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INSTITUTO NACIONAL DE RECURSOS HIDRAULICOS (INDRHI)

UNIVERSIDAD DEL ESTADO DE COLORADO (CSU)

ESTUDIOS SOBRE LA OPERACION Y SEGURIDAD DEL SISTEMA DE EMBALSES DE VALDESIA

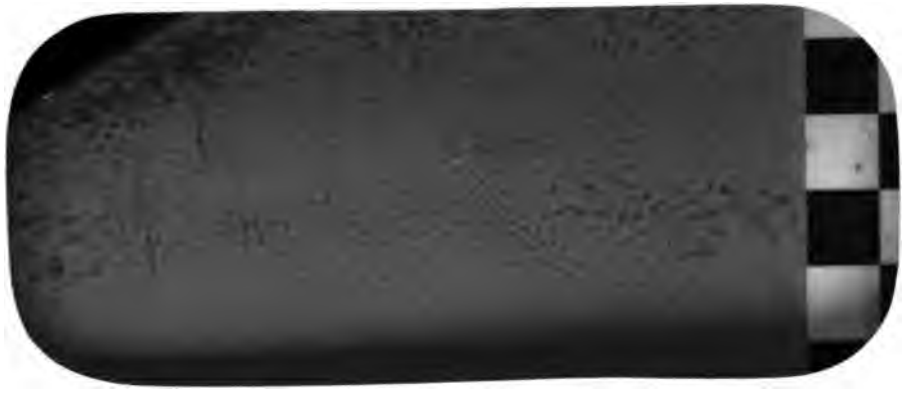
FINAL REPORT

VOLUME VI

TRANSFER OF TECHNOLOGY

AND TRAINING 1/

DOCUMENTO No. 41 / 31/08/86



IICA-CIDIA

Serie Publicaciones Misceláneas
A1/DO-86-007
ISSN-0534-5391

FINAL REPORT
VOLUME VI
TRANSFER OF TECHNOLOGY
AND TRAINING 1/

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PRESENTACION

Los estudios de Operación y Seguridad del Sistema de Embalses de Valdesia fueron ejecutados conjuntamente por el Instituto Nacional de Recursos Hidráulicos (INDRHI) de la República Dominicana, la Universidad del Estado de Colorado (CSU) y el Instituto Interamericano de Cooperación para la Agricultura (IICA) a través del Contrato IICA/INDRHI/CSU firmado el 6 de abril de 1984. Los estudios se iniciaron el 6 de agosto de 1984 y finalizaron el 31 de agosto de 1986.

Los estudios fueron financiados por el INDRHI a través del préstamo 1655-DO del Banco Mundial.

La ejecución de los estudios se desarrolló en seis áreas:

a) Estudios Hidrológicos
b) Operación Normal
c) Operación de Emergencia
d) Inspección, Mantenimiento y Seguridad de Presas
e) Organización para la Operación del Sistema de Embalses
f) Entrenamiento y Transferencia de Tecnología

En este documento se incluye parte del material técnico del Informe Final, el cual consta de los siguientes volúmenes:

-Resumen
-Estudios Hidrológicos
-Operación Normal
-Estudios de Operación de Crecidas
-Estudios de Inspección, Mantenimiento y Seguridad de Presas
-Organización y Funciones para la Operación del Sistema de Embalses de Valdesia.

-Transferencia de Tecnología y Capacitación.

-Plan de Operación de Emergencia para el Sistema de Embalses de Valdesia.

-Plan de Operación Normal para el Sistema de Embalses de Valdesia: (1) Riego y Energía, (2) Control de Crecidas.

-Manuales de Operación de Modelos Computarizados para la Operación Normal del Sistema de Embalses.

-Manual de Usuario de Modelos de Sistemas Hidrológicos.

Santo Domingo, República Dominicana
31 de agosto de 1986

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VOLUME VI

TRANSFER OF TECHNOLOGY AND TRAINING

VOLUME VI

TRANSFER OF TECHNOLOGY AND TRAINING

6.1 Introduction

An essential and unseparable part of the current study is the qualification of Dominican Republic staff in the use of the analytical methods and administrative procedures developed in the components described in previous five volumes. This is usually accomplished through the active participation of counterpart personnel assigned to the project in a training program and through a process of effective transfer of technology developed outside the Dominican Republic. Just as the objective of the physical water resources system is to provide a high degree of assurance that the water and energy resources planned will be available when and where needed and with the quality needed, the objective of a transfer of technology and training program is to provide a high degree of assurance that the human resources will be available when and where needed both to assure the achievement of the underlying project goals. Lack of sufficient numbers of qualified staff can cause the failure of a project jut as surely as drought; inadequate storage capacity or catatrophic event.

