WATER OPERATION AND MAINTENANCE

BULLETIN NO. 122

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IN THIS ISSUE

UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Reclamation

The Water Operation and Maintenance Bulletin is published quarterly for the benefit of those operating water supply systems. Its principal purpose is to serve as a medium of exchanging operation and maintenance information. It is hoped that the reports herein concerning laborsaving devices and less costly equipment and procedures will result in improved efficiency and reduced costs of the systems for those operators adapting these ideas to their needs.

To assure proper recognition of those individuals whose suggestions are published in the bulletins, the suggestion number as well as the person's name is given. All Bureau offices are reminded to notify their Suggestions Award Committee when a suggestion is adopted.

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Cover photograph

A minicomputer processor, printer, and dual-disk cartridge used in an office at the E&R Center.

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WATER OPERATION AND MAINTENANCE
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INTRODUCTION

Irrigation ownership limitations modified by 1982 Reform Act. See page 1.

Do you know what "bit," "chip," or "bytes" are? They are part of the fascinating world of computers. To get a "feel" of what computers are and what they can do for you, see article beginning on page 6.

The article on page 15 provides a solution to a dust problem that was literally "choking" engines.

April 14, 1982, may not mean anything to you and me, but it is a date of a great success story and tribute to the foresight of a group of farmers back in 1920. Read the article on page 16.

Could this accident have happened at Reclamation? See page 19.

The article on page 20 describes how the A&B Irrigation District installed boosters to sprinkler irrigation systems enabling them to conserve water and provide better farming procedures.

On page 21 are 10 tips for keeping your feet warm and dry during the winter months.

THE RECLAMATION REFORM ACT OF 1982 – AN OVERVIEW

by Mitchell Snow[1]

When some future historian spins the saga behind the settlement of the Western United States, few events will match the signing of the Reclamation Act of 1902 in importance. While earlier congressional actions had allowed for the opening of the West to homesteaders, the Reclamation Act provided Western settlers with something far more vital than mere land – it provided water. Without water, the Western States would have remained essentially uninhabited lands.

In the ensuing years, the Western States have become one of the leading producers of agricultural products in the world, and the growth promoted by the Reclamation Act of 1902 has turned the "Great American Desert" into a homeland for millions of people. Reclamation has changed the face of the Nation. Today, Reclamation itself has been changed to reflect that transformation. With the passage of the Reclamation Reform Act of 1982, signed into law by President Ronald Reagan October 12, 1982, a new chapter in the story of the West was opened. "While preserving the basic objectives of the original program, this legislation provides a new direction for the Federal role in Reclamation – one that will, I believe, prove to be a significant step forward on our road to economic recovery in the 1980's," the President said.

As the success of the Reclamation program became increasingly apparent and the problems the Reclamation Act of 1902 was designed to resolve were solved, a new generation of problems was created while the Bureau of Reclamation struggled to implement an increasingly outdated law. Perhaps the most troublesome provision of the original Reclamation Act was the 65 ha (160 acre) ownership limitation imposed on Reclamation farmers. This, more than any other issue, became the focus of discontent that eventually precipitated congressional action.

The new Reclamation Reform Act sets expanded ownership limits on the amount of land for which an individual can receive low-cost Reclamation project water. The ownership limits are also applied Westwide under the new law. Both of these changes are significant.

Two different ownership limitations now apply to farmers on Reclamation lands. Instead of the former limit of 65 ha (160 acres), which had been expanded to 129 ha (320 acres) for married couples by administrative action in 1916, the new law expands the limitation to 388 ha (960 acres) for qualified recipients. Qualified recipients include individuals – defined by the Act as any person, including spouse and dependents – and legal entities with 25 or fewer beneficiaries. Tax-exempt religious and charitable groups will also be treated as

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[1] Mitchell Snow is a Staff Assistant in the Bureau's Public Affairs Office, Washington DC. A similar article is published in the Reclamation Era, Volume 67, Issue No. 4, January 1983.

individuals, regardless of their affiliation with any of their respective governing bodies. Qualified recipients are classified as any legal entity which benefits 25 people or less. An ownership limitation of 259 ha (640 acres) now applies to what the law calls "limited" recipients, legal entities benefiting more than 25 people.

Farmers who own lands in excess of the limits set by the Act will still be allowed to enter into recordable contracts which require the sale of those lands to an eligible purchaser within a specified period. Water deliveries are permitted for lands designated as excess which are under recordable contract. Under procedures established under the earlier law, the period which landowners had to dispose of their lands was 10 years. Under provisions of the new law, the maximum has been set at 5 years. Owners of non-Indian lands receiving agricultural water from the yet-to-be-completed Central Arizona Project did receive an exemption, however, which will allow them 10 years from the date water is available to their lands for the disposal of excess lands.

Landowners who had entered into recordable contracts prior to the enactment of the new law will be able to amend their contracts to bring them into conformance with the new acreage limitations. Those recordable contracts which were placed under moratorium as an end result of lawsuits related to the implementation of the old 1902 Act will also be affected.

When the moratorium expires on existing recordable contracts, low-cost subsidized water will be available for 18 months. Following that 18-month period, full cost will be charged for water used in the irrigation of excess lands, as defined by the provisions of the new law, for the duration of the time remaining on the contract when the moratorium began.

