

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

December 12, 2000 Board Meeting

8-1

Subject

Authorize \$1.5 million to amend agreement for the inspection and analysis of Metropolitan's prestressed concrete cylinder pipelines

Description

The program to assess Metropolitan's prestressed concrete cylinder pipelines (PCCPs) is a key component of Metropolitan's Infrastructure Reliability and Protection Plan. This program was identified as an area requiring attention by an Infrastructure Reliability Study completed in 1995. The study was originated in response to a number of catastrophic pipeline failures that several water agencies had experienced using PCCPs. The Board approved the PCCP Assessment program in December 1996 with purposes that included: assessing the condition of Metropolitan's PCCPs, investigating state-of-the-art inspection methods, and conducting internal inspections of Metropolitan's pipelines that warranted attention.

Prior to the assessment project, PCCP inspections resulted in limited early-warning detection of pipeline failure or stress. Conventional corrosion monitoring measurements have generated extensive data for analysis; however, this method only detects large areas of corrosion. Internal visual inspection, concurrent with manual sounding, is the most successful test for pipe conditions, but a high degree of degradation is required before distress is visible. Small areas of corrosion that might be severe enough to cause catastrophic failure were difficult to detect.

Staff contracted with the Pressure Pipe Inspection Company (PPIC) which utilizes remote field eddy current/transformer coupling (RFEC/TC) technology to inspect PCCPs. PPIC uses this technology to locate and quantify breaks in the prestressing wires along the length and/or around the circumference of PCCPs. No other technology is capable of producing this type of information. PPIC holds an exclusive license for this technology and is the sole provider of that service. Staff verified the validity of this proprietary technology on the Allen McColloch Pipeline and the Second Lower Feeder, before recommending wholesale RFEC/TC inspections of Metropolitan's PCCPs.

In September 2000, the Board authorized staff to amend the existing contract with PPIC to provide for RFEC/TC inspections of two additional critical reaches of Metropolitan's PCCPs. The two additional inspections, a 16-mile reach of the Sepulveda Feeder and a 5.4-mile reach of the Second Lower Feeder, are scheduled to occur during the 2000-2001 shutdown season. The Board was also informed that, upon completion of the cost estimates, staff would request authorization and funding to inspect all of Metropolitan's remaining PCCPs.

Staff has now completed a report that documents the accomplishments of the PCCP Assessment Program, evaluates the RFEC/TC technology, and compiles costs for inspecting the remaining PCCPs. Based on the report, staff recommends that the existing agreement with PPIC be amended to authorize the inspection of Metropolitan's remaining 110 miles of PCCPs over a 3-year period. (See [Attachment 1](#) for a detailed report, [Attachment 2](#) for financial statement, and [Attachment 3](#) for a site map.) Once the field inspections and assessments of the pipe sections are completed, a prioritized list of repairs and funding will be developed as necessary. If serious conditions are identified during the inspection program, staff will promptly bring remedial recommendations back to the Board for consideration.

This program was evaluated by the Capital Investment Plan (CIP) Evaluation Team for its original appropriation and was determined to be a critical component of Metropolitan's commitment to infrastructure reliability. If the

Board approves this recommendation, the fiscal year 2000/2001 expenditure plan will be increased to include funds for this project so that all PCCPs will be inspected at an accelerated schedule over the next three years.

Policy

Metropolitan Water District Administrative Code Section 5108: Capital Project Appropriation
Metropolitan Water District Administrative Code Section 8117: Professional and Technical Consultants

Board Options/Fiscal Impacts

Option #1

- (a) Appropriate \$1.5 million and authorize an amendment to Agreement No. 30402 with PPIC to have all work performed for the inspection and analysis of Metropolitan’s remaining PCCPs, approximately 110 miles. This action will increase the contract with PPIC from \$560,000 to \$2.06 million. This option would generate data that identifies distressed pipe and possible pipeline failure. Staff would be able to locate and repair distressed pipe.
- (b) The proposed project is categorically exempt under the California Environmental Quality Act (CEQA) as a check for performance of an operation, or quality, health, or safety of a project (State CEQA Guidelines Section 15309); and as a minor alteration of existing public facilities involving no expansion of use (State CEQA Guidelines Section 15301).