In order to provide for the qualification of the professional staff in the Dominican Republic to meet this long-range requirement, the transfer of technology and training components of the project consisted of several activities. As a part of transferring the technology developed at Colorado State University, almost all the computer models, designed specifically with consideration to the available computing facilities in INDRHI/CDE and other agencies, were implemented in the Dominican Republic. Their use, with examples, were demonstrated during

several formal training courses conducted by the CSU staff in the Dominican Republic. Many other supporting material including text books, users manuals, reports, etc. were also delivered for informal training of personnel in the Dominican Republic.

A common deficiency of many personnel training plans and systems is a preoccupation with training a specific person for a specific position. These programs may fail because human beings, taken as individuals, are not "reliable" in the sense of always being available to do the assigned task year in and year out over the life of the system. In order to avoid this problem as much as possible, formal group training sessions were conducted in the Dominican Republic at several stages of the project. These sessions usually consisted of intensive short courses, generally two-weeks long, and included lectures and work sessions to demonstrate the usage of various techniques and models in specific topics. These were supplemented by informal training through correspondence. In addition, formal training at Colorado State University (CSU) was provided to four counterpart engineers who participated in the project work and/or attended academic courses at CSU during the training period.

This volume describes in detail the project activities involved with the components of transfer of technology and training. Section 6.2 outlines the particulars of transfer of technology program whereas Section 6.3 consists of the details of the formal and informal training program. Section 6.4 includes some final remarks and recommendations for further training and transfer of technology.

6.2 Transfer of Technology

6.2.1 Software Development and Implementation

Computer models have been employed in almost all phases of hydrologic studies, normal operation studies, and flood operation studies. Although, many of the computer models employed in these studies are available readily on main-frame computers, they cannot be implemented readily at the counterpart institutions in the Dominican Republic due to limited computing facilities. Consequently, a major effort was undertaken and successfully completed to convert and/or modify existing computer models and to develop new models which could be implemented on the microcomputers currently available at INDRHI and CDE. These software have been implemented in the microcomputers at INDRHI and they are intended for use in actual opration of the Valdesia system. In fact, many of the workshop sessions carried out during the training periods were conducted on microcomputers. In addition to the software implemented on these small computers, many others were also implemented and used in the IBM System/34 computer at INDRHI.

The software developed for the Hydrologic Studies and the Flood Operation Studies have been combined into one single, menu-driven package named "Colorado State University-Hydrologic Modeling System (CSU-HMS)". This system is already implemented at microcomputers at INDRHI and IICA. The software includes capabilities for the following:

1. Precipitation Data Analysis (Programs PCMAPS and OPTIM).
2. Flood Event Simulation (Program HEC-1 of U.S. Army Corps of Engineers).
3. Flood Forecasting (Program SACKW including software for plotting results).

4. Reservoir Routing (Program ROUTS including software for plotting results).

5. Hurricane Track Forecasting (Program MCLIPER and softare for plotting hurricane tracks).

6. Streamflow Forecasting (Program PCKFA).

Many of the above software are to be used either for future operation studies and/or real time operation of the Valdesia system. A separate users manual for the package has been prepared and accompanies the final report.

Software developed for the normal operation studies consist of two major models:

1. A general dynamic programming code for water resources system optimization (Program CSUDP).

2. A river basin simulation model (Program MODSIM).

Both of the above models were implemented in the microcomputers at INDRHI. The CSUDP was used for developing optimal monthly operating rules. Program MODSIM is developed for real time operation. A separate users manual (in Spanish) prepared for the use of above software accompanies this final report.

In addition to the microcomputer software, the following main-frame programs have been provided to the counterparts:

1. DCHAN1 : Dection of changes in annual time series.

2. EXTE1 : Extension of data using a simple linear regression.

3. UMOSE1 : Univariate seasonal time series modeling.

4. GENSEA : Seasional data generation.

5. DCSSO4 : Detection of changes in seasonal time series.

6. DISPE : Parameter-estimation for dissaggregation model.

7. DISGEN : Data generation for disaggregation model.
8. EXTEN3 : Extension of data using a multivariate autoregressive model.
9. HEC1 : Flood Hydrograph Package - U.S. Army Corps of Engineers.
10. BASIC : Basic statistics, empirical frequency distributions, fitting normal and log-normal distributions.
11. MISA4 : Filling in of missing data in annual time series using multiple regression.
12. MISS6 : Filling in of missing data in seasonal time series using multiple regression.
13. EXTE2 : Extension of data using a multiple linear regression.
14. SAUTO : Sample autocorrelation function.
15. SWM : NWS (Andersion) version of the Stanford Watershed Model.
16. ROSEN : Nonlinear least squares optimization program.
17. MAPELEV: Main-frame version of PCMAPS which account for elevation effects.

