February 16, 1999

To: Board of Directors (Engineering and Operations Committee--Action)

From: General Manager

Submitted by: Jay W. Malinowski
Chief of Operations

Subject: Authorize $5,000,000 to Finance all Costs Associated with the Procurement and Installation of Replacement Equipment for the Computer-Based Control System and Award a $1,410,000 Contract Amendment to Systems Integrated

Reference: Appropriation No. 15140

RECOMMENDATIONS

To finance all costs for procuring and installing replacement equipment for the computer-based control system, it is recommended that your Board:

1. Approve increasing Appropriation No. 15140 by $5,000,000, to a total of $30,000,000; and

2. Authorize the General Manager to exercise an extra work order to Contract No. 1396A with Systems Integrated for an additional $1,410,000.

EXECUTIVE SUMMARY

The current supervisory control and data acquisition (SCADA) software is not Year 2000 (Y2K) compliant. If this software is not upgraded with a Y2K compliant version by December 31, 1999, the SCADA system may cease to function properly and could severely impact the District's ability to reliably operate its water delivery system.

The traditional SCADA life-cycle management policy used by the District is not cost effective with today's technology. Traditionally, the District's SCADA system life-cycle management policy was to install a SCADA system and then maintain it with minimum upgrades and enhancements until the system was replaced. Today, new generations of SCADA software packages with major revisions are developed every three to five years; and SCADA computer processing power doubles every two years while the input/output transducers still have a useful life of six to twelve years. The District will reduce its overall SCADA costs, improve functionality and increase reliability by adopting a policy of continuously upgrading the existing SCADA system because of this disparity in component life-cycles.

JUSTIFICATION

Year 2000 Compliance

The contract for the District's current supervisory control and data acquisition (SCADA) system was signed in January 1995. The contract included a provision that required the vendor to use the latest software packages available at the time the contract was awarded. This provision was designed to eliminate conflicts between the District and the vendor concerning which version of software was required. The software packages available when the contract was signed were not Y2K compliant. This fact was recognized by 1997 and funds were placed in the 1998/1999 capital project budget to eliminate the deficiency.

It is not possible to predict every problem that will occur if the SCADA system is not made Y2K compliant, but almost all SCADA processes are related to time and are very likely to malfunction in some manner. These malfunctions will effectively render the system useless. Loss of the SCADA system will result in a significant increase in staff, the inability to meet regulatory requirements, or both.

Life-cycle Technology Upgrade

The need to change the District's SCADA life-cycle management policy is the result of changes in the computer industry and the way the District operates its facilities. The computer workstations and servers specified by the vendor when the contract was signed were superseded with newer models by the time the system had been delivered; software packages used in the system are being improved constantly; and additional requirements are being developed by users as they become more familiar with the system. The limited time for which vendors offer hardware and software support, technology improvements, changing regulatory requirements, and increased functionality combine to warrant varied replacement intervals for system components.

The District is also changing the way its facilities are operated. Greater reliance is being placed on technology as a way to stay competitive. This increased reliance on technology results in more reliable equipment being required. The need for reliable equipment combined with trends in the computer industry result in the need for more frequent system upgrades than in the past.

The most effective way to provide Year 2000 compliance, meet increasing demands, avoid obsolescence, increase reliability, and preserve the existing investment is by upgrading existing SCADA system computer equipment and software. This approach will also defer the need to replace the entire system at one time.

ALTERNATIVES TO PROPOSED ACTION

Year 2000 Compliance

There is no viable alternative to upgrading the existing system to provide Year 2000 compliance.

Life-cycle Technology Upgrade

1. Competitively Bid Modifications

   The District could choose to prepare a request for proposals to provide another software package and equipment upgrades that will meet its increased SCADA system requirements. This alternative would be costly because of the expenses related to proposal evaluation, system configuration, testing, and training. It also increases risk because it would result in the use of an entirely new system rather than a limited number of modifications to an existing system. (Estimated present value cost = $19,100,000)[1]

2. Do Nothing at the Present Time

   The District could choose to do nothing at this time. If no action is taken, maintenance will increase; reliability will decrease; and the system will be unable to provide the required performance and have to be replaced within a few years. This alternative would significantly increase cost and risk without a corresponding increase in benefits. Three of the costliest tasks involved in installing a SCADA system are installation, configuration and project management; tasks that would have to be redone if the current system is replaced. (Estimated present value cost = $24,500,000)[1]

FUNDING REQUEST

Program Name:	SCADA System Life-cycle Replacement		
Source of Funds:	Pay-as-You-Go Fund		
Appropriation No.:	15140	**Board Action No.:** 4	**FY 98/99 Budget:**
Requested Amount:	$5,000,000	**Capital Program No.:**	98911-A
Total Appropriated Amount:	$25,000,000	**Capital Program Page No.:**	E-70
Total Program Estimate:	$30,000,000	**Program Category:**	A

ACTIONS AND MILESTONES

❒ SCADA system Year 2000 testing complete	May 1999
❒ Windows NT human machine interface complete	September 1999
❒ AMR remote terminal unit design complete	November 1999
❒ SCADA system software enhancements complete	May 2000
❒ Windows NT remote terminal units design complete	September 2000
❒ All equipment upgraded	March 2003

[1] See attachment for breakdown of costs.