Full-cost payment for water deliveries is directly related to acreage limitation and the new operations limitation focus which clarifies the leasing of lands above the ownership limitations. Leasing of farmlands was never addressed under the former law, and many extensive operations were run on leased land. To resolve the situation, a complex set of provisions was written into the Reclamation Reform Act. The leasing of lands in excess of the ownership limitations is permitted under the new law, if full cost is paid for the water. Full cost for water includes the unrepaid project construction cost allocated to irrigation on an annual basis, with interest.

Four basic leasing situations were addressed by the Act, and two different interest rate formulas were specified. For qualified recipients in existing projects, water for more than 388 ha (960 acres) based on the weighted average yield of United States securities sold during the year in which project expenditures were made, but not less than 7-1/2 percent. The same interest formula also applies to water for more than 129 ha (320 acres) delivered to limited recipients who received water on or before October 1, 1981.

Qualified recipients in new projects will be required to pay full cost for water delivered to acreage in excess of 388 ha (960 acres) based on the arithmetic average of interest rates on 15-year public obligations and the weighted average yield on all interest-bearing issues

sold by the Treasury during the fiscal year preceding the fiscal year in which project expenditures are made. Today, that figure stands near 12 percent. The same interest formula applies to limited recipients who first received water after October 1, 1981; however, full-cost payment will be required for water delivered to all lands in those operations.

The Reform Act also spells out several other requirements for leasing that have not been employed by Reclamation in the past. All of the leases for lands served by Reclamation water must now be in writing. Leases will be limited to 10 years, with the exception of leases for perennial crops, which can run for a maximum of 25 years.

Another area closely related to the issue of acreage limitation is the application of Class 1 Equivalency. Essentially, equivalency formulas provide for expanded ownership limits by equating all lands in a district to the most productive lands in that district. The new Act does not alter any existing equivalency formulas already authorized by Congress. It does give the Bureau of Reclamation flexibility to implement any new system of classification which it might develop.

The application of Class 1 Equivalency, as well as the provisions for expanded acreage limitation and many other sections of the Act, does not automatically apply to all Reclamation lands. Provisions of the new law apply only to contracts entered into after the enactment of the Act, existing contracts which are amended to grant supplemental or additional benefits to a district, and contracts which are specifically amended upon the request of the district to bring them into conformance with the new law. Districts in existing projects may elect to retain the provisions of the old law, although individual water users may elect to come under the provisions of the new Act even if their district does not choose to do so.

Districts which decide to operate under the old law will be limited to the 65 ha (160 acre) ownership ceiling. Full cost, based on the arithmetic average of interest rates on 15-year Treasury bonds sold during fiscal year 1983, will be applied to water delivered to all leased lands that exceed the 65 ha (160 acre) ownership limit for districts which fail to amend their contracts within 4-1/2 years.

Recipients of project water in districts who choose to enter into new or amended contracts will be required to certify that they are in compliance with the law. Each landowner and lessee within a district will have to furnish the district with a certificate stating the amount of land owned and leased in their operations, the term of the lease, and a statement that the rent on the lease reflects the reasonable value of the irrigation water.

Another issue closely related to the acreage limitation debate has been the residency requirement. Under the 1902 Act, landowners had to live on or near the land they farmed; but when the provision was left out of the 1926 Omnibus Adjustment Act, the status of the requirement became unclear. The 1982 Reform Act has ended the confusion over the issue by eliminating all residency requirements.

Water delivered from U.S. Army Corps of Engineers projects to farmlands in Reclamation States also entered the controversy over acreage limitation, and again, the issue was addressed and resolved by the Reform Act. Now, unless Congress has specifically designated that Reclamation law applies to a Corps project or the project contains works provided by the Secretary of the Interior, those projects are exempt from acreage limitation.

Districts which have completed their repayment obligation will also be exempt from acreage limitation, although they will still be liable for operation and maintenance charges on their projects. Existing or future rehabilitation and betterment loans will not subject districts to acreage limitation provisions once their construction cost repayments have been completed. Existing contracts allowing accelerated repayment of project construction costs will continue to be valid, but lump-sum or accelerated repayment was not authorized under any other conditions.

All new and amended contracts will carry sections which require operation and maintenance charges to be calculated and applied on a yearly basis. In the past, certain districts were allowed an exemption from operation and maintenance charges. Districts which operate and maintain their project facilities without Federal funds will be exempt from this provision.

All districts which have entered into a repayment or water service contract with the Bureau of Reclamation will be required to develop water conservation plans. The new law directs that the plans contain definite goals, specific water conservation measures, and a timetable for meeting their conservation objectives. The Secretary of the Interior is also authorized to enter into memorandums of agreement providing for the coordination of Federal water conservation programs with the participation of non-Federal interests.

The new Act also requires the Secretary of Agriculture, with the cooperation of the Secretary of the Interior, to transmit a report to Congress on the production of surplus crops on acreage served by Reclamation water within a year. The report is to include recommendations on the coordination of Reclamation and agricultural policy regarding surplus crops. The law also provides that on existing Reclamation projects, restrictions on the delivery of water to surplus crops extend no longer than 10 years after the date of initial authorization of the project.

All of the provisions of the new Reclamation law will also apply to future Small Reclamation Projects. The 65 ha (160 acres) for all Small Reclamation Projects already in existence will remain valid for the time being.

