutions and others as to what kind of materials can be provided to CSU and, of course, a host of other factors. This study will be made by a Library Committee appointed by Maurice Albertson, Project Director, and Le Moyne Anderson, Director of Libraries,CSU.

Recently, serious thought and action have been taken by Utah State University and Colorado State University to close this informational gap. CSU plans to place special emphasis on collecting fugitive literature of international and national significance; interdisciplinary type literature; and other types of literature in the field of water delivery and removal systems and relevant institutional requirements. USU has already done a great deal of work in searching their library, including archaeological files, and listing on library cards all references relating to on-farm water management. The University of Arizona has responsibility for collecting material in the field of watershed management. Obviously, interactions among the three elements of water management are essential. Also, without adequate institutional structure, none of the three levels can become very efficient. It is therefore very essential that library facilities be augmented, maintained, and placed under an effective system of control and operation. It is therefore proposed that the CUSUSWASH Universities, in order to more effectively meet increasing international and national responsibilities in water management research, participate in an inter-university agreement to establish a library system that will eventually make all types of water resources and related information on a world-wide basis more readily available.

Hopefully, assistance in this endeavor can be counted on not only from the universities, but also from AID, other agencies of the Federal Government, State organizations, institutions and foundations.

B. Proposal for Finding New Directions Land-Grant Universities Should Take as Agents of Domestic and International Social Change

Colorado State University is planning a week-long national conference in the summer of 1972 devoted to examining what new directions U.S. colleges and universities

should take to serve more effectively as instruments of planned social change, and how best to implement these new directions. The Land-Grant University, for example, has largely achieved its initial goals of developing excellence in "Agriculture and the Mechanical Arts" as established by the Morrill Act of 1862. This Act provided services to areas of important need a hundred years ago--namely, agriculture and industry.

The issue today is: Should the university in the second century of its existence expand its goals and horizons to become more instrumental in finding solutions to the current and future social and environmental problems of society both at home and abroad? We intend this conference to have a dual theme, namely:

1. The colleges and universities in the U.S. are able to play, and should play, a more active role in planned international development.
2. They can fruitfully expand their original horizons and address themselves to other problems in this country, such as urban social problems and the nature of the human environment.

To bring into detailed focus the purpose and mechanics of the 1972 conference, a mini-conference will be held this summer (1971) to which a small number of eminent national leaders of higher education have been invited to probe the following questions:

1. To what specific subjects should the conference address itself?
2. How can the "good ideas" of the 1972 conference best be nurtured to bear fruit?
3. Who are the people best equipped to participate in this conference and implement its objectives?

The decisions made at this and subsequent meetings could lead to greatly increased interest in international development and technical assistance, not only by CSU, but rendering such assistance through a consortium of universities, or inter-university bases.

C. Proposal for Integrated Management of Ground and Surface Water Resources

The objective of this proposal is to increase agricultural production given land availability, groundwater quality and quantity, surface water quality and quantity, and physical, legal, social, economic and other constraints. The study area would be located in Pakistan, Colombia, and a specific basin area in the United States. The study would be analyzed by an inter-university task group to develop the broad principles and methods of approach

applicable to any area of interest. Also, the study will focus on a) short-range goals of improved management of existing systems, and b) long-range goals of planning system development in which the systems considered are given by the complex of physical, social, and institutional factors which influence integrated management of groundwater and surface water. The several sources of funding might be as follows:

Pakistan study: sub-project agreement with existing Water Management Research Project
Colombia study: sub-project agreement with existing Water Management Research Project
U.S. study area: USBR, OWRR, NSF