



● **Board of Directors**  
***Engineering and Operations Committee***

6/13/2017 Board Meeting

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**8-4**

**Subject**

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Adopt CEQA determination and appropriate \$4.45 million; and authorize: (1) conceptual design for a system-wide upgrade of Metropolitan's control system; and (2) agreement with CH2M in an amount not to exceed \$2,485,000 to provide specialized technical support (Appropriation No. 15467)

**Executive Summary**

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This action authorizes conceptual design activities for a comprehensive upgrade of Metropolitan's control system, and a professional services agreement to provide specialized expertise for the planned upgrades. The control system spans the Colorado River Aqueduct (CRA), Metropolitan's five water treatment plants, and the entire conveyance and distribution system. The control system consists of hardware, software, and a communication network.

**Timing and Urgency**

Metropolitan's control system monitors, operates, and collects critical information from facilities throughout Southern California. The existing control system was commissioned in the mid-1990s and relies on proprietary hardware and software that needs to be replaced in order to maintain reliability and reduce cybersecurity risks. Over the next several years, major elements of the control system will need to be upgraded including hardware, software, and the communication network. Maintenance and support of the existing system are becoming increasingly difficult, as many components of the system can no longer be replaced in-kind and are no longer supported by their manufacturers.

In March 2017, Metropolitan's Board initiated preliminary investigations to replace the existing control system. This action represents the second step in the comprehensive, long-term effort to upgrade the system.

This work has been reviewed with Metropolitan's Capital Investment Plan (CIP) prioritization criteria and is included in the System Reliability Program. Funds for this action are available within Metropolitan's capital expenditure plan for fiscal year 2016/17.

**Details**

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**Background**

Metropolitan's control system was commissioned in the mid-1990s to augment the local, manual controls that were installed when facilities were originally constructed. The control system is used to monitor and operate pump stations, treatment plants, chemical feed systems, flow control structures, and hydroelectric power plants. In addition to its control, monitoring, and alarm functions, the system compiles operational data that is critical for regulatory compliance and for daily business processes.

The existing control system has operated reliably for over 20 years, but is nearing the end of its service life. In 2013, Metropolitan initiated a review and condition assessment of the control system. This review identified near-term cybersecurity risks with certain components, along with impending technological obsolescence of the system's hardware, software, control, and communication features. While minor upgrades over the past 20 years

have extended the system's life and it continues to operate reliably today, the existing system needs to be replaced. Without a reliable control system, a broad range of equipment that was designed to operate remotely would instead need to be operated locally, with manual input. Operational data that is presently collected automatically and compiled for submission to regulatory agencies would instead need to be gathered and logged manually, while safety procedures that include automatic alarms would need to be assessed, modified, and staffed appropriately.

A comprehensive, staged effort is underway to upgrade major components of the control system including servers, field computers, input/output devices, software, and communication equipment. The upgrade project will adopt industry-standard technology and programming as much as possible, while utilizing today's modern architecture. The upgrade will be executed in several stages, including:

- Preliminary investigations
- Conceptual design of the new control system and its architecture [**This action**]
- Proof-of-concept testing
- Preliminary design of the new full-scale control system
- Selection of a control system equipment provider and award of a procurement contract
- Final design and installation/construction of the new control system in multiple staged contracts

The system-wide upgrade will extend over a 10-year period. In March 2017, Metropolitan's Board authorized the preliminary investigations for this effort, which included the selection process for a consultant to provide specialized technical support. Staff has completed the consultant selection process; prepared a scope of work for development of the system architecture, business needs, and network requirements; and estimated the cost for the conceptual design effort. This action authorizes conceptual design to move forward with support from the selected consultant. Staff will return to the Board in late 2018 to authorize the next stage of the project, which will include proof-of-concept testing.