President Reagan said that the bill is a major step forward in the Administration's efforts to work more closely with the States. "Enactment of this landmark legislation makes a Federal-State partnership in water resources development an overdue reality and stands as

a symbol of our commitment to such partnerships," the President said, after signing the bill into law. The Bureau of Reclamation is carrying out the Administration's plan to implement the new law and meet the challenge of transforming the practices that have grown up around the Reclamation Act of 1902 as it moves to meet the changing needs of an expanding West, extend Reclamation's traditions of outstanding accomplishment in water resources development, and meet the needs of the 21st Century.

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SMALL COMPUTERS FOR OPERATION AND MAINTENANCE[2]

The advent of the data processing industry over the last two decades has brought us to an environment today where the term "computer" is nearly a household word. We see computers doing inventory and checkout work at the local supermarket, handling intricate engine diagnostics at your favorite automobile dealership, and even providing accurate and immediate medical analysis at the hospital. For many years, computers have provided an important role in the banking industry and have even printed many of our paychecks. Obviously, we are married to the computer institution; therefore, we should further our knowledge of how we can use these machines in our work environment. We have all read horror stories about the results of computer failures or more likely computer programing or computer operator mistakes. With any system we depend upon, whether it be a piece of earthmoving equipment, an office adding machine, or a computer, we are depending upon the quality of workmanship and materials used to build the item or the reliability of the operator. Computers are simply pieces of equipment designed to assist us with our daily operations, and in their common form look like an overgrown typewriter with a television-type tube and some electronic memory boards.

This article will familiarize you with the work a computer can accomplish in an irrigation district office, how to buy a computer or more specifically a minicomputer, and what some of the computer language terms mean.

What Is a Minicomputer?

There are many names given to the type of computer best suited for the requirements of an irrigation district. Some names are minicomputer, microcomputer, small business computer, personal home computer, and intelligent terminal. The distinction between these names is very blurred, but basically, they all refer to that part of the computer industry with equipment priced less than $100,000. For this article, the term "minicomputer" is used and refers to a computer small in physical size and not requiring a special office environment, such as additional air conditioning or heating. The power requirements for a minicomputer usually meet the existing electrical wiring system. However, a dedicated line for the minicomputer is usually worthwhile, especially if heavy-duty electrical equipment is used nearby.

Generally, a minicomputer consists of a keyboard similar to a typewriter but with a few more special keys, a CRT (cathode-ray tube), a data storage device using tape cassettes or diskettes, and a printer. Usually, the memory of the minicomputer is located in the same box as the CRT. This box could be called the central processor as it performs all the data transfers, calculations, and operating system functions. The data storage device most commonly used is the diskette which is similar to a phonograph record, flexible, and can contain from 250,000

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[2] Written for this publication by L. A. Brower, Water O&M Branch, Engineering and Research Center, Denver, Colo.

to 1,000,000 characters of information. A printer is desirable to produce the output records from the minicomputer. There are various types of printers available, but the main considerations are speed and print quality.

The cost of a minicomputer on today's market to fit the needs of the average irrigation district will be in the $10,000 to $20,000 range. Some of the personal (home) computers sold at the local electronics or computer stores begin at a price of $600. Such a "minicomputer" can be configured to the district's needs by adding increased memory capacity, data storage devices, and a printer, for a total price in the $5,000 to $6,000 range.

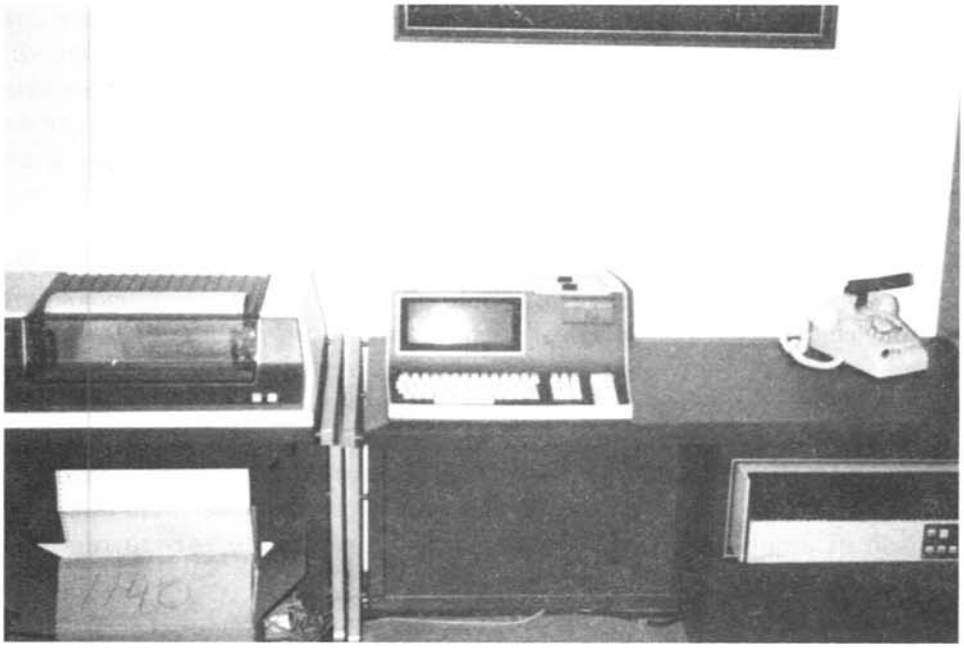

Figure 1. Printer, minicomputer processor, dual-disk cartridge.

