THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

BOARD ACTION

- Board of Directors
  *Engineering and Operations Committee*

11/18/2014 Board Meeting

**7-2**

## Subject

Appropriate $1.95 million; and authorize: (1) design of seismic upgrades to the electrical switch houses at the Colorado River Aqueduct pumping plants; (2) agreement with Degenkolb Engineers for design services; and (3) agreement with Fugro West, Inc. for geotechnical investigations (Approp. 15438)

## Executive Summary

This action authorizes design of seismic upgrades to the 6.9-kV switch houses at each of the five Colorado River Aqueduct (CRA) pumping plants. These switch houses contain critical electrical equipment used to power the aqueduct's main pumps. This action also authorizes two professional services agreements for specialized technical support.

**Timing and Urgency**

Metropolitan has an ongoing program to evaluate the seismic stability of its facilities in order to maintain reliable water deliveries and to meet current seismic design practices and code requirements. Although Metropolitan facilities have always been designed to meet codes that were in place at the time of their construction, seismic upgrades are important since both the magnitude of potential earthquakes and building code requirements are periodically updated.

Recent seismic analyses of the 6.9-kV switch house buildings at the five CRA pumping plants identified that the buildings may be damaged during a major earthquake, which could lead to an extended outage of the CRA. Given the CRA's importance as one of the primary sources of imported water for Southern California, staff recommends moving forward with seismic upgrades at this time.

This project has been reviewed with Metropolitan's Capital Investment Plan (CIP) prioritization criteria, and is categorized as an Infrastructure Reliability project. Funds for this action are available within Metropolitan's capital expenditure plan for fiscal year 2014/15.

## Details

**Background**

The CRA is a 242-mile-long conveyance system that transports water from the Colorado River to Lake Mathews in Riverside County. It consists of five pumping plants, 124 miles of tunnels, 63 miles of canals, and 55 miles of conduits, siphons, and reservoirs. The aqueduct was constructed in the late 1930s and was placed into service in 1941.

The 6.9-kV switch houses located at each CRA pumping plant contain circuit breakers and other electrical equipment used to control, protect, and isolate the high voltage power that serves the nine main CRA pumps. The outward appearance of all five switch house buildings is similar. Each building is constructed of reinforced concrete and features a main level and a basement level. The buildings at Hinds, Eagle Mountain, Iron Mountain, and Gene Pumping Plants are each approximately 163 feet long by 15 feet wide and 22 feet high. The building at Intake Pumping Plant is slightly smaller at 148 feet long by 14 feet wide and 21 feet high. Each building has a flat roof constructed of concrete decks with several large skylights. At the basement level, a tunnel and an

underground duct bank extend from the switch house to the nearby pump house, containing the electrical cables that feed the main pumps. Steel lattice towers with a height of 50 feet are mounted on top of the switch house buildings at Hinds, Eagle Mountain, Iron Mountain, and Gene Pumping Plants, and with a height of 12 feet at Intake Pumping Plant. The towers support the high voltage electrical lines which supply power to the switch houses.

The switch houses were constructed in 1938 in accordance with then-current building codes. Since that time, industry knowledge of earthquakes and seismic design has advanced significantly, leading to the development of more stringent, modern seismic codes. In October 2009, a seismic risk assessment of the switch houses identified that these structures are vulnerable to damage during a major seismic event. The risk assessment concluded that a 7.9-magnitude earthquake on the San Andreas Fault could damage the switch houses, potentially interrupting CRA deliveries for an extended period. Hinds Pumping Plant is located approximately 20 miles from the San Andreas Fault, while Eagle Mountain and Iron Mountain Pumping Plants are located 33 and 64 miles from the fault, respectively. Gene and Intake Pumping Plants are located approximately 110 miles from the San Andreas Fault.

In January 2013, Metropolitan's Board authorized preliminary design of seismic upgrades to the 6.9-kV switch houses. A 3-dimensional analysis of the buildings identified several areas where extensive damage could potentially occur. Due to its further distance from the San Andreas Fault, damage at Gene Pumping Plant would be less extensive than the other plants. At Intake Pumping Plant, any damage would likely be minor due to its distance from the fault and the shorter steel lattice towers.

Based on the results of the risk assessment and preliminary design, staff recommends that final design of structural upgrades to the 6.9-kV switch houses be initiated to improve their capability to withstand a major seismic event.

**CRA 6.9-kV Switch House Building Seismic Upgrades – Final Design Phase ($1,950,000)**

Planned structural upgrades to the Hinds, Eagle Mountain, and Iron Mountain 6.9-kV switch houses include bracing of walls to support the steel towers mounted on the roofs; reinforcement of roof decks; addition of an exterior buttress wall; strengthening of existing shear walls; installation of piles beneath the existing shear walls and beneath the new exterior buttress wall; and injection grouting of existing cracks in the walls and roof decks.

