MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

BOARD ACTION

- **Board of Directors**
  Asset, Real Estate and Infrastructure Policy Committee

October 12, 2004 Board Meeting

9-7

Subject

Authorize entering into an agreement with DHI in an amount not to exceed $2.3 million to develop and implement a Real Time Operating System for Metropolitan's water conveyance and distribution system (Approp. 15397)

Description

The Board approved appropriation of funds for the Real Time Operating System (RTOS) project in October 2002. The project is included in the Information Technology Strategic Plan, under Approp. 15397, Project No. 103420. Specifically, this project is part of the Water Operations and Optimization category within the IT Strategic Plan. (A complete list of all projects within the Water Operations and Optimization category of the IT Strategic Plan is attached for reference.) This contract is needed at this time to continue work on the RTOS implementation.

The RTOS is a hydraulic model of Metropolitan's water system, utilizing hydraulic calculations and real-time data from the Supervisory Control and Data Acquisition (SCADA) system to analyze, track, report on, and help manage water conveyance and distribution. The RTOS will allow Metropolitan to use actual real-time flow, pressure, and water quality conditions of the conveyance and distribution system to evaluate a variety of short- and long-term "what if" operating scenarios. This capability is needed for a number functions, including water operations planning and scheduling, emergency management, water quality planning, water security management, hydraulic engineering analysis, training new operators, and shutdowns (drain, fill, routing). For example, in the future when unexpected or emergency situations (such as the Rialto Pipeline shutdown or the recent West Valley Feeder No. 1 shutdown) occur, accurate and timely analyses could be performed using RTOS to assist operators in making appropriate changes to Metropolitan's distribution system in coordination with local facility operators. Today, Metropolitan relies heavily on experienced operators and planners in conjunction with a combination of disparate systems, spreadsheets and manual efforts to plan and implement the necessary adjustments. This is becoming an increasingly difficult task to perform in this manner given the growing water system complexity, increased water demands, high variability of water resources, and more and enhanced water quality regulations. Many of the analyses needed are extremely time-consuming and tedious to perform, often taking days of data collection and spreadsheet work. Real Time Operating Systems, which are common in the industry, are much more expedient, flexible, accurate and powerful than the variety of internal tools we are currently maintaining.

The RTOS project includes the purchase of software and the consulting services needed to develop and implement its main components. These components include a database, hydraulic modeling software, and interfaces to other applications. According to the preliminary schedule, a hydraulic model for the Rialto Feeder region will be implemented on a pilot basis within the first year of the project, with interfaces to other applications. If the pilot proves to be feasible and effective, then the model will be expanded to the remainder of Metropolitan's water system over the course of approximately the following year.

A comprehensive set of requirements for the software and consulting services was developed and incorporated into a Request for Proposals. The RFP was issued on May 14, 2004. Metropolitan received and evaluated two responses, including interviews of the two firms. Based on the evaluation criteria and interview process, DHI was selected as the best respondent and is recommended for award.

This board action authorizes entering into a competitively selected professional services agreement with DHI in an amount not to exceed $2.3 million to assist in development and implementation of the RTOS project.

See **Attachment 1** for the Detailed Report and **Attachment 2** for the List of ITSP Projects for Water Operations and Optimization Category.

Policy

Metropolitan Water District Administrative Code § 8113 – Award of Contracts over $250,000
Metropolitan Water District Administrative Code § 8115 – Negotiated Contracts

California Environmental Quality Act (CEQA)

CEQA determination for Option #1:

The proposed action is categorically exempt under the provisions of CEQA and the State CEQA Guidelines. The proposed action involves the funding of a study, awarding of a contract, and minor operational changes to existing public facilities with negligible or no expansion of use and no possibility of significantly impacting the physical environment. In addition, the proposed action consists of basic data collection and resource evaluation activities, which does not result in a serious or major disturbance to an environmental resource. This may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not yet approved, adopted, or funded. Accordingly, the proposed action qualifies for both Class 1 and Class 6 Categorical Exemptions (Sections 15301 and 15306 of the State CEQA Guidelines).

The CEQA determination is: Determine that pursuant to CEQA, the proposed action qualifies under two Categorical Exemptions (Class 1, Section 15301 and Class 6, Section 15306 of the State CEQA Guidelines).

CEQA determination for Option #2:

None required

Board Options/Fiscal Impacts

Option #1

Adopt the CEQA determination and authorize entering into an agreement with DHI in an amount not to exceed $2.3 million to develop and implement a Real Time Operating System for Metropolitan's water distribution system.
Fiscal Impact: Expenditure of $2.3 million appropriated and budgeted capital funds

Option #2

Do not award contract.
Fiscal Impact: No immediate expenditure of $2.3 million appropriated and budgeted capital funds**.** However, the absence of the services requested seriously limits the operational risk-mitigating benefits of this system-wide tool.