What Minicomputers Can Do for an Irrigation District

Most irrigation districts already have some form of automated system for their recordkeeping procedures. Perhaps a bookkeeper uses a calculator and/or posting machine to total the water orders throughout the irrigation season for billing purposes. The minicomputer can accomplish this task in a fraction of the time, allowing the bookkeeper to do other important work. Frequently, the use of a minicomputer system does not reduce the number of personnel in the office, but it does help accomplish more work in an 8-hour day. An operator is still required to enter the data into the system and execute the commands to produce the desired results. Most minicomputer systems are not difficult to operate as self-training manuals are usually provided by the manufacturer, or training courses may be offered at some cost to the irrigation district.

A minicomputer can perform the calculations and bookkeeping requirements of the WMC (Water Management and Conservation) program. Software, consisting of the actual computer

programs, is now written and available from the Bureau of Reclamation to place on most minicomputers. Depending upon the capabilities of the equipment, this software may have to be modified or rewritten to accommodate the minicomputer specifications. The WMC program, in addition to field-by-field scheduling of irrigations, is capable of providing information on scheduling water throughout the distribution system. Water order data, as provided to the district from the individual farmers, are input to the minicomputer. A data base consisting of the type of crops, acreage, soil types, and layout of the distribution system is also stored within the storage medium. Using this available data, the water demands on the distribution system can be calculated and a forecasted demand schedule can be printed.

Using the WMC data base, especially the data associated with water orders, the district can computerize the water accounting procedure to keep updated records on water used for each farmer. Perhaps these data can be checked against the allocated yearly usage figures to flag those areas approaching the allocation. Billing for water used can be quickly achieved from the water accounting records, and the minicomputer can even produce the bill on a special form and also produce the mailing label to send the bill to the water user.

There are many different records and reports irrigation districts retain for their own management. Given the proper type of input data, the minicomputer can complete practically all the records management requirements. Records and reports regarding the water user can be produced, containing such data as ownership, legal description, operator, addresses, acreage, etc. Such records can assist with assessments, water user ledgers, stockholders' ledgers, and other reporting from the district to the individual owner/operator. An inventory system can be built into the minicomputer to help keep track of real property and movable equipment. Computer programs can be purchased or written at the local level to aid with determination of equipment depreciation, and of course, the service records for the equipment can be placed into the computer.

Personnel records are a good application for a minicomputer. Packaged programs can be purchased to help maintain time and attendance records on each employee, produce payroll journals, print W-2 forms at yearend, and even print and prepare the mailing of individual paychecks. Financial statements of the district's operation can be produced by minicomputers, and operation and maintenance cost accounting reports are also a possibility of the minicomputer. Most of the reporting requirements can share a common data base within the storage medium, reducing the duplication of effort commonly found in records management. A computer has the added advantage of producing legible and neatly cataloged reports, all of which can aid the occasional auditing procedure.

Minicomputers can aid the engineering staff of the district by calculating drainage requirements, sprinkler design problems, and construction details. Graphical analysis is also a potential usage of these types of computer systems.

With a somewhat more sophisticated minicomputer acting as a centralized computer, telemetered data can be interpreted to perform the complicated control functions. This

capability, coupled with the WMC program which can predict water demands on the distribution system, can produce a completely automated and managed irrigation system. The technology is here and tested in various areas of the West. The next step is to accumulate the known data into a minicomputer and try to accurately manage the water delivery system for the most efficient use of the available water. Assistance from the Bureau at the project, regional, and Engineering and Research Center levels is available to help choose the right minicomputer system for your district.

How to Choose a Minicomputer – 10 Easy Steps

The next big question is, where do I begin? Purchasing or leasing a minicomputer is in some regard similar to purchasing a backhoe. First, your must determine what you want it to do, what is available on the market, who can operate it, and of course, the costs involved. Perhaps a lease agreement is the best alternative if you think the minicomputer may become obsolete. Not all companies offer lease or lease-purchase options, but if the options are available, they should be economically considered. Presently, the minicomputer industry is changing its product lines almost daily. A survey taken in March 1982 by the Datapro Research Corporation showed 232 minicomputers available from 61 vendors. Today, these figures could be considerably different as the industry is very competitive.

The 10 steps listed here are possible procedures you may desire to follow as you investigate the minicomputer industry.

1. As you proceed with your quest for a minicomputer, do not become confused with what the equipment is called. The important matter is to find a machine that can be cost effective.

2. Read all you can find concerning minicomputers, especially if you consider yourself a novice in this area. You should familiarize yourself with the basics by visiting a public library, bookstore, or even a college bookstore, if one is available. Perhaps responses to business or computer magazine advertisements will provide you with much informative literature.

3. Analyze your actual current needs for a minicomputer and outline your probable future needs. Forecasting the future workload for a minicomputer is sometimes difficult, but as one becomes familiar with the selected equipment, additional water management or office applications may want to be placed onto the computer system. Word processing and/or graphics capability are normal software enhancements that are beneficial. Additional memory, more advanced computer languages, more data storage capacity, and faster printers are some of the items you may desire in the future. The selected equipment should have the ability to expand as both your needs and your budget grow.