6.2.2 Technical Publications, Reports and Training Documents

During the course of the project, several technical material were provided to the counterparts. These include:

1. Text books in Hydrology and Water Resources Area.
2. Users manual of computer programs.
3. Various research reports on topics related to the project.
4. Copies of articles published in technicqal journals.

5. Specially prepared (both in Spanish and English) lecture notes for training sessions.

Many of the above material were used for reference during formal training sessions. A complete list of these documents are given in Appendix 6.A.

6.3 Training

6.3.1 Formal Training in Dominican Republic

Four formal training sessions were organized and conducted in Dominican Republic by the CSU staff:

1. Special training course on basic concepts of techniques used in the project. This was held in March, 1985.
2. First formal training course.
3. Short course on Project Operation in Water Resources using a Sytems Approach.
4. Second formal training course.

6.3.1.1 Special training course

This two-week special training session was held during March 11-22, 1985. The first week covered the basic concepts of the topics of hydrology and economics whereas the second week was devoted to an introduction to systems analysis. Following is a brief description of different topics covered and other details of the short course.

Hydrology. The major objective of this portion of the March Short Course was to present to the participants of the Valdesia project, and to the participants from INDRHI and CDE, the basic concepts of stochastic hydrology and hydrologic modeling. The material focussed on

the techniques to be used for tasks of hydrology, data generation and emergency operation. This background on basic concepts was deemed necessary if participants were to continue in the future advanced training sessions without much difficulty.

Considerable time and effort was spent planning the training course. Since the medium of instruction which is familiar to the participants in the Dominican Republic is Spanish, most of the lecture notes were translated into Spanish. Also, during the short course, a CSU staff member translated all the lectures and discussions. In our opinion this was not a hinderance to effective communication in regard to subject matter. Several computer programs with example data sets on all the topics covered in the short courses were also prepared. In addition, copies of several publications, reports and text books were left at INDRHI for future use by the project personnel.

The course was attneded by 28 participants. Among them were five civil engineers from CDE, nineteen civil engineers from INDRHI, two agricultural engineers from INDRHI, a geologist and a programmer both from INDRHI. The group of participants was excellent and very keen for learning the relatively new topics that they were exposed to (sometimes for the first time). The subject of stochastic hydrology in general is not covered in the undergraduate curricula in many universities, and to most students who have completed only an undergraduate degree, it is a relatively new topic. Although many participants had limited past knowledge of basic probability and statistics, the course was effective in communicating the basic concepts at a level that they could grasp without much difficulty.

Table 6.B.1 in Appendix 6.B shows the detailed schedule of the first week of the training course. Basically, all of the morning sessions were devoted to lectures on basic concepts, and the afternoon sessions were exclusively for problems and computer applications. The entire class was divided into five groups for the problem and computer terminals. However, this grouping facilitated effective discussion among participants. The daily sequence of lectures, problem sessions, and computer sessions wsas very effective for demonstrating the application of the basin concepts and the utility of computer programs that were taken to the Dominican Republic.

Normal Operation. During the week of March 18-22, 1985, the second part of the short course dealing with "Introduction to Systems Analysis" was presented at INDRHI. The overall goals of the course were to present the basic concepts of systems analysis and to give the course participants experience in using optimization computer programs. The short course covered the following topics:

- Concepts of Systems Analysis
- Concepts of Models
- Characteristics and Uses of Simulation Models
- Introduction to Linear, Non-Linear, and Dynamic Programming Optimization
- Application of Simulation to Develoop Reservoir Operation Guidelines
- Application of Linear and Dynamic Programming Models to Develop Reservoir Operating Rules
- Application of Dynamic Programming to Estimate Reliable Water Yield from a Reservoir

Economics. The text: "Planeamiento de Proyectos para Economias en Desarrollo," by W. W. Shaner was copied and left with INDRHI.

