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

July 9, 2002 Board Meeting

8-4

Subject

Appropriate $3.5 million for upgrades to the La Verne Machine Shop equipment and bridge cranes, construction of a foundation for the Fabrication Shop, and construction of a blast room for the Coatings Shop (Approp. 15395)

Description

Metropolitan's Machine, Fabrication, and Coatings Shops are used extensively to support system-wide routine maintenance; to provide emergency services within Metropolitan, for our member agencies, and for the California Department of Water Resources (DWR); and to perform fee-for-service work that supports our member agencies and the State Water Project. They continue to play a key role in all major reliability and rehabilitation projects, both at Metropolitan and DWR, and maintaining these capabilities in-house will ensure that Metropolitan's infrastructure is adequately maintained and continues to operate efficiently.

The La Verne Facility Shop Equipment Upgrades Program will provide necessary upgrades to the Machine Shop, Fabrication Shop, and Coatings Shop so that these shops can continue to effectively and efficiently serve the needs of Metropolitan, the member agencies, and DWR. The program consists of the four projects summarized below. **Attachment 1** contains the Detailed Report, **Attachment 2** contains the program Financial Statement, and **Attachment 3** contains additional information regarding upgrading the Machine Shop equipment, which represents the bulk of the requested funding**.**

The La Verne Facility Shop Equipment Upgrades Program has been evaluated and approved by the Capital Investment Plan (CIP) Evaluation Team and is included in the fiscal year 2002/2003 capital budget.

- **Machine Shop Equipment Upgrade** ($2.445 million). Over 90 percent of the machines in the Machine Shop were purchased used, and almost two-thirds of the machines are over 30 years old and are showing signs of significant wear. This project funds much-needed maintenance on several of the oldest machines, the replacement of several machines that are not cost-effective to repair, the replacement of a large lathe, and the purchase of two additional machines to increase productivity and efficiency.
- **Machine Shop Bridge Crane Upgrade** ($300,000). The capacities and configurations of the existing bridge cranes are inadequate for some of the tasks performed within the Machine Shop. This project increases the crane capacity and provides new controllers so that heavy loads can be lifted, carried, and lowered safely and smoothly.
- **Fabrication Shop Welding Manipulator Foundation** ($175,000). The large sub-arc welder and associated welding manipulator are used to weld large-diameter pipes, spools, pump components, and other large items. Currently, employees operating the machine and inspecting the parts being welded must work on ladders or platforms up to 12 feet above the shop floor. This project involves lowering a portion of the shop floor and then installing the machines in the lowered area. This will reduce the average work height and eliminate the need for high ladders and temporary platforms. The new work area will also maximize the use of available workspace within the shop and improve overall workflow and efficiency.
- **Coatings Shop Abrasive Blasting Room** ($580,000). The existing abrasive blasting facility is too small to accommodate some of the larger components that must be processed through the Coatings Shop. This project involves constructing a large, self-contained abrasive blasting room that will accommodate large components such as shafts and pipe sections. The new abrasive blasting room will be located in an existing warehouse that is currently used for temporary storage.

Consistent with Metropolitan's approach of managing projects in the most cost-effective manner and providing opportunities for staff, Metropolitan forces will perform those tasks that are critical to overall program success, including project management, preparation of specifications, and field coordination. Metropolitan forces will also be responsible for constructing the welding manipulator foundation and minor construction activities necessary in the Machine Shop. The remaining tasks will be competitively bid where applicable. Staff estimates that the overall program will be completed in two years.

Implementing this program will allow the La Verne shops to continue to support emergency situations and routine maintenance throughout Metropolitan and our member agencies and to continue to support DWR's pumping and hydroelectric power plants along the State Water Project. Although the program is necessary even without Metropolitan's support activities for DWR, some of the program costs will be recovered through adjustments in the equipment rates DWR pays as a part of their contract with Metropolitan.

Policy

Metropolitan Water District Administrative Code § 5108: Appropriations
Metropolitan Water District Administrative Code § 8103: Competitive Bids
Metropolitan Water District Administrative Code § 8113: Awards
Metropolitan Water District Administrative Code § 8115: Negotiated Contracts
Metropolitan Water District Administrative Code § 9100: Objectives (Risk Management)

California Environmental Quality Act (CEQA)

CEQA determination for Options #1 and #2:

The proposed action relating to the four project activities will not have a significant effect on the environment and is therefore categorically exempt under the provisions of CEQA. The project activities involve the funding, final design, installation of small new equipment and facilities in small structures, and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure. As such, the proposed action qualifies under a Class 3 Categorical Exemption (Section 15303 of the State CEQA Guidelines).

The CEQA determination is: Determine that pursuant to CEQA, the proposed action qualifies under a Categorical Exemption (Class 3, Section 15303 of the State CEQA Guidelines).

