9-1-1984

Water Management Simulator Presentations

Leslie E. Mack
University of Arkansas, Fayetteville

PUB-112

WATER RESOURCES RESEARCH CENTER • 223 Ozark Hall

UNIVERSITY OF ARKANSAS · Fayetteville, Arkansas 72701

WATER MANAGEMENT SIMULATOR PRESENTATIONS

by

Leslie E. Mack

WATER MANAGEMENT SIMULATOR PRESENTATIONS

Leslie E. Mack, Director
Arkansas Water Resources Research Center
University of Arkansas
Fayetteville, Arkansas 72701

Research Project Technical Completion Report

Project G-829-22

The research on which this report is based, was financed in part by the United States Department of Interior as authorized by the Water Research and Development Act of 1978, (P.L. 95-467).

Arkansas Water Resources Research Center
University of Arkansas
223 Ozark Hall
Fayetteville, Arkansas 72701

Publication No. 112

September, 1984

ABSTRACT

WATER MANAGEMENT SIMULATOR PRESENTATIONS

One of the larger stumbling blocks to comprehensive water management is the lack of public understanding of the multitude of variables that operate at the same time within the hydrologic cycle. With more public understanding, there is greater public support for various water projects.

Dr. John R. Amend from Montana State University developed a water management simulator which could handle a large number of variables simultaneously of natural surface and groundwater flow plus a number of water use variables on an accelerated time sequence. By using several remote control devices, participants can "control" their water use but have no control over other participants competing for the same water molecule.

The purpose of this information transfer project was to demonstrate the use of the water management simulator and to begin to develop experienced teams of people from government agencies and academia to explain its operation to local professional and civic groups.

The interest level is very high for the team members to learn about the operation of the water management simulator. The simulator demonstrations have been well received by various audiences.

Mack, Leslie E.

Completion report to the United States Department of the Interior, Washington, D. C., September, 1984.

KEYWORDS-water management/simulation/educational/electronic

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The principal investigator of this project wishes to acknowledge the following persons and organizations:

1. Dr. Richard Peralta, Department of Agricultural Engineering, University of Arkansas, Fayetteville, AR and his assistant Mr. Paul Killian.
2. Mr. John Saxton, Director, Arkansas Soil and Water Conservation Commission, Little Rock, AR and his many staff members who have shown an interest in this project.

INTRODUCTION

A. Purpose and Objectives

With an increase in population and a greater dependency on technological innovations, water use in the United States continues to increase. As the basic water supply is essentially limited (rainfall, surface and groundwater storage), there is and will be greater competition for the same water molecule. More water projects are needed to handle an increase in competitive demand. Obviously, more money is needed for single and multi-purpose projects at an ever-increasing cost. In a democratic society, basic public approval is needed to expand large water uses, water projects, institutional arrangements, water law and financing. There has been some concern for several decades that public awareness of water problems was lacking or insufficient to keep pace with the needs.

The advent of the microprocessor relatively recently permitted the sorting of large amounts of data at very high speeds. With adequate data storage and a pleasing data display of interactive variables, a means was found to make public awareness and education of water management principles more palatable if not fun. The beauty of the water management simulator is that it accelerates time so that several years of runoff record can be observed at a rate of about one year per minute.

Aside from the public awareness and educational aspects of the simulator, one of the main purposes of this project was to train a few teams of two persons each to operate the simulator. The initial effort was to train one team from the Department of Agricultural Engineering at the University of Arkansas in Fayetteville and another team from the Arkansas Soil and Water Conservation Commission in Little Rock. This has proved satisfactory in order to avoid conflicts in scheduling as well as a broader geographical distribution.

B. Related Activities

The use of the water management simulator is part of a larger program of public awareness of Arkansas' water resources. It is believed that while many of our water problems can be solved by scientific and engineering techniques, one of the world's greatest water problems is the lack of public education concerning water resources.

During 1981-82, the Winthrop Rockefeller Foundation funded a public awareness project about Arkansas' water resources. In addition to publishing a document entitled Arkansas Water: Why Wait for the Crisis?, about two dozen volunteers made slide presentations to various professional and civic groups throughout the state. This was well received and was very effective. As a follow-up to these activities, it was thought that the water management simulator would be equally effective by having audience participation.

The author was first introduced to the water management simulator by Dr. Ted Mills at Oklahoma State University. Dr. Mills and his assistants were invited to make a presentation in Little Rock by using their simulators during a day-long workshop. The audience, with widely diverse backgrounds, was very enthusiastic about the demonstration and this led to the decision for Arkansas to purchase its own custom-made simulator.

It is intended that this water management simulator be used on a regular basis for many years to come as part of the public awareness program concerning Arkansas' water resources.