4. Now you should be ready to start looking at equipment that may be located in a local computer store. This will give you an opportunity to see what the minicomputer looks

like, perhaps get some hands-on experience, and allow you to talk to salespeople in a relaxed atmosphere. Also, since the equipment sold in computer stores is usually from the less expensive home computer market, you will have a chance to observe the type of function these "microcomputers" can perform. Perhaps for a small irrigation district or if the budget is limited to around $5,000, this type of minicomputer may be a practical alternative. The home computer usually supports the BASIC (Beginners All-purpose Symbolic Instruction Code) language capable of both mathematical and administrative applications, and can perform most district functions.

5. Preliminary talks with sales representatives from the minicomputer companies that have sales offices in your area can now begin. These salespeople will demonstrate the capabilities of their equipment, probably using computer jargon having little meaning to the layman. Have the representatives explain what it is they are talking about so you can learn from the experience. Some explanation of your planned use of the minicomputer will be helpful, indicating that you want programing capability similar to the BASIC computer language to handle both mathematical and administrative applications. Much sales literature is usually available from these visitations. Acquire all that you possibly can so that some of the comparative shopping can be done in your own armchair. Of great importance is to inquire about the serviceability of the equipment, such as maintenance available in your community or how long the minicomputer will be out of service should something go wrong. Cost of this maintenance is also a factor to consider.

6. Spend some time talking to other businesses in your area that have been using minicomputer equipment similar to what you are interested in. Perhaps you can have discussions with management of other irrigation districts to learn what type of equipment they may have or may recommend. Frequently, these conversations will reveal the problems of service or reliability encountered, and you will have an opportunity to review the types of applications placed on their minicomputer. Sometimes, an exchange of software (programs) between your district and another is a possibility, or even multiple districts can share the same minicomputer. Security problems encountered with a shared system can be worked out.

7. The financial picture now must be focused toward your board of directors and accountant. The economics of lease, lease-purchase, or purchase must be considered. Maybe the availability and economics of using a terminal to hook into a time-sharing system are possibilities. Also, consider the depreciation and the investment tax credit available if the equipment is purchased. Approval to seriously shop for a minicomuter may have to be made at this time, if not already achieved through management channels.

8. Now you should be prepared to start shopping for your minicomputer, having a good idea of what applications will be placed upon it, what is available, and how much you can spend. The salespeople should provide firm equipment configurations and related costs. The following list contains some of the technical items that should be discussed and included in the configuration:

a. Memory capacity.–The minicomputer must contain sufficient memory to satisfy the requirements of your current applications. Make sure the equipment can have additional memory added if you expect it to perform more complicated and larger tasks in the future. The cost of future add-on memory should be considered.

b. Access speed.–This provides an indication of how fast the central processors request for data can be accomplished. If data are located on cassette tape, the speed will be much slower than if located on disk or diskette.

c. Central processor.–Since the actual computational work is done here, it will be good to compare the time required to add numbers. This is an indicator of the speed of the processor.

d. Programing.–The software availability is very important. Perhaps, the vendor will provide packaged computer programs to accomplish your work, but normally you will need additional programing expertise in your organization. Therefore, stay with the more basic programing languages, such as BASIC. Consider the cost of training personnel to program the minicomputer or the costs of packaged programs available from the vendor.

e. Input equipment.–Usually minicomputers use the keyboard for entering data, but optical card readers or punched card readers may be helpful in some environments.

f. Output equipment.–The CRT is normally a part of the equipment, but a printing device is required to retain a copy of the output. Printers are a significant cost item that should be carefully examined for quality and speed.

g. Maintenance.–This is a very important consideration to discuss with the vendor. Maintenance is usually provided through a cost-per-month agreement which can vary depending upon the distance from the nearest service center to your office. The availability of maintenance can be a deciding factor when selecting a minicomputer.

9. The shopping is now finished so the final decision must be made regarding your minicomputer acquisition. A final meeting with the board of directors may be required. Again, justify the costs versus benefits to be expected from the equipment and be certain your organization is ready to make a commitment to use the equipment. Costs are currently decreasing in the minicomputer field as advancements are made in electronic technology, but a commitment today will improve your water management and office administration.

10. Make the commitment to acquire the equipment. Notify the district employees of the decision, and collect the tools to help computerize your water management and office endeavors.

Glossary of Computer Terminology

Binary Numbers – The binary system uses two symbols, 1 and 0, to perform all mathematical combinations and computations. The symbols are the presence or absence of a pulse of electricity within the computer. Numbers are represented as being so many ones, so many twos, so many fours, so many eights, etc., with each place doubling the prior place, going from right to left. The decimal number eight would be written in binary as 1 0 0 0. Fifteen would be written 1 1 1 1. Binary numbers also represent alphabetical characters and special symbols.

Bits – A bit is a binary digit; that is, a 0 or a 1.

Bytes – A byte is a series of bits, usually eight, which is the standard "word" length in the minicomputer field. Memories are configured in thousands of bytes, such as 32 K bytes which means the memory capacity is 32,000 8-bit words.

Cassette – Similar to the cassette tape unit in an automobile, a cassette in a minicomputer is a data and program storage medium.

Central Processor – Sometimes known as the CPU (central processor unit), it is the heart of the minicomputer where the "thinking" is accomplished.

Chip – A very small silicon chip containing the microscopic circuitry that makes up the brainpower of the computer.

Disk – Not a farm implement, but a magnetic storage medium resembling a stack of phonograph records that can contain a large amount of data. Disks are usually found on the more costly and sophisticated minicomputers.