CEQA COMPLIANCE / ENVIRONMENTAL DOCUMENTATION

The proposed action is exempt from the provisions of the California Environmental Quality Act because it does not have the potential to cause a significant effect on the environment.

CONTRACT SUMMARY

Contract Status:	Existing (1396A)	**Type of Selection:**	Competitive bids – 3 Spec. No. 1207
Contract Form:	Equipment	**Firms Receiving RFP:**	
Contract Type:	Milestone payments	**Proposals Submitted:**	
Evaluation Criteria:	Lowest responsible bidder meeting the requirements of the specification		

MBE / WBE

At the time the original contract was awarded, the District had no required MBE/ WBE goals. However, the successful contractor, Systems Integrated, is a minority-owned enterprise certified by Caltrans.

DETAILED REPORT

The District has already invested $43,158,000 in SCADA and AMR systems over the last ten years. They are currently being integrated into a single system to enhance their effectiveness. Demands on these systems have increased significantly from when their requirements were originally developed. Operators who once monitored the system full time will rely more on automation as they move out of the control room to perform other duties. The most cost effective way to meet increasing demands, avoid obsolescence and preserve this investment is by upgrading the SCADA system computer equipment and software. With these upgrades, the system will be Year 2000 compliant, gain increased system functionality and reliability, realize extended system useful life, and defer the need to replace the entire system.

The contract for the District's current supervisory control and data acquisition (SCADA) system was signed in January 1995. The contract included a provision that required the vendor to use the latest software packages available at the time the contract was awarded. This provision was designed to eliminate conflicts between the District and the vendor concerning which version of software was required. The software packages available when the contract was signed were not Y2K compliant. This fact was recognized by 1997 and funds were placed in the 1998/1999 capital project budget to eliminate this deficiency.

It is not possible to predict every problem that will occur if the SCADA system is not made Y2K compliant, but almost all SCADA processes are related to time and are very likely to malfunction in some manner. These malfunctions will effectively render the system useless. Loss of the SCADA system will result in a significant increase in staff, the inability to meet regulatory requirements, or both.

In the past, the District's SCADA system life-cycle management policy was to install new SCADA systems and then maintain them with minimum upgrades and enhancements until the system was replaced. In many cases it was not possible to work with vendors to develop a policy of continuously improving their systems. Much of the equipment was proprietary and many vendors went out of business soon after completing their systems for the District.

The current system is composed almost entirely of "standard" components integrated into a SCADA system using widely available interfaces. Because of this openness, it is possible to institute a "continuous improvement" technology upgrade life-cycle management policy for the existing SCADA system. Instituting such a policy will extend the life of the system and significantly reduce costs. These savings are possible because a large portion of the total SCADA system procurement costs are related to configuration and installation of new systems. Upgrading the existing system to extend its useful life reduces these costs significantly.

The current technology upgrade program will replace all computer equipment after approximately five years of usage. This timeframe will result in the equipment being replaced before it becomes difficult to support, and before serious failures are likely. Replacement at this time will ensure equipment upgrades before the system is incapable of meeting any of its performance requirements.

It will also provide sufficient time to perform adequate testing of the software modifications before they are placed in service. It is impossible to eliminate all software "bugs" from the system without this testing. Thorough field testing on an actual system is not a viable option because normal plant operations impede a tester's ability to recreate conditions and to duplicate them when necessary to isolate and identify problems.

Another benefit of the technology upgrade is that it incorporates Intel and Microsoft based equipment. In the last few years, this equipment has become more widely used than the equipment it is replacing. Once this conversion has been accomplished, it will be easier and less expensive to change software packages if the current vendor discontinues support for the system.

The specific benefits of the proposed technology upgrade include:

1. SCADA System Y2K compliance—The current operating system, database, and SCADA system package would be certified as being Year 2000 (Y2K) compliant.

2. Increased compatibility with District IT standards—The current SCADA system is based entirely on Digital Equipment Corporation's UNIX operating system and Alpha processor. Few new products are being developed for these platforms, and those that are available are more expensive than similar products available for Windows NT. Conversion to Windows NT for both the operator consoles and the remote terminal unit (RTU) processors will comply with District IT standards, reduce the cost of this equipment, and significantly increase product availability.

3. Increased SCADA system functionality—The SCADA system specifications were originally developed in 1990. Since then, there have been significant changes in the District's operating philosophy, regulatory requirements, and technology. Among the improvements incorporated into this project will be a more consistent interface, simplified

operator responses to alarms, additional on-line help capability, and several other enhancements that make the system easier to use.

4. Improved SCADA system performance and reliability—Demands on the SCADA system are rapidly increasing as the District increases its reliance on automation as a way of increasing efficiency. The proposed enhancements will increase system reliability to support operators who will be out of the control room much of the time. They will also meet the increased regulatory requirements for historical data, which place demands on system resources that were not anticipated when the original specifications were developed in 1990.