CEQA determination for Option #3:

None required

Board Options/Fiscal Impacts

Option #1

Adopt the CEQA determination and appropriate $3.5 million in budgeted funds.
Fiscal Impact: $3.5 million of budgeted CIP funds under Appropriation 15395

Option #2

Adopt the CEQA determination and defer one or more projects.
Fiscal Impact: Varies, depending upon the deferred project or projects

Option #3

Reject or defer all projects.
Fiscal Impact: $0

Staff Recommendation

Option #1

Eddie Rigdon 6/14/2002

Eddie Rigdon *Date*
for Jill T. Wicke
Manager, Water System Operations

Ronald R. Gastelum 6/14/2002

Ronald R. Gastelum *Date*
Chief Executive Officer

Attachment 1 – Detailed Report

Attachment 2 – Financial Statement

Attachment 3 – Additional Information, Machine Shop Equipment Upgrade

BLA #1767

Detailed Report

Metropolitan's Machine, Fabrication, and Coatings Shops are used extensively to support system-wide routine maintenance; to provide emergency services within Metropolitan, for our member agencies, and for the California Department of Water Resources (DWR); and to perform fee-for-service work that supports our member agencies and the State Water Project (SWP). They continue to play a key role in all major reliability and rehabilitation projects, both at Metropolitan and DWR, and maintaining these capabilities in-house will ensure that Metropolitan's infrastructure is adequately maintained and continues to operate efficiently.

Management recognized the need for in-house expertise in maintenance support areas such as machining and fabrication very early in Metropolitan's history, when the first formal maintenance shops were created at the Weymouth plant in the early 1940s. As the water delivery system grew and expanded, management recognized that its maintenance facilities needed to expand as well. New, larger shop facilities were constructed in the late 1960s and then expanded in the early 1980s, when Metropolitan implemented the first major rehabilitation project for the CRA pumps.

Also in the late 1980s, Metropolitan entered into a formal agreement with DWR to provide machining and maintenance-related services for DWR's facilities along the SWP. Under this agreement, Metropolitan provides machining, fabrication, welding, and coating services to DWR, and DWR reimburses Metropolitan for direct materials, outside services, labor, equipment usage, and associated labor fringe benefit costs and administrative overhead. The first 1-year agreement was signed in 1983 and was amended six times, with each amendment increasing both the scope and dollar amount of the contract. A new 5-year contract, signed in 2001, allows Metropolitan to bill DWR up to $3 million per year, for a total of $15 million over the life of the contract.

Having these shops ensures that Metropolitan has reliable, competent repair capabilities to meet the increased maintenance demands of the large pumps, valves, and hydroelectric generators used throughout our water delivery system. The services provided by these shops support both the Colorado River Aqueduct (CRA) and SWP, and work performed by these shops ensures that Southern California continues to receive an adequate and reliable supply of water from both sources.

Machine Shop Equipment Upgrade ($2.445 million)

Metropolitan's Machine Shop at La Verne consists of a large area for machining operations and a small area for sheet-metal fabrication. The machining area contains approximately 30 machines, ranging in size from the huge lathes and milling machines used to machine 16-foot-diameter impellers and 20-ton shafts to smaller machines that are used to fabricate special clamps and fasteners, refurbish valve bodies, and polish bearings and seal rings. The sheet metal area is used to fabricate cabinets, covers, and containers that are used for a variety of equipment, including field instrumentation and general electrical and mechanical equipment. Both areas are heavily involved in maintenance projects throughout the service area, and the machining area in particular has been instrumental in supporting several planned and unplanned shutdowns of the CRA pumps.

Between the years 2000 and 2001, Water System Operations (WSO) staff evaluated the Machine Shop to determine the following:

- Overall purpose and function
- Need for in-house expertise
- Relevance to Metropolitan's overall goals and mission
- Current condition
- Current and anticipated needs
- Ability to meet these needs
- Alternative solutions

Purpose and Function: The evaluation concluded that the purpose of Metropolitan's Machine Shop is to support the maintenance of Metropolitan's conveyance, treatment, and distribution systems and to provide emergency services as necessary to ensure that water continues to flow to our member agencies. Its primary functions are to provide these services when needed and to maintain in-house expertise in the maintenance and repair procedures necessary to preserve Metropolitan's aging infrastructure.

Need for In-House Expertise: Metropolitan's water delivery system is large and complex, and in many cases even a short unplanned shutdown in one area can affect the entire system. Metropolitan's recent emphasis on preventative maintenance will reduce the likelihood of unplanned shutdowns, but maintaining in-house expertise in critical areas such as machining and repairs will minimize the impact of a shutdown, even if one occurs. The evaluation concluded that maintaining in-house expertise in refurbishing and repairing Metropolitan's equipment is critical to Metropolitan's ability to keep its system operating at acceptable levels.

Relevance to Goals and Mission: The Machine Shop directly supports the infrastructure that moves the water from its source to its destination. For example, each time a CRA pump is removed from service for maintenance, most of the components are sent to the Machine Shop to be refurbished before they are reinstalled. Some components, such as the studs, nuts, and bushings that attach the impeller to the shaft, are replaced during the refurbishment process, and these components are fabricated in the Machine Shop. Similar activities are performed on motors, valves, hydroelectric generator components, and treatment plant components, all of which are critical to Metropolitan's ability to provide its service area with reliable supplies of high-quality water.