Fiscal Impact: \$1.5 million.

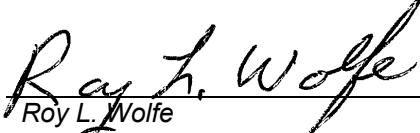

Option #2

Do not use the RFEC/TC technology and, instead, rely exclusively on traditional procedures that are less sensitive to pipe degradation.

Fiscal Impact: \$200,000 in O&M costs using traditional procedures that provide limited early-warning detection of potential pipeline structural deterioration.

Staff Recommendation

Option #1

 _____ Roy L. Wolfe Manager, Corporate Resources	11/17/2000 Date
 _____ Ronald R. Jester General Manager	11/20/2000 Date

- [Attachment 1 – Detailed Report](#)
- [Attachment 2 – Financial Statement](#)
- [Attachment 3 – Site Map](#)

Detailed Report

History of Prestressed Concrete Cylinder Pipelines. Prestressed Concrete Cylinder Pipelines (PCCPs) were introduced to the western United States in the early 1950s. In the early to mid-1960s, PCCPs began to gain a wider acceptance for use in transmitting and distributing water in municipal, industrial, and irrigation systems. PCCPs gained favorable acceptance in the waterworks industry primarily due to economics and its ability to be designed for many combinations of internal and external loads.

Metropolitan owns and operates a total of approximately 166 miles of PCCPs, which were installed between 1965 and 1985. The diameters of Metropolitan's PCCPs range from 54 to 201 inches, and the pipelines are located in both dense urban areas and remote rights of way. PCCPs are fabricated with tightly wound reinforcing wire that is prestressed to 196,500 psi. Operating pressure on these pipelines, within Metropolitan's distribution system, can exceed 280 psi. Unfortunately, the prestressing wire is vulnerable to corrosion under some conditions, such as, corrosive soil, stray electrical current interference, improper use of cathodic protection, and defective materials of fabrication.

Conventional Corrosion Monitoring. Metropolitan's Corrosion Engineering team has maintained an ongoing monitoring program to detect and mitigate corrosion on over 400 miles of pipelines throughout the distribution system for over 40 years. Historically, it has taken several years to complete the monitoring cycle of the entire distribution system. However, in 1993, because of the potential for catastrophic failure of PCCPs, Corrosion Engineering increased its efforts and began conducting annual corrosion surveys along all PCCPs.

Additionally, Metropolitan's Engineering Services Section and Water System Operations Group have teamed to perform internal inspections of all Metropolitan's PCCPs on a five-year rotating schedule, beginning in 1990. These inspections included visual examinations of the internal surfaces of the pipelines, and "sounding" of the pipelines to locate areas where delamination of the pipe wall may be present. These inspections are useful, but are limited in results since significant degradation of the pipe is required before it can be detected visually or by sounding. All of Metropolitan's PCCPs have been inspected with this method at least once, and most have been inspected twice.

Metropolitan's PCCP Assessment Program. A number of water agencies have experienced catastrophic PCCP failures over the years. This prompted Metropolitan to reevaluate its PCCP inspection efforts, and develop the PCCP Assessment Program. This program, which was approved by the Board in December 1996 with an appropriation of \$1.9 million, was initiated to ensure pipeline reliability by identifying and assessing the pipelines based on developing, evaluating, and implementing state-of-the-art inspection methods; and performing internal inspection of PCCPs that require attention. The appropriation included funds for the inspection of three pipeline reaches.

Pilot Program to Evaluate New Technology. While researching and evaluating inspection technologies, staff determined that the remote field eddy current/transformer coupling (RFEC/TC) technology is by far the best tool available to assess the condition of existing PCCPs. The RFEC/TC technology was developed by the Applied Magnetics Group of Queen's University, in Kingston, Ontario, Canada. RFEC/TC uses an electromagnetic technique to locate breaks in the prestressed wire windings of individual pipe sections. If the inspection is properly conducted, and the data is properly analyzed, even one broken prestressing wire can be detected. Currently, the Pressure Pipe Inspection Company (PPIC) is the sole provider of internal inspections with the RFEC/TC technology.