5. Improved AMR functionality— Implementation of the original AMR system was completed in mid-1996. It is currently being merged with the SCADA system to enhance the overall effectiveness of both systems. It was not originally designed to provide meter data on a daily basis. A three-day window was acceptable for internal use and allowed commercial cellular networks to be used to transmit data to the host computer system. Once member agencies discovered that this usage information was available, they requested it be available daily. This increases the need for reliable communications and in many cases the cellular systems are unable to meet this need. The District is also in the process of automating distribution system operation to reduce the required number of operators. Information from selected service connections will enable automatic process control programs to function more effectively. These additional requirements will be most effectively met by a combination of communications media that includes remote terminal units with the ability to use radio communications. Lastly, the AMR RTU manufacturer has decided not to remain in the cellular RTU market, resulting in excessive costs for repair and spare units.

ROA/SHL/ms

Attachment 9-5A

Attachment 9-5A

Cost Comparison of Options (Present Value)

Cost (Time Period)	Proposed Project Technology Upgrade	Alternative 1 Bid the Upgrade	Alternative 2 Do Nothing / Replace System
Upgrade (1999-2002) Y2K compliance District IT compatibility Increased SCADA functionality Improved performance/reliability Improved AMR functionality	$ 4,600,000		
New SCADA system software (1999-2002) RFP development Vendor selection Software package System configuration Training Program conversion		$ 6,700,000	
Ongoing support (2004-2012) Software upgrades Computer replacement I/O device upgrades	$ 11,700,000	$ 11,700,000	
Increased maintenance (2001-2003)			$ 300,000
Y2K compliance upgrades (1999) Y2K compliance upgrades Additional equipment		$ 700,000	$ 700,000
Replace system (2001-2006) RFP development Vendor selection System development System configuration Training Program conversion Installation			$ 23,500,000
Total for Alternative	$ 16,300,000	$ 19,100,000	$ 24,500,000
Additional costs (over proposed project)		$ 2,800,000	$ 8,200,000

NOTES:

1. The timeframe for the cost analysis was selected based upon the following:
   - The existing system is assumed to have a total useful life of approximately eight years if the proposed upgrades are not performed (based upon a SCADA system average useful installed life of between eight and twelve years). The useful life of this system is assumed to be relatively brief because the requirements were developed in 1990, with installation to begin in May 1993. Because of problems with the original contractor, installation did not actually start until early 1996. It will be completed by June 1999.
   - The end point of 2012 is based upon equipment useful life of two generations of systems, using the current bid, install, and replace policy as opposed to the continuous improvement policy proposed in this letter (assuming each generation of system is replaced after eight years in the field).

- The Capital Improvement Program (CIP) projects that a new treatment plant will be constructed around 2012.
- A new facility presents an opportune time to replace dated SCADA equipment since we would be procuring control equipment for the new facility

2. A real interest rate of 3.5 percent was used to calculate present value costs.

Explanations

System life: The existing system will have a total useful life of approximately eight years dating from early 1996, if the proposed upgrades are not performed (based upon a SCADA system average useful installed life of between eight and twelve years). Installation of the existing system began in 1996 and will be completed by June 1999. To replace the current system after eight years, it will be necessary to begin procuring a replacement system in two years because it takes approximately two years to develop requirements and select a vendor and at least another year to develop, stage and test the new system.

Upgrade: This includes the cost of implementing the software modifications listed in the preceding table and to replace all SCADA system computer equipment: workstations, servers, communication devices, and remote terminal unit (RTU) processors.

New SCADA system software: This covers the cost to implement a new software package selected as a result of bidding the upgrade. No other vendor would be able to upgrade the existing SCADA software package, so their bid would require them to replace the entire software package. If it is replaced, all configuration data must be converted and operators, technicians and engineers trained on the new system. Costs for this option are also significantly higher than the recommended option because of the need to develop software requirements for the entire system, evaluate the proposals, and select a vendor.

Ongoing support: This represents the additional support costs that will be required to extend the system's useful life past eight years. Strategies will be developed that equalize annual expenditures while recognizing the different life expectancies of various components. An effective ongoing support program will enable the existing system to perform similar to a new system at a significntly reduced cost. The cost of providing this support has been conservatively estimated at $2 million per year for software upgrades and replacement hardware. Authorization for these expenditures is not included in this letter.

Increased maintenance: Although the system as a whole has an estimated useful life of eight years, certain components should be replaced before then. Their maintenance requirements will increase otherwise. Workstations, servers, and RTU processors will require additional maintenance approximately five years after they have been installed. As much of the equipment is located in remote sites, it requires considerable travel before repairs can be performed. Also, because the system operates continuously, certain failures require that standby technicians be called out on overtime.

Y2K compliance upgrades: These are costs to provide Y2K compliance and for additional workstations which will be placed throughout treatment plants to permit operators to leave the control room.

Explanations

Replacement system: These are costs required to replace the SCADA and AMR systems after an eight-year life. Total cost, including requirements development and vendor selection are estimated to be $30,600,000; a 30 percent reduction from the costs for the present system. This cost is based upon reduced hardware costs and the assumption that installation will be less time-consuming that it was with the present system.