Current Condition: The current condition of the Machine Shop reflects the current condition of many portions of Metropolitan's system: Operational, but in need of upgrades and improvements if it is to continue to meet the needs it was created to meet. Many of the machines are very old and worn out, and the combination of age and excessive wear makes routine maintenance difficult and costly and increases the likelihood of delays. Some specific observations and findings were as follows:

- **Second-Hand Equipment**: Over 90 percent of the machines currently being used in the Machine Shop were purchased used, some from Government surplus for as little as a few hundred dollars;
- **Old Equipment**: Almost two-thirds of the machines are over 30 years old, which is well beyond the average life expectancy of equivalent machines;
- **Excessive Wear**: Several of the machines are worn to the point that they require constant adjustment to compensate for the wear;
- **No Repeatability**: Some machines have lost repeatability, meaning that performing the same operation two times in a row can yield different results if the machining operation is not carefully monitored;
- **Workflow and Process Bottlenecks**: Certain machining tasks occur more often than others, and machines that perform these tasks are used extensively. The shop would benefit from having more machines that perform these tasks to off-load some of the work from the high-use machines and to more efficiently move items through the machining process.

Current and Anticipated Needs: Metropolitan's current needs are that the Machine Shop must be capable of supporting routine maintenance and adequately respond to emergency situations as they arise. Routine maintenance needs are expected to increase, particularly as programs such as the Infrastructure Reliability Protection Program (IRPP) and CRA Pumping Plant Reliability Program become more active. Emergency situations may also increase, as indicated by recent maintenance and repair activities on the CRA pumps and the potential for increased maintenance if the pumps are started and stopped due to load shedding. DWR's needs have also increased and will continue to increase, as their rehabilitation programs begin.

Ability to Meet Needs: The evaluation concluded that the Machine Shop will most likely continue to meet its existing commitments, provided that there are few emergency situations and no sudden increases in work from the major rehabilitation projects. If, however, several emergencies occur, of if the need for routine maintenance increases significantly as a result of on-going projects, it is increasingly likely that the Machine Shop may not be able to provide adequate support for either Metropolitan's needs or DWR's.

Alternative Solutions: In terms of alternative solutions, staff evaluated two: Outsourcing work to other machine shops and continuing as-is, fixing or replacing machines as they break down.

a. **Outsourcing Metropolitan Work**: The Machine Shop aggressively pursues outsourcing when necessary, primarily as a backup in case of machine problems or failures and to offload routine work during emergency situations so that staff can focus on the emergency work. The main problems with outsourcing, however, are the associated costs and the likelihood of delays, particularly in emergency situations. In general, jobs that are outsourced cost more than jobs performed in-house, take longer to complete, and require an exceptional amount of up-front paperwork and other documentation in order to proceed. Private shops also charge premium time for changes in scope, standby, and rework, all of which occur frequently in an emergency situation. Metropolitan also has less control of schedule and quality control when work is outsourced. Some of these factors can be minimized through the agreement process, but the most significant issue–schedule delays–typically cannot be avoided because staff at a private machine shop does not have the same familiarity with Metropolitan's hardware as in-house personnel.

b. **Outsourcing DWR Work**: Metropolitan's agreement with DWR allows for a certain amount of outsourcing under normal circumstances, with an option for additional outsourcing in emergency situations. Outsourcing too much work, however, would have several negative effects, both to Metropolitan and to DWR. For DWR, the problems mentioned above (higher direct costs, increased delays, and less control over schedule or quality) would still apply, with the additional problem of lost revenue if a power plant was involved. For example, according to DWR, having a single unit down at one of their average power plants (Gianelli) results in approximately $114,000 in lost revenue per day (using an estimated cost of $100/megawatt). This number could be as low as $25,000/day for a smaller plant (Mojave) or as high as $450,000/day for a larger plant (Castaic). For Metropolitan, outsourcing significant amounts of DWR work also results in increased costs, since Metropolitan is the largest contractor for SWP water and almost all infrastructure costs on the SWP are paid by the water contractors. Metropolitan's relationship with DWR would also be affected, since one of the reasons DWR did not build their own shop was that Metropolitan agreed to provide them with access to ours.

c. **Continuing As-Is**: Having the Machine Shop continue in its current condition may reduce our ability to respond to emergencies, delay scheduled maintenance projects, add additional costs and schedule delays to on-going projects, and potentially result in the failure to meet contractual commitments to DWR. This will be because the machines are likely to continue to degrade both physically and functionally to the point that they will no longer be capable of operating properly.

Recommendations: Based upon these observations and conclusions, staff provided a detailed list of recommendations to improve the overall efficiency of the Machine Shop and ensure that the Machine Shop will continue to meet current and anticipated needs. These recommendations are summarized in Table I, which also lists the chronological age of each machine, based on manufacturing date.