Diskette – A flexible or "floppy" mylar material housed in a plastic envelope commonly used as a minicomputer storage medium. It is low in cost compared to the disk or magnetic tape medium, but generally provides a data acquisition speed commensurate to the minicomputer environment.

Hardware – The actual computer equipment, without the operating system or programs required to make it function.

Integrated Circuit or IC – This is the combination of electronic components that fit into a chip, designed to serve a variety of purposes.

Interface – The electronics that translate a mechanical motion to electronic binary pulses, such as when an "8" is depressed on the keyboard. Interfacing also translates internal binary actions back to numbers or letters during the output phase of the operation.

Lease-purchase – Rather than leasing the equipment for a flat charge per month or purchasing the equipment outright, an alternative some vendors provide is the lease-purchase agreement. Using this option, a percentage of the lease investment can be applied toward the purchase price at a later time.

Line Printer – A device which prints, onto paper, the output from the computer one line at a time. This is usually the more costly but faster type printer available.

Matrix Printer – A device which prints, on paper, the output from the computer one character at a time, with each character composed of a matrix of dots rather than solid lines.

Memory – That portion of the computer that contains the main storage, referenced as a number of words, such as 16 K words. The MOS (metal oxide semiconductor) memory is used commonly in the minicomputer field.

Operating System – Every computer contains a software package known as an operating system. This handles the communications between the operator and computer, allows for data file management, and performs many other internal and external chores. Batch operating systems do not allow communications between the operator and computer once the job has begun. Interactive operating systems allow data to be entered as a job is executing. Real time means the system responds to external demands on a priority basis, such as receiving telemetered data. Time-sharing operating systems allow multiple users to access the system and share its resources at the same time.

Peripherals – An input or output device tied to the central processor, such as printers, card readers, or plotters.

Programing – The art of teaching a computer what to do, using a computer language such as BASIC (Beginners All-purpose Symbolic Instruction Code), FORTRAN (FORmula TRANslator), COBOL (COmmon Business Oriented Language), RPG (Report Program Generator), or other languages available from a vendor.

RAM – Random Access Memory is a memory bank you can add to or retrieve information at random. This is the area of the computer that will contain your program and the data used when the actual "thinking" process is underway. The contents of this memory are changeable.

ROM – Read Only Memory is memory that cannot be changed by the operator or programer. It contains the essential instructions seldom changeable in day-to-day usage, such as the computer language itself.

Software – The programing packages and languages used to program the computer, and also the operating system. The compiler is also a software tool which converts programs written by humans into machine language (binary) object programs.

Storage Protection – The art of protecting programs and data located within the storage medium of the computer. Retaining backup copies of all data and programs is feasible should a computer "crash" occur. Security of the data is also a prime consideration, especially for financial, payroll, and employee records.

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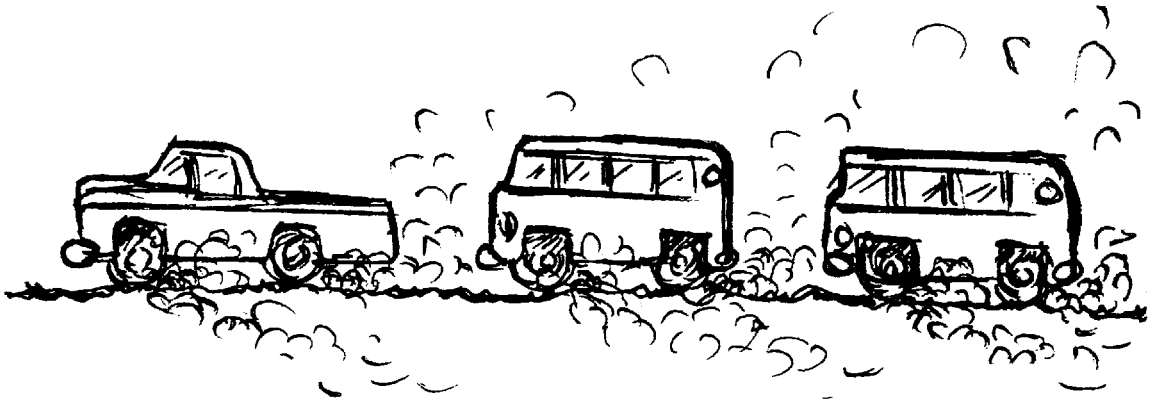
AIR FILTERS SAVE MONEY[3]

Every project has vehicles that operate on dusty roads. The Arizona Projects Office had two 1979 Chevrolet Suburbans that often traveled about 24 kilometers (15 miles) on dirt roads to a major pumping plant site in a caravan with contractor employees' vehicles and delivery trucks. The fine dust was literally choking the engines on these vehicles. Weekly air-filter changes could not control the dust buildup inside the vehicles' carburetors. In a 12-month period, the two vehicles' carburetors were rebuilt nine times, and eventually both were replaced with new carburetors. The vehicles were out of service a total of 52 days. Total costs for parts and labor over the same 12-month period on carburetor problems alone were over $1,600.



The Arizona Projects Office shop foreman, Gordon Sewell, suggested installing Amsoil (LTF) Life Time Filter foam and wetting-agent air-filter elements in the vehicles. Since they were installed, neither vehicle has had any unavailability due to carburetion problems. The LTF filters cost about four times more than conventional air filters, but their extra cost has been recouped during the first few weeks of operation.