METHODS AND PROCEDURES

A. Description of the Simulator

The water management simulator hardware consists of three basic units which are: 1) the central display, 2) a cathode ray tube monitor, and 3) a series of six small consoles to control various types of water uses.

The central display unit is approximately 36" x 24" x 8". The heart of the unit contains an 8080 microprocessor which is the computational element of the simulator. From thirty years of actual streamflow data (usually U.S.G.S records), an algorithm is programed and stored on an erasable read-only memory. This can be done for sixteen separate hydrographs for sixteen rivers and tributaries. In the Arkansas simulator, eight hydrographs represent different types of geology and climate around the country and eight hydrographs represent rivers and streams in Arkansas.

When the unit is switched on, a large time indicator showing the year and the month is set in motion, the electronic "clock" advances the hydrograph river stage about one month per minute. The "clock" can be stopped, started, speeded, slowed or paused.

Also displayed on the main panel are five different water use units showing a controllable amount of water used for livestock, municipal and industry, energy, irrigation and inter-basin transfer. There is also an additional and detachable reservoir unit. Each of the six units are controlled by a console operated by the audience participants. Each of the consoles, except the reservoir console, can use a variable amount of either surface or ground water or both.

Each participant is usually so busy operating his own console that he is unaware of the other uses taking place and too much water is used causing the demand to exceed the supply which creates a crisis. An alarm is sounded and red lights flash. This is the crux of the educational value of the simulator.

A cathode ray tube monitor (a portable modified television set), is also attached to the main panel so that the participants can observe a comparison of the FLOW, DEMAND and the RESERVOIR level. The participant can control his portion of the demand or the reservoir but has no control over the other participants or the hydrograph. At the completion of each year of the thirty years of record, the cathode ray tube starts a new display of the comparison of the flow, demand and the reservoir level.

One hydrograph, if allowed to run its entire thirty years, will consume a half-hour of water competition and conflict. Participants will soon be aware that they should consider conjunctive use of surface and ground water. Also, it makes a big difference which time of the year water is or is not available.

B. Initial Team Organization

The first team of operators for the simulator was developed from the Department of Agricultural Engineering's Water Resources Laboratory at the University of Arkansas in Fayetteville. Dr. Richard Peralta, an Assistant Professor in the department had attended a simulator workshop three years ago at Oklahoma State University with the author. The workshop was conducted by Dr. Ted Mills. Mr. Paul Killian, a graduate student in the Department of Agricultural Engineering, has also been assisting the author in its operation.

A relatively new team is being developed within the Arkansas Soil and Water Conservation Commission at Little Rock. The Director, John Saxton, or his Deputy Director, Randy Young, will be assisted by John Sweeney, Tom Lane, Dave Ferguson, Danny Goodwin or Ed Cearly.

Another team is anticipated from the University of Arkansas at Little Rock. Dr. Gerry Hanson of the Geography Department will be the new leader.

The Fayetteville team will make presentations to professional and civic groups. The Soil and Water Conservation Commission team will make presentations to state and federal agencies and the County Soil and Water Conservation Districts around the state. The

University of Arkansas at Little Rock team will make presentations to professional and civic groups in the Little Rock area and work with the Arkansas Department of Education.

There is a possibility that not only additional teams will be formed but also an additional simulator may be purchased or a new simulator will be designed to show the effects of specific types of water pollution.

C. Demonstrations

Demonstrations and presentations have been made before the Southern Section of the American Society of Agricultural Engineers in Little Rock, several classes in ground water geology at the University of Arkansas in Fayetteville, the Commissioners of the Soil and Water Conservation Commission as part of a standing display in their offices in Little Rock, numerous guests and visitors to the Soil and Water Conservation Commission and to the participants and attendees of National Water Week in Eureka Springs which is an annual event.

Once a participant has the opportunity to operate one of the consoles, his or her interest quickly soars as they begin to realize the complexity of water management and the innumerable variables involved.

RESULTS

As part of a continuing program of public awareness of Arkansas' water resources, the water management simulator has shown its use to be a very effective tool. It is always made clear to the audience and the participants that the water management simulator is only an educational device and is not to be considered a real-time, real-life water management control unit. Participants feel that they actually have a real role and a better understanding of the water management process. Therefore, they become better informed citizens for the public and private roles in the never-ending water management decision-making processes.

CONCLUSIONS

The water management simulator developed by Dr. John Amend has been very effective in stimulating interest in Arkansas' water resources at times other than floods or droughts. This has been a worthwhile investment for the Arkansas Water Resources Research Center to develop teams to lead simulator workshops. The process has advanced public interest in water resources which will lead to more aggressive programs in the future.