In addition to the recommendations summarized in Table I for the existing equipment, staff also recommended that two additional machines be purchased to alleviate workflow bottlenecks and reduce the load on the high-use machines. The two purchases consist of one medium-sized lathe and one large milling machine. Attachment 3 contains additional information on the Machine Shop equipment, including the recommended new purchases.

If future expansions within the Weymouth facility require that the Machine Shop be moved to a new facility, the machines that are upgraded or purchased in this project can be removed and transported to the new facility.

Table I: Machine Shop Equipment Status and Recommendations

Description	Age	Disposition				
		OK As Is[1]	Refurbish	Replace		Requires Further Study
				With New	With Used	
Pacific hydraulic press brake	45				X	
10" Cincinnati lathe [small lathe]	38			X		
15" Le Blond lathe [small lathe]	18			X		
14" Clausing lathe [small lathe]	22	Salvage				
30" Kuraki lathe [medium lathe]	22	X				
24" Le Blond lathe [medium lathe]	32			X		
48" Le Blond lathe [large lathe]	30	X	(completely refurbished in 2001)			
10" Okuma lathe [small CNC lathe]	17	X				
120" Niles modular lathe [large lathe]	14			X		
10" Bridgeport lathe [small CNC lathe]	5					X
Atrump Mill [small mill]	4	X				
Cincinnati Toolmaster mill [small mill]	40	X				
K&T mill [medium mill]	42			X		
5" G&L horiz. milling machine [large mill]	39	X	(completely refurbished in 2000)			
Cincinnati Versimill mill [medium mill]	47	To be replaced by new purchase (4" HBM)				
6" Carlton horizontal boring mill [large mill]	44		X[2]			
Chevalier milling machine [small CNC mill]	10					X
72" Bullard vertical lathe [large CNC lathe]	24		X			
120" Froriep vertical lathe [large lathe]	45		X			
276" OM Ltd. vertical lathe [large lathe]	34		X			
60" G&L turret lathe [large lathe]	46				X	
Covel ID/OD grinder [large grinder]	40			X		
K.O. Lee tool grinder [large grinder]	40				X	
Thompson 24" surface grinder [large grinder]	42				X	
Sunnen honing machine	13	X				
Fosdick radial drill press [large drill press]	42		X	See Note 3		
Burgmaster drilling center	43	X				
IRD balancer	17		X	See Note 3		

1 "OK As Is" means either acceptable in its current condition or can be brought to an acceptable level through minor repairs.

2 Refurbish as a temporary measure only. This machine is a lighter-duty machine and is not well suited to Metropolitan's needs.

3 Currently being refurbished under current fiscal year O&M budget.

Actions and Milestones

Staff anticipates that the Machine Shop equipment upgrade project will span two fiscal years as summarized in Table II. Tasks are staggered so that refurbishments and upgrades can be appropriately staged to avoid impacting current and scheduled projects. Table II also includes an estimated cost for each major activity.

All purchases of new machines and machine refurbishments will be competitively bid following Metropolitan's standard procurement practices. Requests for purchases of used machines will be provided directly to the Chief Executive Officer for review and approval in accordance with Metropolitan's Administrative Code. As indicated in Table I, staff anticipates that only four used machines will be purchased as a part of this project.

The costs associated with new machines and machine refurbishments will be used to update the equipment usage rates Metropolitan uses for reimbursable activities, including the work Metropolitan performs for DWR.

Table II: Machine Shop Equipment Upgrade, Estimated Costs and Scheduling

Phase I		FY	Est. Cost
Machine Replacements	24" Le Blond Lathe	2002/3	$79,000.00
	15" Le Blond Lathe		$54,000.00
	10" Cincinnati Lathe		$30,000.00
	60" G&L Hypro (with a 70"+ vertical lathe)		$237,200.00
	Surface Grinder		$64,700.00
	Tool & Cutter Grinder		
	I.D. / O.D. Grinder		
New/Used Machine Purchases (2002/3)	20" CNC Slant-Bed Lathe		$139,450.00
	Pacific Press Brake		$162,450.00
	4" Horizontal Boring Mill		$156,700.00
	CNC Mill (K&T Replacement)		$49,750.00
New/Used Machine Purchases (2003/04)	Niles Replacement (Poreba-ToolMex Lathe)	2003/4	$668,450.00
Machine Refurbishment	6" Carlton Upgrade		$47,450.00
	72" Bullard CNC		$87,700.00
	120" Froriep		$346,450.00
	276" OM		$185,450.00

Machine Shop Bridge Crane Upgrade ($300,000)

The Machine Shop currently has two overhead bridge cranes that are used to lift, handle, and transport large, heavy parts. Each crane incorporates a trolley, which is the portion that moves from one side of the bridge to the other, and each trolley incorporates two hooks (a main hood and an auxiliary hook). One of the bridge cranes has a 30-ton main hook and a 5-ton auxiliary hook, and the other crane has a 15-ton main hook and a 10-ton auxiliary hook. These values (30, 5, 15, and 10) are the lifting capacities of the hooks. In addition, each crane incorporates a controller that contains the buttons used to move the crane, move the trolley and raise/lower the hooks. The 30/5-ton crane was purchased and installed in 1967 and the 15/10-ton bridge crane was purchased and installed in 1987.