#### **Control System Upgrade – Conceptual Design Phase (\$4.45 million)**

The planned work includes conducting a detailed inventory of the existing control system, development of functional requirements and new system architecture, planning for proof-of-concept testing of the proposed new architecture and technologies, and preparation of a system migration plan. Specific activities will include:

- **Site assessments** – The existing control system contains approximately 453 field computers and on-site controllers. All equipment will be identified and confirmed functionally, and all control software will be documented. Representative samples of equipment will also be inspected in detail, and system vulnerabilities at each site will be identified. This effort will establish a detailed inventory of current control system components, network infrastructure, processes, and software. The findings from this assessment will also form an initial basis for the plan to migrate equipment and software to the new control system.
- **Development of functional requirements and business needs** – Functional requirements, anticipated business needs, cybersecurity protocols, and requirements for operational control and monitoring will be developed for each type of facility. During this systematic process, key technologies will be evaluated, including their capabilities and limitations, to assess the needed level of control system functionality. System-wide and local functional requirements for the new control system will be established.
- **System architecture development** – The architecture of the existing control system has evolved as process automation and new facilities were added over time. This effort will consider the overall design of the new control system from a holistic perspective. Options for the architecture of the new system will be identified and evaluated with consideration of new technologies that have achieved widespread industry adoption; flexibility of migration between control system vendors; long-term viability of potential products; capability to interface with Metropolitan's existing specialized, stand-alone control systems; and allowances for future system expansion.

- **Proof-of-concept testing plan** – A plan will be developed for demonstration and testing of the proposed control system equipment and architecture. The purpose of the testing is to reduce overall technological, integration, and financial risks. The plan will identify key technologies and functional areas that should be evaluated during the proof-of-concept testing stage. A test plan and acceptance criteria will be developed.
- **Conceptual design** – The conceptual design effort will summarize the findings and will document the current state of the existing control system; compare the options for technology, architecture, and implementation; map out the planned implementation of the new system; specify a proof-of-concept testing plan; and update the total program cost.

CH2M is recommended to provide specialized control system support, as described below. Metropolitan's scope will include creating the inventory of the existing control system, detailing current control functions, providing oversight for development of the functional requirements and evaluation of control system architecture options, preparing test equipment procurement documents, and all project management activities. Value engineering will be performed by a third-party specialty firm under an agreement that will be awarded under the General Manager's Administrative Code authority.

This action appropriates \$4.45 million and authorizes conceptual design to upgrade Metropolitan's control system. The requested funds include \$2,485,000 for CH2M to prepare the conceptual design; \$1,147,000 for the Metropolitan activities described above; \$443,000 for project management and procurement activities; \$80,000 for value engineering; and \$300,000 for remaining budget.

#### **Agreement for Specialized Technical Support (CH2M) – New Agreement**

CH2M is recommended to provide specialized technical support for the control system upgrade. Staff followed a competitive process to select a firm to provide specialized control system, network, and communication system support. CH2M is recommended based upon its extensive expertise in control and communication technology, and its experience in upgrading large control networks similar to Metropolitan's system.

The planned activities include development of functional requirements for the 453 field computers and on-site controllers; identification of technology and control system architecture options for the system-wide upgrade; and preparation of a proof-of-concept testing plan. The estimated cost for these services is \$2,485,000.

This action authorizes an agreement with CH2M in an amount not to exceed \$2,485,000. For this agreement, Metropolitan has established a Small Business Enterprise (SBE) participation level of 25 percent. The planned subconsultants under this agreement are Lee & Ro, Inc., Project Line Technical Services, Inc., and Gillespie, Prudhon & Associates, Inc.

#### **Summary**

This action appropriates \$4.45 million, authorizes conceptual design to upgrade Metropolitan's control system, and authorizes a professional services agreement for specialized technical support. This work is included within capital Appropriation No. 15467, the Water Operations Control Appropriation, which was initiated in fiscal year 2009/10. With the present action, the total funding for Appropriation No. 15467 will increase from \$43.31 million to \$47.76 million.

The total estimated cost to complete the upgrade of the control system, including the amount appropriated to date, current funds requested, and future installation and integration costs, is anticipated to range from \$94 million to \$100 million.

This work has been evaluated and recommended by Metropolitan's CIP Evaluation Team, and funds are available within the fiscal year 2016/17 capital expenditure plan. See [Attachment 1](#) for the Financial Statement.