For the Gene switch house, planned structural upgrades include bracing of walls, reinforcement of the roof deck, and injection grouting of existing cracks in the walls and roof deck. For Intake Pumping Plant, the only upgrade anticipated is injection-grouting of existing cracks.

Planned final design phase activities for the five switch house buildings include engineering design, preparation of drawings and specifications, development of construction cost estimates, and receipt of multiple bids. A test pile program is planned to be conducted at this time to determine the required pile depth needed to resist seismic uplift forces. Conducting these tests during the design phase in advance of construction provides the benefit of confirming site conditions so they may be specified more accurately in the bidding documents, reducing risk and cost for prospective bidders. The test pile program will consist of drilling, installing, and proof-testing two micropiles at the Hinds, Eagle Mountain, and Iron Mountain Pumping Plants. A material testing program will also be conducted to verify the structural strength of existing switch house structural components such as outer walls, interior walls, and roof decks.

Final design of seismic upgrades and material testing for the CRA switch house buildings is recommended to be performed by Degenkolb Engineers. The civil and electrical portion of the design is planned to be conducted by Metropolitan staff. Specialized assistance with implementation of a test pile program will be provided by Fugro West, Inc., as described below.

This action appropriates $1.95 million and authorizes final design phase activities for seismic strengthening of the CRA's 6.9-kV switch house buildings. Requested funds include $759,000 for final design by Degenkolb Engineers and Metropolitan; $77,000 for materials testing by Degenkolb Engineers; $450,000 for foundation pile testing by Fugro West, Inc.; $275,000 for peer technical review, bidding of multiple contracts, program management, and development of construction cost estimates; $30,000 for potholing by Metropolitan forces to

locate below-ground utilities; $97,000 for submittals review and monitoring of the foundation testing program; $75,000 for value engineering; and $187,000 for remaining budget.

The final design cost as a percentage of the total estimated construction cost is approximately 11.7 percent. Engineering Services' goal for design of projects with construction cost greater than $3 million is 9 to 12 percent. The construction cost to upgrade all five switch house buildings is anticipated to range from $6.5 million to $9 million.

**Structural Design Services – Degenkolb Engineers**

Degenkolb Engineers is recommended to perform structural engineering design of this project. Degenkolb Engineers was prequalified via Request for Qualifications (RFQ) No. 1012 to provide seismic design services, and was selected for this project based on its experience with similar projects and the expertise of its project team. The planned scope of work includes detailed modeling, material testing, preparation of drawings and specifications, and bidding phase support. The estimated cost for these services is $510,000.

This action authorizes an agreement with Degenkolb Engineers in an amount not to exceed $510,000 to provide structural design services for seismic upgrades to the switch house at all five CRA pumping plants. For this agreement, Metropolitan has established a Small Business Enterprise (SBE) participation level of 18 percent. Degenkolb Engineers has agreed to meet this level of participation. The planned subconsultants under this agreement are IBI Group, Twining, Inc., and Orsa Consulting Engineers, Inc.

**Geotechnical Investigations – Fugro West, Inc.**

Fugro West, Inc. is recommended to perform geotechnical investigations at the Hinds, Eagle Mountain, and Iron Mountain Pumping Plants. Fugro West, Inc. was prequalified via RFQ No. 1033 to provide geotechnical services. Fugro West, Inc. was selected for this project due to its experience with foundation design and testing for similar projects. The planned scope of work includes installing and testing of prototype piles at Hinds, Eagle Mountain, and Iron Mountain Pumping Plants, and recommendation of foundation design criteria. The estimated cost for these services is $450,000.

This action authorizes an agreement with Fugro West, Inc. in an amount not to exceed $450,000 to conduct geotechnical investigations at the Hinds, Eagle Mountain, and Iron Mountain Pumping Plants. For this agreement, Metropolitan has established an SBE participation level of 18 percent. Fugro West, Inc. has agreed to meet this level of participation. The planned subconsultant under this agreement is Hayward-Baker, Inc.

**Summary**

This action appropriates $1.95 million and authorizes final design of seismic upgrades to the 6.9-kV switch houses at the five CRA pumping plants. This work has been evaluated and recommended by Metropolitan's CIP Evaluation Team, and funds are available within the fiscal year 2014/15 capital expenditure plan. See **Attachment 1** for the Financial Statement and **Attachment 2** for the Location Map.

This project is included within capital Appropriation No. 15438, the CRA Reliability Appropriation – FY 2006/07 Through FY 2011/12, which was initiated in fiscal year 2006/07. With the present action, the total funding for Appropriation No. 15438 will increase from $40,719,000 to $42,669,000. The total estimated cost to complete this project, including the amount expended to date, current funds requested, and future construction cost, will range from $9.5 million to $12 million.

