WATER AUTOMATION NEEDS SURVEY

by

C. A. Pugh

July 1995
Water Automation Needs Survey

The Bureau of Reclamation (Reclamation) has been involved in canal automation since the 1960’s. In 1992 the Water Resources Research Laboratory (WRRL), formerly known as the Hydraulics Branch, conducted a survey of Reclamation Offices to help compile a data base of water automation efforts on Reclamation projects, and to determine the interest level of field personnel in obtaining training, technical assistance, and design assistance with their automation needs. A copy of the survey is attached.

This report summarizes the results of the survey and provides additional information obtained from field level contacts since the survey. Figure 1 shows the distribution of responses and contacts on a state by state basis.

**Progress in Automation** - In 1991, the “Canal Systems Automation Manual - Volume 1” was published. This manual addresses fundamentals of canal automation. It deals with basic terminology, operation and control concepts, supply and demand concepts, and canal control history. The 113 page manual is designed for engineers, managers, and operators of water conveyance systems and irrigation projects. Volume 2 of the Canal Automation Manual is scheduled for publication in 1996. The second volume will provide a more detailed discussion of automated canal system design, control theory, simulation methods, and control system hardware.

**Automation Survey Responses**

![Map showing responses](image)

Figure 1 - Responses from Reclamation Offices in the seventeen western states.
**Survey Results** - The survey results are encouraging; however, they are by no means exhaustive. The bar charts in figures 2 and 3 show the total number of responses and indicate how many of the respondents would like to obtain training in the form of video tapes and workshops, and how many would be interested in technical assistance. Eighty-six percent indicated that they would be interested in extra training and over three-fourths expressed interest in technical and design assistance. Table 1 is a summary listing of the compiled information.

**Water Automation Survey Responses**

<table>
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<tr>
<th>Total Responses</th>
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<tr>
<td>100</td>
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**Figure 2** - A high percentage of the responses indicated that training and technical assistance would be helpful.

**Responses by State**

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<tr>
<th>State</th>
<th>Technical Assistance</th>
<th>Workshops &amp; Training</th>
<th>Total Responses</th>
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<td>25 20 15 10 5 0 0 0 0 0 0 0 0 0 0</td>
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**Figure 3** - Individual survey responses by state.
**Small Scale Automation** - Many water managers now recognize that improvements are necessary, but are striving to find cost-effective solutions. Often, operators of small scale irrigation projects do not realize that automation is a practical solution to their problems. This misconception is partially due to the fact that many of the well publicized automation efforts have been on large scale systems, such as the Central Arizona Project and the Central Utah Project. However, our research indicates that the vast majority of canal systems, most of which are relatively old and usually small scale, could benefit from automation technologies. The elaborate and expensive equipment used on large projects is not necessary to retrofit existing systems.

The Bureau of Reclamation’s Provo Area Office, in conjunction with the WRRL, has implemented several small scale control and monitoring enhancements recently in Utah. Two articles in the Water Operation and Maintenance Bulletin ¹ ² detail how monitoring and control enhancements can be implemented at reasonable costs. Figure 4 shows a check structure which was modified to automatically control upstream water level by installing a solar powered, inflatable gate. This site can also be remotely monitored and controlled from the water district office by radio.

![Solar powered, inflatable gate check structure, Strawberry Highline Canal, Utah](image)

Figure 4 - Solar powered, inflatable gate check structure, Strawberry Highline Canal, Utah


Training - In response to the need and desire for additional training in automation methods, a training course/workshop is under development. The training program will include production of informational video tapes and a training course, "Modern Methods in Canal Operation and Control." Course notes and reference materials will also be supplied to the participants. The course will be up to 5 days long with shorter versions available to meet client needs. A preliminary course outline follows:

I. Canal Control Fundamentals
   A. Introduction
   B. Basic Terminology
   C. Operations
   D. Control Fundamentals
   E. Control Selection for Existing Systems

II. Technical Aspects of Canal Operation and Control
   A. Introduction
   B. Automated Canal System Design
   C. Analysis and Simulation
   D. Control Theory and Application

III. Canal Automation Equipment
   A. Introduction
   B. Communication Systems
   C. Instrumentation for Physical Measurements
   D. Electrical and Mechanical Systems
   E. Control Equipment
   F. Equipment Specification

IV. Example Canal Control Systems

A new canal model is currently under construction in the WRRL. This model will be used for hands-on demonstrations in the training course. Clear acrylic canal sections and automated gate controls will make the model very valuable for workshop demonstrations. Hands-on laboratory sessions are planned for each day of the workshop. The first training class is tentatively scheduled for January or February of 1996. The first video tape in the series, "Solar Powered Canal Automation," was produced in conjunction with the Provo Office. Additional video tapes are planned, including:

   a. Introduction to Canal Automation,
   b. Low Cost Control Equipment for Canal Operation,
   c. Modern Canal Operation, Control, and Automation.