The following topics from the above text were covered:

Conditions in the developing countries (Chapter 1)

Macroeconomic planning (Chapter 1)

Project planning (Chapter 2)

Cash flow analysis (Chapter 3)

Principles of engineering economy (Chapter 3)

Criteria for decision making (Chapter 4)

Multiple alternatives (Chapter 5)

Handling inflation (Chapter 5)

Alternative discout rates (Chapter 6)

Handling uncertainty (Chapter 6)

Shadow pricing (Chapter 7)

Externalities (Chapter 8)

Financial analyses (Chapter 10)

The following problems were assigned and solved:

Solving interest problems

Applying the criteria for decision making

Multiple alternatives

Sensitivity analysis

Shadow pricing

Externalities

Finance

6.3.1.2 First formal training course

This training course was held during the two week period of July 15-26, 1985. The course was primarily intended for presentation of specific methods that are being used in the various phases of the project. It was attended by fourteen participants from INDRHI, CDE and IICA. Among them were: (a) seven civil engineers, one economist, and a programmer from INDRHI; (b) two civil engineers and two electrical engineers from CDE; and (c) a civil engineer from IICA.

The schedule of the short course is given in Table 6.B.2 in Appendix 6.B. The participants received hands on experience on many of the computer models that were being used in the project. Most of the course material covered in the training course were distributed to the participants. Some of this material was translated into Spanish. The medium of instruction for the training course was Spanish and assistance from translators was obtained when necessary.

6.3.1.3 Special short course on project analysis using systems approach

This special course was presented by Prof. J. W. Labadie and Ing. V. Floris during the week of March 17-21, 1986. The course objective was to train the supervisory level technicians on techniques of systems engineering applied to water resources projects analysis and operations. It was attended by 35 technicians, 21 from INDRHI; 8 from CDE; two from UNPHU and UCMM; and three from IICA. The course schedules topics covered are given in Table 6.B.3, Appendix 6.B.

6.3.1.4 Second formal training course

This training course was held during the period June 12-20, 1986. The primary objective of this course was to present all the results of various components to counterparts who will be directly involved with the follow-up activities of the project. The course was attended by counterpart technicians from INDRHI, CDE, and IICA. The course content is outlined in Table 6.B.4 of Appendix 6.B. Several demonstration sessions of the software developed and implemented in microcomputers at INDRHI were conducted. Formal and informal discussions held during the session benefitted both the counterparts and the CSU staff in defining the modifications and additions to the final products.

6.3.2 Formal Training at Colorado State University

Three engineers from INDRHI (A. Perez, J. Piementel, and M. Roa) and one engineer from CDE (E. Garcia) participated in the project activities at Colorado State Univesity (CSU). During their study at CSU they received training in usage of many of the computer models used for the project and helped in resolving many issues concerning both normal and flood operation studies including those related to data.

Training of Counterparts from INDRHI. As a part of his training, Mr. Andrez Perez enrolled in three courses offered by the Department of Civil Engineering at Colorado State University. Following is a list of the three courses:

(a) Engineering Hyrology

(b) Optimization in Hydrology and Water Resources

(c) Stochastic Processes in Hydrology

USAID

Mr. Perez satisfactorily completed the above courses. During off-class hours, Mr. Perez spent some time at the Engineering Research Cetner to receive informal training and work with other researchers involved in the project. He became familiar with several computer programs that are being used at CSU for this project. Mr. Perez assisted in the calibration and implementation of computer packages used for hydrologic and reservoir operation studies of the Nizao basin. In particular, Mr. Perez was involved in: (a) the calibration of HEC-1 flood hydrograph package for Nizao basin; (b) precipitation data analysis using areal averaging techniques; and (c) running computer programs in stochastic modeling and data generation. He was also involved in writing a users manual in Spanish for one of the programs.

Mr. Juan Piementel, an engineer from INDRHI also began his training on dam safety and inspection component of the project. He attended two courses at CSU: (a) Control of Floods and Droughts; and (b) Risk Analysis. He also attended a short course on Flood Technology and an International Hydrology Symposium held at CSU. However, his training was interrupted because of illness.

During several visits of Mr. Modesto Roa from INDRHI, he received training and participated in many activities related to normal operation studies. In particular, he gained a strong familiarity with the computer model MODSIM and was of considerable assistance in resolving many issues concerning data.

Training of Counterparts from CDE. Mr. Eldon Garcia from CDE visited CSU and participated in project work during the months of November and December in 1985. He gained a strong familiarity with the computer model MODSIM and was of considerable assistance to CSU staff in

resolving many issues concerning both normal and flood operation studies including those related to data.

6.3.3 Informal Training

During the period of the project informal training of counterpart personnel were carried out through visits of CSU staff and through correspondence.