***Project Milestone***

October 2018 – Completion of conceptual design for a comprehensive system-wide upgrade of Metropolitan’s control system

**Policy**

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Metropolitan Water District Administrative Code 5108: Appropriations

Metropolitan Water District Administrative Code 8121: General Authority of the General Manager to Enter Contracts

**California Environmental Quality Act (CEQA)**

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**CEQA determination for Option #1:**

This project was previously determined to be categorically exempt under the provisions of CEQA and the State CEQA Guidelines. The Board found this project to be exempt under Class 1, Section 15301; Class 2, Section 15302; and Class 3, Section 15303 of the State CEQA Guidelines on March 14, 2017. The statute of limitations has ended and with the current action, there is no substantial change proposed to the project since the Board approved the project. Hence, the previous environmental determination in conjunction with the project fully complies with CEQA and the State CEQA Guidelines. Accordingly, no further CEQA documentation is necessary for the Board to act with regard to the proposed action.

The CEQA determination is: Determine that the proposed action has been previously addressed in the 2017 Categorical Exemptions (Class 1, Section 15301; Class 2, Section 15302; and Class 3, Section 15303 of the State CEQA Guidelines) and that no further environmental analysis or documentation is required.

**CEQA determination for Option #2:**

None required

**Board Options**

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**Option #1**

Adopt the CEQA determination that the proposed action was previously determined to be categorically exempt, and

- a. Appropriate \$4.45 million;
- b. Authorize conceptual design for a system-wide upgrade of Metropolitan’s control system; and
- c. Authorize agreement with CH2M in an amount not to exceed \$2,485,000 to provide specialized technical support.

**Fiscal Impact:** \$4.45 million of capital funds under Appropriation No. 15467

**Business Analysis:** This option will support Metropolitan’s comprehensive, long-term effort to replace the existing control system in order to maintain reliable water deliveries to member agencies.

**Option #2**

Do not authorize the conceptual design or the professional services agreement at this time.

**Fiscal Impact:** None

**Business Analysis:** Under this option, the reliability of Metropolitan’s control system would slowly degrade. When parts fail, as individual components become unavailable, staff would increasingly need to manually operate processes and equipment.

**Staff Recommendation**

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Option #1

  
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Gordon Johnson  
Manager/Chief Engineer  
Engineering Services

5/25/2017  
Date

  
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Jeffrey Knightlinger  
General Manager

5/30/2017  
Date

**Attachment 1 – Financial Statement**

Ref# es12650684

**Financial Statement for Water Operations Control Appropriation**

A breakdown of Board Action No. 7 for Appropriation No. 15467 for the upgrade of Metropolitan’s control system<sup>1</sup> is as follows:

	<b>Previous Total Appropriated Amount (Apr. 2017)</b>	<b>Current Board Action No. 7 (June 2017)</b>	<b>New Total Appropriated Amount</b>
Labor			
Studies & Investigations	\$ 1,048,076	\$ 1,127,000	\$ 2,175,076
Final Design	1,636,000	-	1,636,000
Owner Costs (Bidding & program mgmt)	1,467,000	443,000	1,910,000
Submittals Review & Record Drwgs	823,000	-	823,000
Construction Inspection & Support	1,534,000	-	1,534,000
Metropolitan Force Construction	3,873,000	-	3,873,000
Materials & Supplies	1,303,121	5,000	1,308,121
Incidental Expenses	21,000	15,000	36,000
Professional/Technical Services	25,059,589	-	25,059,589
CH2M	-	2,485,000	2,485,000
Value engineering firm	-	80,000	80,000
Contracts	2,500,000	-	2,500,000
Remaining Budget	4,045,214	295,000	4,340,214
<b>Total</b>	<b>\$ 43,310,000</b>	<b>\$ 4,450,000</b>	<b>\$ 47,760,000</b>

Funding Request

<b>Appropriation Name:</b>	Water Operations Control Appropriation		
<b>Source of Funds:</b>	Revenue Bonds, Replacement and Refurbishment or General Funds		
<b>Appropriation No.:</b>	15467	<b>Board Action No.:</b>	7
<b>Requested Amount:</b>	\$ 4,450,000	<b>Budget Page No.:</b>	261
<b>Total Appropriated Amount:</b>	\$ 47,760,000	<b>Total Appropriation Estimate:</b>	\$ 119,300,000

<sup>1</sup> The total amount expended to date on the Control System Upgrade is approximately \$64,203. The total estimated cost to complete the upgrade of the control system, including the amount appropriated to date, current funds requested, and future installation and integration costs, is anticipated to range from \$94 million to \$100 million.