Staff Recommendation

Option #1

Roy L. Wolfe 9/20/2004
Roy L. Wolfe *Date*
Manager, Corporate Resources

Ronald R. Gastelum 9/20/2004
Ronald R. Gastelum *Date*
Chief Executive Officer

Attachment 1 – Detailed Report

Attachment 2 – List of ITSP Projects for Water Operations and Optimization Category

BLA #3058

Detailed Report

Real-time Operation Model

Project Description

The main objective of the Real Time Operating System (RTOS) project is to build a dynamic hydraulic model for Metropolitan's water conveyance and distribution system, including the Colorado River Aqueduct. The model will enable Metropolitan to perform more accurate and timely studies and analyses of Metropolitan's conveyance and distribution system. There are multiple components including a real-time dynamic hydraulic model with interfaces to Supervisory Control and Data Acquisition (SCADA), Geographic Information System (GIS) and water quality data. The RTOS will provide the ability to perform operational "what-if" scenarios, studies, planning, emergency response, pollution remediation, engineering design and operator training as well.

Background/Purpose

Since 1928, Metropolitan has been successfully operating its conveyance and distribution system based on experience and the use of some simple analytical tools. However, recent changes, including increased demand, increasing system complexity, high variability of water resources, more and enhanced water quality regulations, and new facilities and programs, have created a need to understand and analyze water distribution on weekly, daily, and hourly basis. Currently, Metropolitan relies on disparate systems, spreadsheets and manual efforts without the systematic ability to perform accurate and prompt studies and analyses of the water distribution system. Accurate real-time simulation of Metropolitan's conveyance and distribution system is also the foundation for planning, security management, engineering design, and control automation design. A sophisticated and complete model of Metropolitan's conveyance and distribution system is the best tool to address the challenges that result from these increasing complexities and constraints.

The RTOS will serve to mitigate risk, improve reliability and increase efficiency. The RTOS project will include software and consulting services to develop and implement a hydraulic model for Metropolitan's entire water distribution system, including the CRA. It will provide a single, Metropolitan-wide water system operating and analysis tool, including interfaces for system operation, water quality, security management, emergency response planning, training, hydraulic engineering and control automation design.

The RTOS will be capable of simulating the complex hydraulic transitions that occur frequently in the water conveyance and distribution system. The ability to track and manage the interface between open channel structures and pipeline structures, hydraulic plants and pressurized flows is a significant example of this capability. The RTOS' ability to take into account the growing operational and behavioral complexities of the water system will provide multiple benefits. These benefits will include more detailed planning over multiple time intervals, blend planning, knowledge retention (mitigating knowledge lost through attrition), operations training and scenario tools, planning models (shutdown, dewatering and refill operations, and communications), safety management (hazardous chemical contamination models), and development of operating procedures/processes.

Use Case Examples

There are multiple uses for the RTOS. Below are some examples.

Example 1 - Distribution Planning

Distribution planning needs to evaluate various options for configuration of the conveyance and distribution system, especially in the weekly planning meetings. This would include determinations of flows in various parts of the system, as well as blends at the treatment plants and ultimately at the service connections. Also, it would include ongoing evaluations to determine replenishment delivery options, taking into account existing orders from customers and the availability of supplies. Additionally, in the event of unexpected or emergency situations, which require the system to be quickly reconfigured (such as the Rialto Pipeline shutdown, or the recent West Valley Feeder No. 1 shutdown), accurate and timely analyses can be performed to assist operators in that task.

Presently, these are tedious and time-consuming tasks involving multiple parties, experience-based information, and disparate tools. The RTOS will increase the speed and accuracy at which these determinations can be made.

Example 2 - Dewatering and Refill Planning

Whenever a conveyance or distribution facility is scheduled for maintenance or other activities that require partial or complete dewatering, a detailed plan must be developed to calculate dewatering times, volumes, and locations for drainage, as well as a refilling plan. Oftentimes, member agencies request information on service pressure and flow during shutdowns, which are difficult to determine without specific calculations. In some cases, this has meant performing actual testing within Metropolitan's distribution system, which can be very costly from the standpoint of labor, energy, and treatment plant operations. The RTOS will provide the ability to perform such planning activities and meet such information tasks quickly, accurately, and with consistency.