In particular, during the week of November 19-23, 1984, Dr. D. Fontane, while visiting with Dr. J. Salas, W. Shaner and Mr. V. Floris, assisted the counterparts in implementing the computer codes provided during the early stage of the project. More specifically, the CSUDP was simplified so that it could be implemented in the IBM System 34 computer available at INDRHI. Some examples were run and some others were left for later implementation.

6.4 Final Remarks and Recommendations

Considering the products and activities associated with the transfer of technology and training, it may be remarked that the original objectives of this component as set out by the CSU staff were successfully achieved. The software developed have been specially tailored to facilities available in the Dominican Republic and successfully implemented. Adequate technical material and training documents have been provided to the counterparts for follow-up work on technology transfer and training. Several technicians have been trained on various aspects of the project and their duty is to train other counterparts with their new knowledge. The achievement of overall objectives however, will not be completed unless the counterparts will

follow up the various activities initiated in this component of the project. Some specific recommendations in this direction are as follows:

1. Trained personnel should be assigned to maintain and update the various computer models installed in microcomputers at INDRHI.
2. Experience should be gained by counterparts by applying the computer models to other reservoir systems in the country and this would be the key to successful implementation of the models for Valdesia system.
3. The models and other material provided to counterparts must be distributed to various agencies involved in water related activities.
4. The technical publications and training documents must be compiled and catalogued in one place so that counterpart personnel have easy access to them in the future. Those written in English should eventually be translated to Spanish.
5. Formal training courses for other counterparts must be conducted every year by those who were trained in this project on the various techniques and the computer models.

APPENDIX 6.A

List of Technical Publications, Users Manuals and Training Documents Provided to Counterparts

Bridgeman, S., Dynamic programming in reservoir operation studies. In: Application of Dynamic Programming to Water Resources Management (Short Course), Fort Collins, Colordo, 1980. pp. 255-260.

Burnash, R., R. Ferral, and R. McGuire, A generalized streamflow simulation system conceptual modeling for digital computers, Joint Federal-State River Forecast Center, California, 1979.

CSU-HMS, Colorado State University Hydrologic Modeling System - User's Manual, developed by J. T. B. Obeysekera, G. Q. Tabios III, J. D. Salas, and H. W. Shen, Department of Civil Engineering, Fort Collins, Colorado 80523, 1986.

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Fontane, D. G., Models for lake and river analysis, Colorado State University, Fort Collins, 6 p., 1984.

Labadie, J., Lecture notes on multipurpose reservoir management, (DP Approach).

Labadie, J. W., Nonlinear programming and search techniques, Colorado State University, Fort Collins, 9 p., (Lecture #27), 1980.

Labadie, J., Lecture notes on El Programa MODSIM.

Labadie, J., Lecture notes on solving stochastic problems with CSUDP.

Labadie, J. W., Introduction to dynamic programming, Colorado State University, Fort Collins, 26 p., (Lecture #2), 1980.

Labadie, J. W., Tools of systems analysis: Simulation, Colorado State University, Fort Collins, 10 p., (Lecture #9), 1980.

Labadie, J. W., Tools of systems analysis: Optimization, Colorado State University, Fort Collins, 10 p., (Lecture #10), 1980.

Labadie, J. W., Development of reservoir operating rules, Colorado State University, Fort Collins, 12 p., (Lecture #14), 1980.

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Labadie, J., ed., Scripts for videotape on management of water resources: A system approach, Colorado State University, 1978.

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Labadie, J. W., D. G. Fontane, V. Floris and N-F. Chou, Manuales de Operacion de Modelos Computarizados para la Operacion Normal de Sistemas de Embalses, Department of Civil Engineering, Colorado State University, Fort Collins, Colorado 80523, July 1986.

Labadie, J. W., D. G. Fontane and J. D. Salas, Impact of indexed sequential modeling on hydrogeneration capacity estimation: A comparative study, Project Cooperation Report to the Western Area Power Administration, Division of Power Resources - A6300, Golden, Colorado, July 1984.

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U.S. Army Corps of Engineers, Hydrologic engineering methods for water resources development, Volumes I to IX, Hydrologic Engineering Center, Davis, California, 1971.

U.S. Army Corps of Engineers, HEC-1 flood hydrograph package user's manual, The Hydrologic Engineering Center, Davis, California, 1985.

List of Thecnical Publications Provided to Counterparts on Dam Inspection and Security

A. Documents

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Commonwealth of Pennsylvania. Department of Environmental Resources. Dam safety and enchochaments act. Harrisburg, Pennsylvania: Bureau of Dams and Waterway Management, 1978. 16 p.