Technical Assistance - Three-fourths of the responses expressed interest in various levels of technical assistance. The survey identified numerous projects where automation is in use or is being considered for installation. The WRRL is currently assisting Reclamation area offices in Utah, Nebraska, New Mexico, Colorado, Arizona, and others as needed.
Updated information on water automation and water conservation activities in the WRRL is available on the internet through the World Wide Web at the following URL's:

http://www.usbr.gov (Reclamation home page)
http://ogee hydlab.do.usbr.gov (WRRL home page)

The Water Systems Automation Team can help assess possible solutions to site specific canal operations problems. After the irrigation district and the Reclamation area office have decided on a solution, we are available to help develop and implement the solution. Recent experience on other Reclamation projects has resulted in new and innovative solutions to common operations and control problems.

For additional information on training or assistance on water automation matters, contact the Water Systems Automation Technology (WSAT) Team, at the WRRL, at 303-236-2000 (plus extension), Fax 303-236-4096.

Current members of the WSAT Team include:

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Cliff Pugh, Water Conservation Team Leader, ext. 452, e-mail - CPugh@do.usbr.gov
Dave Ehler, Electronics Engineer, ext. 454, e-mail - DEhler@do.usbr.gov
Tony Wahl, Hydraulic Engineer, ext. 446, e-mail - TWahl@do.usbr.gov
Jim Higgs, Hydraulic Engineer, ext. 466, e-mail - JHiggs@do.usbr.gov
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WATER AUTOMATION SURVEY
For Regional and Project Offices

Office

Mailing address

1. List names and experience/expertise in water automation (if any):

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<th>Name</th>
<th>Experience/expertise</th>
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2. What assistance would you like to see from the Denver Office regarding canal automation (circle appropriate answers).

- Training and/or workshops. - Video tapes on various aspects of automation, including upstream control, downstream control, control equipment, upgrading existing systems.  
  Yes  No

- Canal automation seminar available on request.  Yes  No

- Technical assistance. - Equipment specifications, control algorithms, etc.  Yes  No

- Design assistance. - Gate design, control methods, computer simulation.  Yes  No

3. Are you interested in water automation seminars or workshops?

a. Similar to the Water Systems O&M Workshop  Yes  No

b. As part of the Water Systems O&M Workshop  Yes  No

c. A 1- or 2-day seminar or workshop  Yes  No
c. What are your maintenance and repair requirements? (consider needed equipment and level of expertise)

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<td>8 9 10</td>
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Comments:
________________________________________________________________________________________
________________________________________________________________________________________
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9. What is your understanding of the capability in the Denver Office in automation?
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
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________________________________________________________________________________________

If you could include a map of your project or district showing automated facilities or where automation is being considered, please attach it to this survey.

Thank you for taking the time to fill out this survey.
Craig Albertsen  
Group Manager, Water Supply,  
Use, and Conservation  
Bureau of Reclamation, D-8520  
PO Box 25007, Denver Federal Center  
Denver CO  80225

Subject: Progress in Water Automation Activities - Water Automation Survey

In light of the recent emphasis on water management as our primary mission in Reclamation, we have updated our database of water automation activities in Reclamation. The enclosed document summarizes the findings of a survey conducted a few years ago and includes additional information on recent automation activities.

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Sincerely,

Philip H. Burgi  
Technical Service Center  
Manager, Water Resources  
Research Laboratory

Enclosure

Identical letters to persons on attached sheet.

bc:  D-8500, D-8560 (Rogers, Wahl, Higgs, Ehler, Pugh, PAP file)  
     (w/encl to each)

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Sincerely,

Philip H. Burgi
Technical Service Center
Manager, Water Resources Research Laboratory

Enclosure

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Subject: Progress in Water Automation Activities - Water Automation Survey

In light of the recent emphasis on water management as our primary mission in Reclamation, we have updated our database of water automation activities in Reclamation. The enclosed document summarizes the findings of a survey conducted a few years ago and includes additional information on recent automation activities.

If you know someone who would like to be added to the list for updates on water automation activities or if you would like to be removed from the listing, please contact us (see attachment for phone numbers).

If you are interested in solar-powered automation techniques, a videotape, "Solar-Powered Canal Automation," is available on request. A copy of the tape has been sent, under separate cover, to the parties indicated in Table 1.

The summary document discusses progress in automation, survey results, small scale automation, training, and technical assistance. Please contact us if you are interested in discussing automation.

Sincerely,

Philip H. Burgi
Technical Service Center
Manager, Water Resources
Research Laboratory

Enclosure

Identical letters to persons on attached sheet.

bc: D-8500, D-8560 (Rogers, Wahl, Higgs, Ehler, Pugh, PAP file)
   (w/encl to each)

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