Many of the lifts performed by the cranes involve parts that are either large, heavy, or both. For many of these lifts, employees must use both bridge cranes together because neither of the cranes can handle the weight by itself. Using the two cranes together, however, is difficult and requires additional rigging, special tooling, and precise coordination of the two cranes.

The cranes are used literally every day in the shop, with well over 1,000 lifts performed in a typical year. Staff estimates that at least 20 percent of these lifts are performed on parts that weigh in excess of 10 tons.

This project will upgrade and modify the cranes as summarized below:

- Purchase and install new 30-ton trolley with 30-ton hoist on existing bridge of the 30/5-ton bridge crane
- Upgrade the 5-ton hook on the existing 30/5-ton bridge crane to 10-ton
- Upgrade the existing 15/10-ton bridge crane to 20/15-ton
- Upgrade controls on all cranes to multi-step inverter controllers to allow for safer control of heavy lifts

Specific issues addressed by the project are listed below:

Insufficient Capacity: The two bridge cranes do not have sufficient capacity to meet current and anticipated needs. These cranes are used to lift, rotate, and transport large, heavy components such as impellers and valve bodies for Metropolitan and the Department of Water Resources (DWR), and in some cases the cranes are unable to perform these operations efficiently. Maximum crane ratings have also had to be extended in the past to accommodate some of the required loads, and even the extended ratings barely accommodated some of the required lifts.

Metropolitan's Engineering Services staff has evaluated the cranes in the light of anticipated work for DWR and has concluded: "The proper way to do this is to have adequate crane capacity to handle the loads without extended ratings."

Adding an additional 30-ton trolley to the existing bridge will result in safer lifts and rotations, and upgrading the 15/10-ton crane to a 20/15-ton would increase the overall capacity of the cranes from 45 tons to 50 tons. This will provide a greater safety margin for even the heaviest lifts required in the shop.

Inadequate Configuration: The current configuration of the two cranes is such that the crane with the highest capacity (30 tons) is configured with an auxiliary hook that has a relatively low capacity (5 tons). Upgrading the 5-ton hook to a 10-ton hook would allow for more efficient, safer lifts at a relatively low cost and would provide a level of redundancy in the 5-10-ton range, which covers a large percentage of the shop's required lifts.

Insufficient Control: The current crane controllers are standard analog controllers that are adequate for lighter lifts but tend to cause heavier parts to sway or jump when the crane motors start or stop. This imposes additional loads on the equipment. Newer controllers utilize a different internal control mechanism (variable frequency drive, or VFD) so that the motor stops and starts gradually under any load, winding up for starts and winding down for stops. The controllers that will be installed as a part of this project will be the same type used at the CRA plants, where staff has reported that they have performed very well.

Employee Safety: Upgrading the controllers as described above will also improve safety by allowing the crane operators greater control over crane speeds.

General Efficiency and Productivity: MWD personnel are required to lift, rotate, and otherwise handle and transport large, heavy components to various areas of the Machine Shop, including the large machines located on either end of the shop. Separately, the existing cranes are not ideally suited for the type of lifts required or the required loads. Increasing the overall capacity of the cranes will improve both efficiency and productivity by allowing only one crane to be used for most of the required lifts (up to 30 tons on the one crane and up to 20 tons on the other).

Emergency Response Capability: Much of the work performed on large components for both Metropolitan and DWR is emergency response work resulting from an unplanned, unscheduled shutdown of a pump or generator. Metropolitan's Machine Shop must be capable of responding to these emergencies quickly and efficiently, so water or power deliveries are not significantly affected. The

unnecessary delays resulting from additional crane setup, extending crane ratings, and extra care and handling because of the controllers affect Metropolitan's ability to respond to these situations.

If future expansions within the Weymouth facility require that the Machine Shop be moved to a new facility, the cranes can be removed and transported to the new facility.

Actions and Milestones

- July 2002 – Board authorization and funding
- August 2002 – Prepare specifications for competitive bid advertisement
- November 2002 – Award contract
- December 2002 – Complete Upgrade and Certification, 15/10-Ton Bridge Crane
- January 2003 – Complete Upgrade and Certification, 30/5-Ton Bridge Crane

Fabrication Shop Welding Manipulator Foundation ($175,000)

The Fabrication Shop performs pipe fabrication, welding, and associated services for Metropolitan, member agencies, and DWR. It is a relatively small shop in comparison with the material and components that are processed through it, and employees have indicated that workspace within the shop is at a premium, particularly when there is a major pipe fabrication effort or a large refurbishment project.