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2. Annual Report FY 1981-82 - Dam Safety Branch (29 p)
3. Notice of the requirement for emergency preparedness for high hazard dams (18 p).
4. Dam Safety Act. House Bill N° 240 (3 p).
5. 1981 Century Code (4 p).
6. Preliminary Safety Evaluation of Existing Dams. Vol. II User Manual. May 1983 (54 p).
7. Preliminary Safety Evaluation of Existing Dams. Vol. II User Manual (Glossary terms and others) (49 p).
8. Pressure test requirements for outlets and pipelines in dams (1 p).
9. Instrumentation of new dams (1 p).
10. Filter design criteria for chimney drains, filter blankets and toe drains (2 p).
11. Spillway Sizing Policy (1 p).
12. Changes to the rules and regulations in the Manual of Rules and Regulations of Reservois Dams (2 p).
13. Dam construction (2 p).
14. Inspection and maintenance of nonpower water control projects (12 p).
15. Use and protection of waters
16. Earth dam failures (2 p).

20. Dam safety branch policies (5 p).

21. Safety of Existing Dams, Evaluation and Improvement, National Academy Press, Washington, D.C.

22. "Georgia Safe Dams Act 1978 and Rules for Dam Safety", Georgia Dept. of Natural Resources, Atlanta, Georgia.

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57. "General Guidelines". Emergency Action Plan Development for Impounding Structures.

58. NDI Program Summary Statistics. Maryland.

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64. New Mexico State Engineer Office. Engineering Review Project Check List (3/23/81).

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71. "Dam Safety: Physical and Legal Aspects". (CSU) Doehring, Charlie and Montgomery.

72. Newspaper articles (6).

73. General information for owners of dams and reservoirs (1 p.)

74. Appropriation and use of surface water. Oregon Administrative Rules (8 p).

75. Flood leaks in Texas (2 p).

76. Recommendation for maintenance and repair of earthfill dams and appurtenant works (8 p).

77. Natural resources and community Development (1 p).

78. Engineer's certificate of completion of dam projects (1 p).

79. What you need to know about owning a dam (2 p).

80. Land Quality (2 p).

81. Maintenance and repair of dams, levees, dikes and floodwalls. (Indiana, 6 p)

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86. Walters, Joseph D. Guidelines of the determination of spillway capacity requirements. Arizona water commission, 1974, revisado 1976: 10 hojas.

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APPENDIX 6.B

Schedules of Training Courses

Table 6.B.1. Schedule of lectures, problem sessions and computer sessions of March, 1985 Training Course.

Monday, March 11, 1985

9:00-10:00	Inauguration
10:15-11:15	Dr. Shaner, Economics
11:15-11:30	Break
11:30-12:30	Dr. Obeysekera, Basic concepts of Probability theory and Statitics
12:30- 2:00	Lunch
2:00- 3:30	Problem session: Dr. Shaner, Economics
3:45- 5:00	Problem session, Obeysekera, Pons, Basic Statistics
5:00- 6:00	Computer session, Obeysekera, Pons, Ventura, Program BASIC

Tuesday, March 12, 1985

8:15-10:00	Dr. Shaner, Economics
10:00-10:30	Break
10:30-12:15	Dr. Obeyserka, Transfer of Information Detection of Changes Filling In, Extension of Data.
12:15- 2:00	Lunch
2:00- 3:00	Problem session: Dr. Shaner, Economics
3:45- 5:00	Problem session: Obeyserkera, Pons, Detection of Changes
5:00- 6:00	Computer session: Obeysekera, Pons, Ventura, Program CDSS04, Program EXTE2

Wednesday, March 13, 1985

8:15-10:00	Dr. Shaner, Economics
10:00-10:30	Break
10:30-12:15	Dr. Obeysekera, Basic Concepts of Stochastic Hydrology
12:15- 2:00	Lunch
2:00- 3:30	Problem session: Dr. Shaner, Economics
3:45- 5:00	Problem session: Obeysekera, Pons, Data Generation

5:00- 6:00 Computer session: Obeysekera, Pons, Ventura, Program SAUTO, Program UMOSE1, Program GENSEA

Thursday, March 14, 1985

8:15-10:00 Basic Concepts of Deterministic Simulation in Hydrology

10:00-10:30 Break

10:30-12:15 Rainfall-Runoff Modeling, Stanford Watershed Model

12:15- 2:00 Lunch

2:00- 3:00 Stanford Watershed Model

3:45- 6:00 Problem session: Obeysekera, Pons, Continuation of Data Generation Example of Stanford Watershed Model

Friday, March 15, 1985

Dr. Shaner, Economics

Dr. Obeysekera, and Pons, visit to Valdesia

12:15- 2:00 Lunch

Dr. Shaner, Economics

Table 6.B.2. Schedule for First Formal Training Course, July 15-26, 1985.