***Project Milestone***

May 2015 – Completion of final design of seismic upgrades for all five pumping plants

## Policy

Metropolitan Water District Administrative Code Section 5108: Appropriations

## 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 overall activities involve funding, design, minor alterations, and replacement of existing public facilities; minor modifications in the condition of land, water, and/or vegetation which do not involve removal of healthy, mature, scenic trees; and a check for performance of an operation, or quality, health, or safety of a project. In addition, these activities involve negligible or no expansion of use and no possibility of significantly impacting the physical environment. Accordingly, the proposed action qualifies under Class 1, Class 2, Class 4, and Class 9 Categorical Exemptions (Sections 15301, 15302, 15304, and 15309 of the State CEQA Guidelines).

The CEQA determination is: Determine that pursuant to CEQA, the proposed action qualifies under four Categorical Exemptions (Class 1, Section 15301; Class 2, Section 15302; Class 4, Section 15304; and Class 9, Section 15309 of the State CEQA Guidelines).

CEQA determination for Option #2:

None required

## Board Options

**Option #1**

Adopt the CEQA determination that this action is categorically exempt, and

a. Appropriate $1.95 million;
b. Authorize final design of seismic upgrades to the electrical switch houses at the Colorado River Aqueduct pumping plants;
c. Authorize agreement with Degenkolb Engineers in an amount not to exceed $510,000; and
d. Authorize agreement with Fugro West, Inc. in an amount not to exceed $450,000.

**Fiscal Impact:** $1.95 million of capital funds under Approp. 15438
**Business Analysis:** This option will reduce the risk of structural failure of key CRA buildings in the event of a major earthquake, and will enhance CRA reliability.

**Option #2**

Do not authorize final design at this time.
**Fiscal Impact:** None
**Business Analysis:** This option would forgo an opportunity to enhance the reliability and extend the service life of the CRA.

## Staff Recommendation

Option #1

10/28/2014
*Gordon Johnson* *Date*
*Manager/Chief Engineer*
*Engineering Services*

11/5/2014
*Jeffrey Kightlinger* *Date*
*General Manager*

**Attachment 1 – Financial Statement**
**Attachment 2 – Location Map**

## Financial Statement for CRA Reliability Appropriation – FY 2006/07 Through FY 2011/12

A breakdown of Board Action No. 28 for Appropriation No. 15438 for seismic upgrades to the CRA electrical switch houses[1] is as follows:

| | Previous Total Appropriated Amount (Oct. 2014) | Current Board Action No. 28 (Nov. 2014) | New Total Appropriated Amount |
|---|---|---|---|
| Labor | | | |
| Studies & Investigations | $ 2,246,800 | $ - | $ 2,246,800 |
| Final Design | 4,792,900 | 326,000 | 5,118,900 |
| Owner Costs (Program mgmt., bidding) | 3,504,090 | 275,000 | 3,779,090 |
| Submittals Review & Record Drwgs | 596,600 | 97,000 | 693,600 |
| Construction Inspection & Support | 2,452,500 | - | 2,452,500 |
| Metropolitan Force Construction | 4,135,600 | 30,000 | 4,165,600 |
| Materials & Supplies | 2,995,405 | - | 2,995,405 |
| Incidental Expenses | 138,800 | - | 138,800 |
| Professional/Technical Services | 2,966,000 | - | 2,966,000 |
| Degenkolb Engineers | - | 510,000 | 510,000 |
| Fugro West, Inc. | - | 450,000 | 450,000 |
| Value engineering firm | - | 75,000 | 75,000 |
| Equipment Use | 25,505 | - | 25,505 |
| Contracts | 15,216,370 | - | 15,216,370 |
| Remaining Budget | 1,443,430 | 187,000 | 1,630,430 |
| **Total** | **$ 40,514,000** | **$ 1,950,000** | **$ 42,464,000** |

## Funding Request

| | | | |
|---|---|---|---|
| **Appropriation Name:** | CRA Reliablity Appropriation – FY 2006/07 Through FY 2011/12 | | |
| **Source of Funds:** | Revenue Bonds, Replacement and Refurbishment or General Funds | | |
| **Appropriation No.:** | 15438 | **Board Action No.:** | 28 |
| **Requested Amount:** | **$** 1,950,000 | **Budget Page No.:** | 280 |
| **Total Appropriated Amount:** | **$** 42,464,000 | **Total Appropriation Estimate:** | $73,300,000 |

[1] The total amount expended to date on the CRA Electrical Switch House Seismic Retrofit project is approximately $1,016,942. The total cost to complete this project, including the amount authorized to date, current funds requested, and future construction costs, is estimated to range from $9.5 million to $12 million.

# Location Map