In 2001, the Fabrication Shop purchased a new sub-arc welding machine consisting of a Koike Aronson welding manipulator, a Lincoln Electric welding equipment package, and a variety of support/rotating equipment, including motorized turning rolls. The machine was purchased to allow the Fabrication Shop to quickly and efficiently fabricate high-quality replacement pipe sections for emergency repairs within Metropolitan's systems and those of our member agencies. In addition, the manipulator and the supporting/rotating equipment are used extensively in the repair of large diameter valves and associated fittings. When completely assembled, the welder and manipulator occupy approximately $1/7^{th}$ of the entire Fabrication Shop floor space.

The welding manipulator portion is used to position the sub-arc welding head at various heights and locations for efficient and continuous high-quality welds. The manipulator consists of a vertical member, called a "mast," and a horizontal member, called a "boom." The mast is installed on a large, moveable base and the boom protrudes out from the mast. The boom reach is 1.5 to 15.5 feet, and the boom can be raised or lowered along the mast from 3 to 17 feet. When the machine is operating, an operator monitors the welding process and makes minor adjustments to the welding head and the welding parameters as necessary to ensure a complete, proper weld.

After the welding machine was installed in the Fabrication Shop, staff found that because both the machine and the parts are very large, the machine operator and the inspectors were required to use high ladders or elevated work platforms to perform their work. Actual work heights ranged up to 12 feet. All appropriate safety precautions were taken, but requiring the employees to work on ladders or platforms resulted in less productivity, more worker fatigue, and longer project schedules.

This project will lower a 60-foot by 40-foot section of the Fabrication Shop floor approximately 6 feet and then line the lowered portion with reinforced concrete to provide a secure, stable foundation for the welding manipulator and the track it moves on. The perimeter of the pit area will be framed with structural steel to support deck plate that will cover the pit area when the equipment is not in use. After the project has been completed, the welding manipulator, along with an 84-inch positioning table and two large rotating tables, will be installed on the new foundation.

Installing the welding manipulator in the lowered area will reduce the average work height to six feet or lower, in most cases eliminating the need for ladders or elevated work platforms. After this project is completed, staff estimates that employees will be able to work directly from the shop floor on 90 percent of the projects involving the welding manipulator and from standard work platforms (3-4 feet, rather than 10-12 feet) for the remaining 10 percent of the work. Moving the additional equipment into the new area will relieve some of the workspace

congestion currently experienced in the shop and improve workflow efficiency by putting similar equipment into a single area. The addition of the deck plate will also provide additional work or storage space when the welding manipulator is not in use, also maximizing on the used of available workspace and improving workflow efficiency.

Actions and Milestones

- July 2002 – Board authorization and funding
- August 2002 – Prepare drawings and specifications
- September 2002 – Begin construction
- October 2002 – Complete construction
- October 2002 – Install and certify equipment

Coatings Shop Abrasive Blast Room ($580,000)

The Coatings Shop, formerly known as the Paint Shop, performs abrasive blasting, fiberglass lay-up, epoxy coating, painting, mortar lining and coating, and related procedures on pipe sections and pump components such as shafts, impellers, and housings. As with the other shops, the Coatings Shop is instrumental in most rehabilitation projects and is a critical part of the support services Metropolitan provides to DWR.

Abrasive blasting is the initial step in the coating process for virtually all components. In abrasive blasting, an abrasive material such as steel shot, garnet (sand), or glass beads is propelled at the exposed surfaces of an item through a nozzle using compressed air. The abrasive material, travelling at high velocities because of the pressurized stream of air, removes scale, rust, old coatings, and various contaminants from the item's surface, cleaning the surface and preparing it for the new coating.

The importance of having a clean, uncontaminated surface for coating has been found to be so critical that Metropolitan's corrosion experts require that the coating must be applied within two hours after abrasive blasting to ensure proper adhesion. Surfaces that have not been properly cleaned may prevent this adhesion, resulting in a coating that bubbles or flakes off. Once the coating has been compromised, moisture can come into contact with the unprotected item surface, eventually resulting in corrosion and increasing the likelihood of failure. In the case of components such as valve bodies, the failure mode may be inability to operate because internal components seize up. In the case of a pipeline or pump component, the failure can be much more catastrophic.

The Coatings Shop currently has one abrasive blast facility that can accommodate parts up to approximately 20 feet in length. This is sufficient for most of the components processed through the Coatings Shop, but several times per year, the Coatings Shop is required to process components such as adapter shafts that will not fit into the existing blast facility. These components are either subjected to abrasive blasting one end at a time or outside in the open air. Abrasive blasting one end at a time is inefficient, because of the additional time required to rotate the item. For blasting outside in the open air, temporary screens and protective covers are installed, but these do not provide the same level of protection as a closed door.

Concerns with conducting abrasive blasting outside have caused other Metropolitan facilities, where abrasive blasting used to be performed on-site, to send their components to the Coatings Shop for abrasive blasting. This has resulted in an increased workload and more use of the existing blast room facility.