A. Week of July 15-19, (Dr. J. Salas, Dr. J. Labadie, Mr. Vinio Floris)

Day 1:	8:00- 8:30	Opening
	8:30-10:15	Dr. Labadie Overview of methods for developing reservoir operating rules - Survey of actual practice in U.S. - Simulation methods - Optimization methods Introduction to Program MODSIM - Network flow concepts - Data requirements - How to run MODSIM
	10:45-12:15	Dr. Salas Stochastic Modeling and Data Generation
	2:00- 345	Dr. Labadie, Vinio Floris Workshop on: - Hand calculations for network flow simulation - Introduction to file manipulation and editing on IBM-PC - Simple Valdesia problem on PC - Setup and solution
	4:00- 5:30	Dr. Salas Workshop on Stochastic Modeling and Data Generation
Day 2:	8:15-10:15	Dr. Labadie Valdesia Reservoir: Data requirements for MODSIM - Irrigation demands (ET model) - Power demands - Inflows - Reservoir and power plant
	10:45-12:15	Dr. Salas Stochastic Modeling and Data Generation (cont.)
	2:00- 345	Dr. Labadie, Vinio Floris Workshop on: - Calibration run for Valdesia with MODSIM - Practice with sensitivity of operations to changes in priorities and demands
	4:00- 5:30	Dr. Salas Workshop on Stochastic Modeling and Data Generation (cont.)

Day 3:	8:15-10:15	Dr. Labadie Finding optimal operating rules - Deterministic dynamic programming (DP) - Program CSUDP on the PC
	10:45-12:15	Dr. Salas Precipitation data analysis
	2:00- 3:30	Dr. Labadie, Vinio Floris Workshop - Running CSUDP on the PC - Problem setup and solution - Interfacing with MODSIM to improve operations for Valdesia Reservoir
	3:00- 5:00	Discussion of Technical Report on Normal Operation
Day 4:	8:15-10:15	Dr. Labadie Stochastic Operating Rules - Stochastic DP
	10:45-12:15	Dr. Labadie Feedback Control Laws (Feedforward control) Optimal Control Theory: Program OPTCON Forecasting and Control
	2:00- 5:00	Dr. Labadie, Vinio Floris Workshop on: - Running stochastic DP problem for Valdesia - Hand calculations - Review - Informal observations - Questions
Day 5:		Dr. Labadie, Vinio Floris Visit to Valdesia Dam and Irrigation Area

B. Week of July 22-26, (Dr. Shen, Dr. Shaner, Dr. Obeyserka, Mr. Pons)

Day 1:	8:15-10:15	Dr. Shen Introduction to Dam Safety Analysis
	10:45-12:15	Dr. Shaner Review of concepts presented in March training course and introduction to case study
	2:00- 3:45	Dr. Shaner Case study assignment
	4:00- 5:00	Dr. Shen Example for a dam safety risk analysis (same used by U.S. Government)

Day 2:	8:15-10:15	Dr. Shen Dam Safety Inspection and Maintenance Procedures
	10:45-12:15	Dr. Shaner Review of the economic situation in the Dominican Republic with discussion of shadow prices, etc.
	2:00- 3:30	Dr. Shen Workshop on Dame Safety (Continuation of Dam Safety Risk Analysis by U.S. Government)
	3:30- 5:30	Discussion of Technical Report on Emergency Operationand Dam Safety
Day 3:	8:15-10:15	Dr. Shaner Power production and use of additional water from better operation
	10:45-12:15	Dr. Obeysekera Workshop on precipitation data analysis: Program PCMAP
	2:00- 3:45	Dr. Shaner Class assignment on power production
	4:00- 5:30	Dr. Obeysekera Rainfall-runoff modeling Introduction to HEC-1
Day 4:	8:15-10:15	Dr. Shaner Agricultural production and use of additional water from better operation
	10:45-12:15	Dr. Obeyserkera Watershed modeling with HEC-1
	2:00- 3:45	Dr. Shaner Class assignment on irrigated agriculture
	4:00- 5:30	Dr. Obeysekera Workshp on HEC-1
Day 5:	8:15-10:15	Dr. Shaner Benefits from better flood protection
	10:45-12:15	Dr. Obeysekera Flood forecasting and reservoir routing studies
	2:00- 3:45	Dr. Shaner Assignment on flood protection and wrap up of concepts presented

4:00- 5:30 Dr. Obeysekera
Workshop on flood forecasting and reservoir routing studies

Table 6.B.3. Course Schedule on Concepts of Project Analysis of Water Resources Using System's Approach

Dia Lunes 17/03/86

Mañana: Conceptos básicos de sistemas aplicado a problemas operacionales en recursos hidráulicos.