The filtration characteristics of the LTF air filters match the actual service conditions and have reduced direct vehicle maintenance costs. Matching filters to actual vehicle operational needs can reduce downtime and lower fleet operating costs.

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[3] Written for this publication by Lynn J. Bernhard, Maintenance and Exploration Division, Arizona Projects Office, Bureau of Reclamation, Phoenix, Arizona.

THEY REPAID IRRIGATION LOAN 12 YEARS EARLY[4]

By Don McCabe

In 1920, a group of North Platte Valley farmers signed a contract, promising to repay the U.S. Government $5 million for their share of the construction cost for an irrigation project.

Having just formed the Gering-Ft. Laramie Irrigation District, these farmers were embarking on a bold plan to bring North Platte River water to irrigate the parched but fertile land south of the river near Gering.

They finally got their first water in 1925 from that irrigation project – the North Platte Project, one of the first five built in the nation under the 1902 Reclamation Act.

Over the next 60 years, the district achieved many milestones.

The latest milestone came without much fanfare on April 14, 1982, when the descendants of those first farmers paid off the $5 million loan. With a payment of $87,000, the Gering-Ft. Laramie District's water users made the last payment – 12 years ahead of schedule!

Was that Federal loan a boondoggle? A waste of taxpayers' money?

Don Winchell, a 35-year veteran of the district and its present manager, answers with one figure: $20 million. That's the average yearly value of the sugarbeets, corn, dry edible beans, alfalfa, and other crops raised by the district's 500 water users on 22 258 hectares (55 000 acres).

To be exact, the value of the district's irrigated crops in 1981 was $20,513,847, according to Winchell. This $20 million is considerably more than the value of the wheat and rangeland that would be here without the irrigation district.

The Gering-Ft. Laramie figures are impressive, but it is only one of the four irrigation districts in the Bureau of Reclamation's North Platte Project.

At least 101 175 hectares (250 000 acres) are irrigated from the Pathfinder, Goshen, Northport, and Gering-Ft. Laramie districts. (Most of this acreage is in Nebraska, with the remainder in Wyoming.)

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Add to this figure at least another 56 658 hectares (140 000 acres) (in both Nebraska and Wyoming) that are irrigated from a number of smaller private irrigation districts. These districts contract with the Bureau for any excess water in the system.

Winchell, who began with the Gering-Ft. Laramie District as a truck driver in 1947, follows in the footsteps of his father. Theo Winchell began working for the Bureau in 1916 and later became one of the first district managers.

Winchell gets right to the point when he talks of this valley without the North Platte Project. "There would not be anything here," he says.

On a June tour with Winchell through the district, we heard his comments reiterated frequently.

Willard Ross, who farms with his son, Glen, southwest of Gering, said the valley could raise only wheat and pasture without irrigation water. "The farmland and the communities would not be what they are today if we had no project," Ross says.

And, since Ross began farming in 1946, he has not experienced a year without water delivery. "I've always raised good crops."

Bob Gingrich, a retired Gering farmer, put it another way. "The water in the North Platte River dams and coming down the canals is like money in the bank."

The total construction cost of the North Platte Project was $19,700,000, with the aforementioned $5 million being the Gering-Ft. Laramie District's share.

Each district's share of those costs includes canals, laterals, plus the hugh storage structures, including the Pathfinder Reservoir, along the North Platte River in Wyoming.

Winchell says the water users in his district paid at least half of the $5 million in repayment charges through the years. The remaining share was paid for a time through hydroelectric plant power revenues in which each of the four districts shared. About 30 years ago, the original contract was renegotiated with the Federal Government. The irrigation districts turned over some of the power revenues to the Government in return for credits on their repayment obligation.

District water users paid between 70 and 80 cents an acre, depending on their land classification, as their share of the construction repayment costs. Irrigators with class I land paid more per acre because of the better land production capability than owners of classes II and III lands. (The total $5 million district construction repayment obligation was interest free when the original contract was signed.)

Obviously, this per-acre loan repayment was not the only costs incurred by district water users. In addition to the per-acre construction loan, each water user pays at present $11.50 per acre-foot (12 in) of water received to cover the district's operation and maintenance costs.

In addition, the district on two occasions has taken out rehabilitation loans to improve the delivery system by slowing water loss in the system. The work included lining canals and laterals with asphalt to stop water seepage and replacing some laterals with underground pipe.

Those loans and the $11.50 per-acre operation and maintenance costs are still being paid today.

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COULD THIS ACCIDENT HAVE HAPPENED AT RECLAMATION[5]

The following is an actual account of the consequences of an accidental release of the energy contained in a liquified, compressed-gas cylinder. Such an occurrence, often pointed out to cylinder gas users, rarely occurs but when it does, the results can be both spectacular and devastating. Fortunately, this case involved only the spectacular and did not occur at Reclamation.

A cylinder filled with 30 kg (65 lbs) of Halon 1301 liquid (bromotrifluoromethane), a fire-extinguishing material, pressurized by nitrogen gas to 4137 kPa (600 lb/in^2) (gage), was being removed by a technician from an outdoor cylinder storage rack during the decommissioning phase of a project. The lever of the manual-actuation cylinder valve had not been removed and a safety pull pin designed to prevent inadvertent manual actuation was not in place when the technician, holding the cylinder in a vertical position, rolled it on its base.

The techician stated that either his shirt sleeve, loosely rolled up his arm, caught the lever or his forearm depressed it, causing a sudden discharge of the gas from the downward-turned discharge tube attached to the valve.