Example 3 - Water Quality and Security

In the case of a known and/or detected toxic chemical contamination incident (accident or terrorist activity), Metropolitan will be able to model the spread of the agent in question using actual flows and pressures from the SCADA system. Isolation and alternative routing strategies could be rapidly evaluated and selected in advance of the spreading agent. Sampling points can be selected, modeled and confirmed via actual samples. Dewatering and refill scenarios could be evaluated, selected and activated.

Example 4 - Training

The RTOS will have the ability to use the same graphic screens and control logic as the SCADA system. In effect, the distribution system can be simulated, using actual SCADA data and control room screens. Operators in training can "control" the distribution or conveyance system, based on actual or scenario conditions, and see how their actions cause the system to behave. This is particularly useful to new operators, given the attrition we will be experiencing over the next several years.

Approach

We intend to contract out the purchase of the software and the development of the model and the various interfaces. Internal staff from Water Resource Management, Engineering, Water System Operations and Information Technology will provide assistance and guidance as needed.

The project will be approached in two main phases: Pilot and Full Deployment. The pilot phase will consist of a hydraulic model of the Rialto Feeder region, which can serve as a microcosm of the whole system, as well as the various interfaces to GIS, training, and water quality. Upon successful completion of the pilot, the model will be expanded to the remainder of the distribution system and the CRA. This approach is being taken to minimize project and cost risks, while realizing that the Rialto Feeder region has been successfully modeled in previous test runs. The Rialto Feeder region is also the pilot area for several other automation projects, such as SCADA/GIS Integration and Distribution System Automation projects, and allows us to test full build-out of multiple efforts under the Water System Control Master Plan.

Information Technology Strategic Plan
Water Operations and Optimization Category
List of Projects

The following table briefly describes the list of projects within the Water Operations and Optimization category of the IT Strategic Plan. Projects are divided into three sections: those where funds were appropriated and the projects are in progress, those where funds were appropriated and the projects are awaiting completion of other efforts currently underway, and budgeted projects planned to start in calendar year 2005 where funds have not yet been appropriated.

FUNDS APPROPRIATED – PROJECTS UNDERWAY

PROJECT	BENEFITS
Real Time Operating System (RTOS)* – Current Board Action The Real Time Operating System (RTOS) is a model of Metropolitan's water system which is needed for a number of functions, including water operations planning and scheduling, emergency and security management, hydraulic engineering analysis, training new operators and shutdowns.	Provides ability to quickly and efficiently perform "what if" scenario analyses needed for planning water system operations shutdowns, and addressing emergencies in the water operation.
Automated Meter Reading (AMR) Upgrade This project will replace the existing outdated Automated Meter Reading computer hardware (remote terminal units) and software with more dependable units with additional capabilities that are easier to maintain. The existing AMR system relies on analog cellular communications, an outmoded technology that will soon be dropped by service providers and needs to be upgraded.	Continued reliable electronic collection of water meter readings used for water billing; provides real time flow information in addition to historic flow readings.
Water System Data Storage and Reporting* Storage/archival of water system information (e.g., water flow and water quality related data, by date/time and location).	Up-to-date system-wide information regarding water deliveries, storage, flows and quality used for operations planning purposes; improved turnaround in performing analyses
Water System Control Program Implementation* This is for program management of the Water System Control Master Plan. The WSCMP serves as a roadmap for further automation of Metropolitan's water system. This project also includes specific studies necessary to implement the plan.	Help ensure Water System Control Master Plan implementation is properly managed; promotes cost-efficiency by ensuring all viable alternatives are evaluated in conjunction with undertaking projects in the plan.
Oxidization Demonstration Plant (ODP) Control System Upgrade* ODP is a 5.5-million-gallon-per-day water treatment facility used for testing and evaluating new treatment methods. The computer system that is used to control the ODP needs to be upgraded in that it is at the end of its life cycle.	Ability to continue to use ODP to evaluate new treatment technologies or removal of contaminants.
Power Management System – Phase I* The first phase of this project involves acquiring and implementing a commercial-off-the-shelf software product to be used for hydroelectric plant power management. This is currently a manual function augmented with the use of spreadsheets.	Increased efficiency as a result of automating a manual process.