- El "Efoque de Sistemas" en la solución de problemas.
- Sistemas computarizados para apoyo al proceso de toma de decisiones en recursos hidráulicos.
- Desarrollo de reglas de operación de embalses.
- Modelos y metodologias para la programación de riego.

Tarde: Introducción al modelaje de flujo en redes (Network Flow Modeling) para simular sistemas complejos de recursos hidráulicos.

- Ejemplo de cálculos manuales.
- Uso del programa MODSIM para la IBM-PC.

Dia Martes 18/03/86

Mañana: Mejoramiento del desempeño de proyectos de riego e hidroeléctricos.

- Estudio de casos: Cuenca del rio Alto Pampanga. Filipinas.
- Aplicación del MODSIM.
- Maximización de la energia confiable de acuerdo con las necesidades de riego.
- Reglas de operación durante sequia.
- Localización de deficiencias de diseño y de operación en el sistema.
- Importancia de las operaciones integradas.

Tarde: Taller usando el sistema de embalse Valdesia como estudio de caso:

- Montaje del MODSIM.
- Requerimientos de información y calibración.
- Inc orporación de objetivos múltiples: Análisis de intercambio (Tradeoff).

Día Miércoles 19/03/86

Mañana: Uso de la Programación Dinámica para encontrar relgas óptimas de operación.

- Problemas de decisiones secuenciales en recursos hidráulicos.
- Concepto de "control de retroalimentación".
- Introducción a solución de las ecuaciones recursivas de la programación dinámica.
- Problemas de ejemplo en distribución de agua y operación de embalses.

Tarde: Introducción al Programa CSUDP

- Cálculos manuales para un ejemplo simple.
- Uso del Programa CSUDP.
- Estudios de caso del Embalse Valdesia.
- Obtención de Reglas de Operación que puedan ser usadas en el MODSIM.

Día Jueves 20/03/86

Mañana: Funciones objetivo complejas en operación de sistemas de recursos hidráulicos.

- Concepto de confiabilidad de energía de suministro de agua.

- Cómputo de las curvas de intercambio óptimo (tradeoff).
- El embalse Pozzillo como un estudio de casos.

Tarde: Solución de problemas multidimensionales de operación mediante programación dinámica.

- Programación dinámica tipo incremental: aplicación a la distribución de fuentes múltiples de agua a demandas múltiples.
- Uso del CSUDP.
- P.D. tip "reaching" para programación de riego.
- P.D. tip Espacio-Objetivo en recursos hidráulicos.

Día Viernes 21/03/86

Mañana: Riegos e incerteza en la operación de sistemas hidráulicos

- Programación dinámica estocástica.
- Distribuciones de probabilidad independientes y condicionales.
- Ejemplo con cálculos manuales.
- Ejemplo de problema para suministro de agua y su solución usando el CSUDP.

Tarde: Taller con discusión informal sobre la aplicación de técnicas de análisis de sistemas a problemas operacionales en República Dominicana.

Table 6.B.4. Schedule of Second Formal Training Session

June 12-13: Hydrology

1. General Introduction
2. Design Storms
3. Rainfall-Runoff Modeling (HEC-1)
4. Stochastic Modeling and Generation
5. Daily Streamflow Forecasting
6. Streamflow forecasting (Sacramento Model)

June 16-17: Normal Operation

1. General Introduction
2. Analysis of Water Supply and Water Demand
3. Monthly Operating Rules (CSUDP)
4. Weekly Simulation of the System (MODSIM)
5. Description of Results

June 18-19: Emergency Operation

1. General Introduction
2. Flood Routing Model for Valdesia and Las Barias
3. Results of Flood Routing Studies
4. Emergency Operating Rules
5. Forecasting of Hurricane Tracks

June 20: Dam Safety and Organization

1. Visual Inspection of the Safety of Valdesia Dam
2. Analysis of Valdesia Dam Data
3. Current Practices on Dam Safety
4. Proposed Organization for the Operation and Safety of Valdesia Dam
5. Discussion

FECHA DE DEVOLUCION			

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Autor

Final report Volume VI

Título

Transfer of technology and training

Fecha Devolución	Nombre del solicitante