As the gas was being expelled, it created a cloud of Halon and dust. The technician's glasses were knocked off and the unstable cylinder fell over and bounced around in the corner of the cylinder rack, where the brass valve broke away from the steel-threaded cylinder. The cylinder was then airborne and rocketed upwards. It struck the roof access panel about 7 m (21 ft) above the floor, then richocheted through the installed sheet metal into a nearby building. It continued its upward motion, smashing through the roof near the peak, approximately 15 m (48 ft) above the floor. Three people working inside the building did not see the cylinder but reported hearing a rapid succession of Boom, Boom, probably as the cylinder first entered through the wall and then exited through the roof.

The cylinder continued upward until the contents were expelled and then fell back through the roof and dropped to an unoccupied area of concrete floor about 42 m (140 ft) from where it started. Fortunately, no one was injured and there was only minimal property damage.

According to the manufacturer, there is no protective valve cap designed to fit over the valve head. In order to prevent similar occurrences, knowledgeable personnel should remove any electrical or mechanical actuation device prior to moving a cylinder and move the nonoperable cylinder only after restraining it within a wheeled, cylinder cart. Valve covers should be kept on all cylinders except when the cylinder is actually in use.

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[5] Reprinted from Bureau of Reclation "Safety News," Third Quarter, Fiscal Year 1982.

SPRINKLER BOOSTER PUMP INSTALLATIONS[6]

The North Side Pumping Division serves lands lying north and west of Rupert, Idaho, and is operated and maintained by the A&B Irrigation District. The District's water users have been installing sprinkler booster systems throughout the District to conserve water and provide better farming procedures. Originally, the booster pumps were being connected directly to the relift pumps. This arrangement could be detrimental to the entire system due to hydraulic surges from power outages. A policy was needed to prevent possible damage to the distribution system.

The new booster installations incorporate a bypass pipe connected directly to the relift discharge line and serves as a wasteway for the farmer. This arrangement allows the water user to pressurize all or part of the water ordered through the district's system which is metered, or his system can be completely shut down to change lines without affecting the other water users on the system. The new policies adopted by the Board of Directors will help the district to accommodate the use of sprinkler systems without losing control of the distribution system.

Figure 2. Booster installation connected directly to relift discharge line.

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[6] Excerpted from 1982 Review of Operation and Maintenance Examination Report by V. D. Temple, Boise, Idaho; and E. M. Corless, Minidoka Project Office, Bureau of Reclamation.

TEN TIPS FOR FOOT WARMTH[7]

Keeping your feet warm and dry can be a problem on construction sites during the winter months. Here are 10 tips to help keep your feet warm when working in cold weather, snow, ice, rain, and mud.

1. Before putting on your work boots, put on a pair of silk socks with a pair of wool socks covering them.

2. Change into an extra pair of silk socks at least once a day. The wool socks never need changing.

3. If you don't have an extra pair of silk socks available, then put the only pair you have under your armpits for a couple of minutes. This procedure will warm the socks. Before doing this, hit the silk socks against your arms. This will allow any moisture that has accumulated in the socks to escape.

4. Keep you toenails short. Otherwise, they will cut through the silk socks, resulting in a loss of thermal protection for your feet.

5. If your feet happen to get cold, then cover your head with a hat. Nearly 80 percent of your body heat is lost through the head.

6. If your boots become wet, don't dry them too fast. This could ruin them. It often happens that boots are placed near open heat to be dried and forgotten. It is too late to save the boots when the odor of burned leather hits the nostrils.

7. Stop at lunch and take the time to check your feet for frostbite. You'll notice a very dull white coloring of your skin if frostbite has begun to set in. The white color will not turn to red after pressure is applied. Do not rub or chafe the affected parts. Do not apply snow, cold water, or direct heat to the frostbitten area. Thaw your feet by warm, dry covering, or body heat.

8. Use a closed-cell styrofoam insole in your boot. This will provide extra warmth for your feet.

9. Lace your boots all the way up so the pressure exerted on the metatarsal of your foot will be lessened. Also, heat will not be able to escape through the top of the boot.

10. For added protection, treat your boots with 50 percent silicone and 50 percent Dubbin. Apply the silicone first. Repeat this procedure about five or six times.

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[7] Reprinted from Bureau of Reclamation "Safety News," Third Quarter, Fiscal Year 1982.

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Mission of the Bureau of Reclamation

The Bureau of Reclamation of the U.S. Department of the Interior is responsible for the development and conservation of the Nation's water resources in the Western United States.

The Bureau's original purpose "to provide for the reclamation of arid and semiarid lands in the West" today covers a wide range of interrelated functions. These include providing municipal and industrial water supplies; hydroelectric power generation; irrigation water for agriculture; water quality improvement; flood control; river navigation; river regulation and control; fish and wildlife enhancement; outdoor recreation; and research on water-related design, construction, materials, atmospheric management, and wind and solar power.

Bureau programs most frequently are the result of close cooperation with the U.S. Congress, other Federal agencies, States, local governments, academic institutions, water-user organizations, and other concerned groups.

A free pamphlet is available from the Bureau entitled, "Publications for Sale". It describes some of the technical publications currently available, their cost, and how to order them. The pamphlet can be obtained upon request from the Bureau of Reclamation, Attn D-922, P O Box 25007, Denver Federal Center, Denver CO 80225-0007.