Under the PCCP Assessment Program, staff began a pilot project to inspect PCCP reaches with the greatest risk potential using the RFEC/TC technology. The pilot project was initiated in the 1999-2000

shutdown season to inspect and evaluate a 24-mile reach of the Second Lower Feeder and a 9-mile reach of the Allen McColloch Pipeline (AMP). PPIC was retained to perform the RFEC/TC inspections. Staff verified the results of the technology by removing the mortar coating and counting the actual number of broken wires on eight of the AMP's pipe sections. The testing proved that the RFEC/TC is very reliable in detecting defects within individual pipe sections.

In September 2000, the Board authorized staff to amend the contract with PPIC to perform two additional inspections and to conduct detailed analysis of the 24-mile reach of the Second Lower Feeder. Additionally, staff notified the Board of plans to recommend RFEC/TC inspection of all remaining reaches of Metropolitan's PCCPs. The contract with PPIC has been amended, and the two additional inspections, a 16-mile reach of the Sepulveda Feeder and a 5.4-mile reach of the Second Lower Feeder, are scheduled to occur during the 2000-2001 shutdown season. Subsequent to the September 2000 Board action, staff has completed a report that documents the accomplishments of the PCCP Assessment Program, evaluates the RFEC/TC technology and other state-of-the-art inspection methods, and compiles costs for inspection and analysis of the remaining PCCPs.

Staff Recommendations. Based on the findings from the report, staff is recommending that RFEC/TC inspection, testing, and analysis be performed on all of the PCCPs in Metropolitan's system. A schedule has been developed for this work to be completed by fiscal year 2002-2003. This equates to shutting down, de-watering, and inspecting approximately 38 miles of pipe during the 2000-2001 shutdown season, 47 miles in 2001-2002, and 44 miles in 2002-2003. The proposed action would authorize an amendment to the existing agreement with PPIC and would provide for the inspection of all of Metropolitan's PCCPs.

CEQA Compliance / Environmental Documentation

The proposed project is categorically exempt under the California Environmental Quality Act (CEQA) as a check for performance of an operation, or quality, health, or safety of a project (State CEQA Guidelines Section 15309); and as a minor alteration of existing public facilities involving no expansion of use (State CEQA Guidelines Section 15301).