This project involves constructing a large blast room facility inside the existing Building 32 at the La Verne facility. Building 32 is currently used for salvage and is located directly across a small breezeway from the existing blast room facility. The new facility will be designed and constructed by a vendor selected through competitive bidding and will be large enough to accommodate the largest components Metropolitan anticipates may require abrasive blasting. Preliminary estimates are that the new blast facility should accommodate components up to 40 feet in length.

Outsourcing abrasive blasting does not appear to be a viable option because of the difficulty in finding a vendor capable of processing items that have lead in the coating, which is the case with many of Metropolitan's and DWR's older components. This requires special blasting, containment, and disposal provisions, and most vendors do not have facilities that meet these special requirements.

The new blast room will consist of a completely enclosed structure that will be located inside the existing warehouse and will incorporate provisions that address the special requirements necessary for abrasive blasting all types of components currently handled by the Coatings Shop. If portions of the La Verne facility must be moved to accommodate future expansions within the treatment plant, the blast room can be disassembled and moved also.

Actions and Milestones

- July 2002 – Board authorization and funding
- August 2002 – Prepare drawings and specifications
- October 2002 – Begin construction
- December 2002 – Complete construction
- January 2003 – Install and certify equipment

Financial Statement for La Verne Shop Equipment Upgrades Program

A breakdown of Appropriation No. 15395 for upgrades to the La Verne shop equipment is as follows:

	Board Action No. 1 (July 2002)
Labor and Additives	$ 346,500
Materials and Supplies	1,493,700
Incidental Expenses	12,300
Professional/Technical Services	564,900
Administrative Charges	185,400
Equipment Use	40,500
Contracts	389,000
Remaining Budget	467,700
Total	**$ 3,500,000**

FUNDING REQUEST

Program Name:	La Verne Facility Shop Equipment Upgrades Program		
Source of Funds:	Construction Funds (possibly General Obligation, Revenue Bonds, Pay-As-You-Go)		
Appropriation No.:	15395	**Board Action No.:**	1
Requested Amount:	$ 3,500,000	**Capital Program No.:**	15395
Total Appropriated Amount:	$ 3,500,000	**Capital Program Page No.:**	E-45
Total Program Estimate:	$ 3,500,000	**Project Goal:**	E – Cost Efficiency/Productivity

Introduction

This attachment provides additional information on the following:

- **Machine Evaluation Criteria**: These are the criteria staff used to evaluate the machines and determine which machines should be refurbished, replaced, or left as-is and what led staff to recommend that two additional machines be purchased;
- **Lathes and Mills**: A discussion of the Machine Shop's lathes and mills, including why the Machine Shop has several different machines of each type and why these different machines are necessary for the Machine Shop to provide its services;
- **Hydraulic Press Brake**: This is a large machine used for form sheet metal for cabinets, coverings, and other protective enclosures.

Machine Evaluation Criteria

Staff evaluated each machine using a set of criteria established by the evaluation team members and then provided a recommendation for each machine as to whether it was in acceptable condition or should be refurbished or replaced. The evaluation criteria included age of the machine, current condition, usage, and overall function, and the decision as to whether a machine should be replaced was based primarily on estimated repair vs. replacement cost. Table I in Attachment 1 summarizes these recommendations.

In addition to the basic evaluation criteria, staff also considered the following:

Replace vs. Refurbish, New vs. Used: When evaluating whether a machine should be refurbished or replaced, staff considered the capability of the machine, its current condition, availability of comparable machines, and cost.

If staff recommended that a machine be replaced, they next evaluated purchasing a new machine vs. purchasing a used one. This decision was based primarily on cost and availability.

Manual vs. CNC: In evaluating replacement machines, staff also considered whether the replacement machine should be manually controlled or computer numerically controlled (CNC). For reference purposes, "manually controlled" means that a machinist is required to manually adjust the various parameters necessary for the machine to perform the required operation (machine speed, depth of cut, etc.). CNC machines are pre-programmed to perform the various operations, so that once the machine has been programmed the operator is required to install and remove parts and monitor the machine. In general, manual machines work best in applications where only one item (or a small number of items) must be machined. In a shop like Metropolitan's, where the focus is on maintenance, rather than production, most jobs involve only one or two items, and manual machines work well. CNC machines are better for production-type work, where multiple identical parts (such as threaded studs or nuts) are to be machined or where extremely close tolerances are required (typical for bushings). Metropolitan does some of this type of work, but not an excessive amount.

Most of Metropolitan's machines are manually controlled, which is suitable for the type of work performed in the Machine Shop (maintenance support, with small quantities). Most machines currently manufactured, however, particularly small to medium-size machines, are CNC, making CNC machines more readily available and in some cases less expensive than an equivalent manual machine. CNC machines were recommended for applications that would fit Metropolitan's needs.

Lathes:

The Machine Shop has 13 lathes that vary in size, type, and control method. There are three sizes (small, medium, and large), two types (horizontal and vertical), and two control methods (manual and CNC). This information is important, because it explains why even though the Machine Shop has 13 machines identified as "lathes," there is very little redundancy in use and function.