* - Part of the Water System Control Master Plan

PROJECT	BENEFITS
Programmable Logic Controller (PLC) Standardization – Phase I* A programmable logic controller is a small, specialized computer device used to control water system processes such as chemical feed and flocculation. Metropolitan has approximately 100 PLC devices representing 18 different models from 10 different manufacturers. The vendors no longer support many of these devices. This project will establish standards to reduce the number of different brands and models of PLCs used at Metropolitan.	Reduced cost for maintenance of the PLC computer devices in terms of staff training and spare parts inventory; increased reliability of the water system processes controlled by PLC devices.
Laboratory Information Management System (LIMS) Upgrade LIMS is Metropolitan's primary source of water quality information. It is used for scheduling water samples, managing water quality laboratory workflow, and documenting quality assurance and regulatory compliance. This project will upgrade the current LIMS system which is 10 years old and no longer supported by the vendor.	An improved LIMS system supported by the vendor; continued ability to demonstrate water quality regulatory compliance.
Maintenance Management System This project upgrades the system used for managing day-to-day maintenance of equipment and facilities at Metropolitan. The project has three components. A software version upgrade of Metropolitan's Maintenance Management System has already been completed to ensure ongoing vendor support. The second component will establish a tie to the material management system to facilitate the ordering of parts needed for work orders.. The final component will acquire and deploy hand-held devices for field maintenance staff to enter work order information.	Increased reliability of the water system through improved maintenance; improved maintenance staff efficiency by reducing the amount of administrative work and increasing "wrench time."

FUNDS APPROPRIATED – PROJECTS PENDING COMPLETION OF OTHER EFFORTS

PROJECT	BENEFITS
SCADA Wide Area Network Conversion* The SCADA system is used to monitor and control the water system operation at the different Metropolitan sites, including treatment plants, pump plants and control structures. SCADA currently relies on leased communication lines from the phone company to link these sites in a wide area network. The IT Strategic Plan called for replacing these commercial lines with the District's own digital microwave based communication system to improve the reliability of the wide area communications. A study of alternatives is currently ongoing.	Increased reliability of the SCADA system used to monitor and control Metropolitan's water system.
CRA Control Integration* This project will tie together the Colorado River Aqueduct pump plants and allow the CRA to be controlled as one system. The project is pending completion of the pump station upgrades, as part of the CRA Reliability Program. The pump station upgrade at Intake is currently ongoing.	Increased efficiency through the ability to run the CRA from the Operations Control Center as a whole.

* - Part of the Water System Control Master Plan

PROJECT	BENEFITS
Distribution System Control Integration* This project compliments the CRA Control Integration project (above) by providing the ability for the entire water distribution system to be controlled using the SCADA system from the Operations Control Center. The project will proceed once the automation of individual distribution processes is completed. The predecessor projects are currently ongoing as part of the Distribution System Control and Equipment Upgrade Program.	Increased efficiency and responsiveness to system changes through the ability of the Operations Control Center to remotely control the entire distribution system.
Treatment Plant Flow Reading Reliability* This project will modify the SCADA system to use readings from multiple meters to determine actual water flow coming into a treatment plant rather than relying on readings from a single meter. This will allow the SCADA system to still function properly if individual flow meters malfunction.	Increased reliability in controlling treatment plant processes.

PROJECTS PLANNED TO BEGIN IN 2005 – FUNDS BUDGETED BUT NOT APPROPRIATED

PROJECT	BENEFITS
Power Management System - Phase II* This project involves implementing additional software modules to enable the Power Management System to be used in managing the power needs for the CRA and treatment plants. This will complement the software implemented in Phase I used for power management at the hydroelectric plants.	Reduced power costs for operation of the desert pump stations and treatment plants.
PLC Standardization - Phase II* Phase II of PLC Standardization project will establish an ongoing replacement cycle for PLC computers based on their expected service life.	Increased reliability of the SCADA system by replacing PLC computers before they begin to fail due to age.
Failure Analysis* Failure Analysis is a project geared to ensure that SCADA continues to control the water system appropriately even when problems (such as power outages or instrumentation/equipment malfunctions) occur, thereby preventing interruptions in the operation of Metropolitan's water system. The project will analyze operational risks when one or more components (e.g., meters, valve actuators, etc.) fail and/or abnormal conditions (e.g., sudden loss of power) occur. The project will focus on reviewing the most critical water system processes, including documentation and existing SCADA program logic to recommend any needed changes.	Mitigated risk of water system interruptions due to instrumentation, equipment, and power failures.
Water System Process Mapping* The project will document/map and analyze selected water system related processes in preparing to integrate the SCADA system with other applications.	Increased cost-efficiency through reengineering water system processes.
SCADA Local Area Network Standardization* The local networks connecting the Supervisory Control and Data Acquisition (SCADA) computers to field equipment (e.g., instruments, actuators, recorders) are comprised of a wide variety of different network communication hardware devices at the various field locations. This project is intended to replace unique / non-standard components, where necessary and cost-effective, with standard network devices.	Increased reliability of the SCADA system through standardization; lower maintenance costs for SCADA local area network maintenance in terms of staff training and spare parts.

* - Part of the Water System Control Master Plan