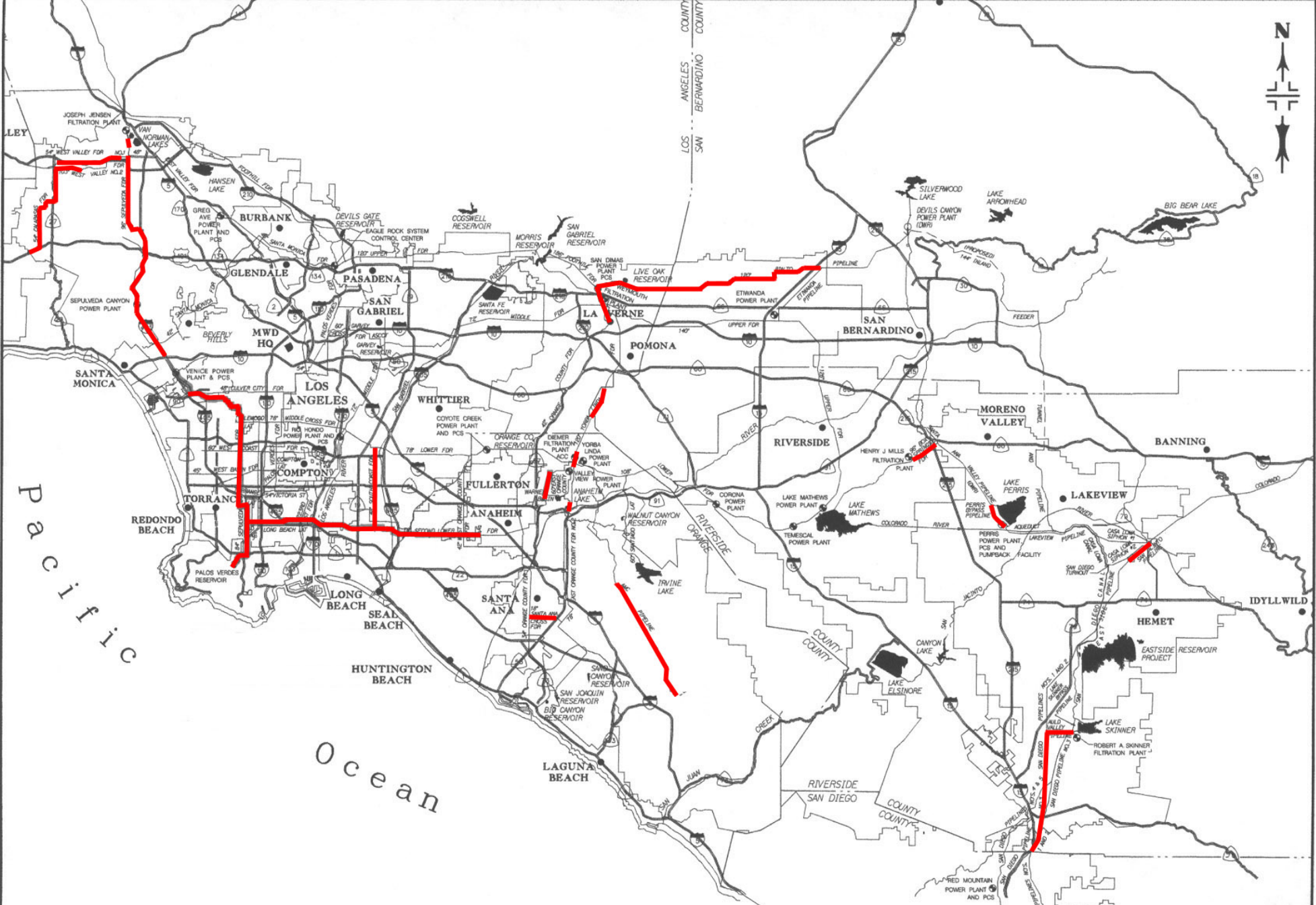
FINANCIAL STATEMENT

Board Action No. 2 for Appropriation No. 15297 to finance management and RFEC/TC inspection of Metropolitan’s PCCPs:

	BOARD ACTION NO. 1 (Dec 1996)	BOARD ACTION NO. 2 (Dec 2000)
Labor:		
Owner Costs (Project Mgmt, Purchasing, Environmental Compliance/Permitting)	\$ 0	\$ 60,000
Corrosion/Structural Engineering/Technical Services: Data Collection & Categorization, Research & Analysis	906,300	704,000
District Forces: Fabrication/Installation	100,700	62,000
Subtotal Labor	\$ 1,007,000	\$ 826,000
Materials and Supplies	\$ 115,000	\$ 38,000
Incidental Expenses	6,000	10,000
Operating Equipment	8,000	35,000
Professional/Technical Services	475,000	2,294,000
Remaining budget	289,000	197,000
Total:	\$ 1,900,000	\$ 3,400,000

FUNDING REQUEST

Program Name:	Assess Condition Of Metropolitan’s Prestressed Concrete Cylinder Pipe		
Source of Funds:	Pay-As-You-Go Fund		
Appropriation No.:	15297	Board Action No.:	2
Requested Amount:	\$ 1,500,000	Capital Program No.:	15297-A
Total Appropriated Amount:	\$ 3,400,000	Capital Program Page No.:	E-3
Total Program Estimate:	\$ 1,900,000	Program Goal:	R-Reliability



Pacific

Ocean

METROPOLITAN PRESTRESSED CONCRETE CYLINDER PIPE



SCALE IN MILES