The following table summarizes the Machine Shop's lathes according to the criteria listed above. The information in the first column is the lathe size and the manufacturer.

Lathe	Size	Type	Control	Mfr. Date	Comments/Recommendations
10" Cincinnati	Small	Horizontal	Manual	1962	Replace with new
15" Le Blond	Small	Horizontal	Manual	1964	Replace with new
14" Clausing	Small	Horizontal	Manual	1980	Salvage
10" Okuma	Small	Horizontal	CNC	1985	No activity required
10" Bridgeport	Small	Horizontal	CNC	1997	No activity required
30" Kuraki	Medium	Horizontal	Manual	1980	No activity required
24" Le Blond	Medium	Horizontal	Manual	1970	This is a long-bed, hollow spindle lathe that is ideal for work on long, threaded shafts (such as valve shafts). None of the other lathes are capable of handling this type of work. Replace with new, same type.
48" Le Blond	Large	Horizontal	Manual	1972	This lathe has recently been completely refurbished under the O&M budget and requires no further work
120" Niles	Large	Horizontal (modular)	Manual	1988	Replace with new
72" Bullard	Large	Vertical	CNC	1978	Refurbish
120" Froriep	Large	Vertical	Manual	1957	Refurbish
276" OM Ltd.	Large	Vertical	Manual	1968	Refurbish
60" G&L	Large	Vertical (turret)	Manual	1956	No activity required

In terms of basic function, lathes operate on the principle of the part being rotated against the edge of a stationary cutting tool. Lathes are ideal for machining cylindrical object such as shafts, sleeves, and bolts and for operations such as threading and boring. Typical components that are machined in Metropolitan's lathes are valve shafts, large fasteners for the CRA pumps, and the interconnecting shafts used at the CRA pumping plants. The "lathe size" number (10-inch, 15-inch, etc.) generally refers to the largest diameter of a component that can be installed in the machine.

Small Lathes:

Approximately 60-80 percent of the work performed on the small lathes comes from within Metropolitan. The Machine Shop currently has five small lathes, although one manual lathe will be salvaged once the other lathes have been upgraded, leaving the shop with four small lathes. The key differences among the remaining four lathes are control method and capacity. Two of the lathes are CNC and are used for jobs where there are multiple identical parts (such as studs or nuts) or parts that require extremely close tolerances (such as bushings). The two small CNC lathes perform are essentially equivalent, and neither one is involved in this proposal.

The two manual lathes that will remain in the shop differ primarily in capacity, with one (the 15-inch Le Blond) being able to accommodate parts that are larger and heavier than the other manual lathe. Manual lathes are critical for machining tasks involving a small quantity of parts, since manual machining is generally faster than CNC machining because CNC requires additional time for setup and programming. Having two sizes (a 10-inch and a 15-inch) accommodates most of the work required at the Machine Shop, although the larger manual lathe

tends to be used more than the smaller manual lathe because of the size of most of the components in Metropolitan's system.

A review of past work and anticipated workload, including the sizes and quantities of parts, has led staff to recommend that one additional small-to-medium lathe (20-inch) be purchased and that the new lathe be CNC. The new lathe will relieve some of the work on the 15-inch lathe as well as some of the work on the medium-size manual lathe (the 30-inch Kuraki), since this lathe is used extensively and has no real backup.

Medium Lathes:

Metropolitan currently has only two medium-size lathes, and both are specialized. The 30-inch Kuraki is a manual lathe that is used extensively on a variety of projects, including studs, nuts, and bushings for the CRA pumps. These components are replaced each time a pump is refurbished, and a spare set of each is generally fabricated at the same time as the set that will be used in the pump. The other medium-size lathe (the 24-inch Le Blond) is also specialized in that it has a hollow spindle (where the part to be machined is held) and a long bed, making it ideal for valve components (such as long valve shafts) that are machined each time a valve is refurbished. The hollow spindle allows longer shafts to be machined, since a large portion of the shaft can be taken up by the spindle.

Large Lathes:

The Machine Shop has six large lathes: Two horizontals and four verticals. The horizontal lathes are large versions of the other horizontal lathes and are used primarily for large shafts (Metropolitan's and DWR's). Shafts generally need machining during refurbishments, particularly the shorter ("stub") shafts that are used in all of Metropolitan's pumps. Some shafts are approximately 20 feet long and 2 feet in diameter, and a large portion of these shafts must be very smooth in order to provide a good bearing surface for the main pump bearing that is installed around it. These stub shafts are generally machined in the 48-inch Le Blond. Larger shafts are generally outsourced at a cost of approximately $40,000 per shaft.

The other large horizontal lathe (the Niles modular), was purchased primarily to support DWR's shaft work. DWR's shafts are too large and too heavy for the 48-inch lathe, and the Niles was purchased in the mid-1990s primarily to do these shafts (although the machine was also intended to be used for some of Metropolitan's shafts and for other large components such as rotors and venturi meters). Unfortunately, the machine was found to be inadequate to meet any of these needs and has consequently not been used very often. The specific problems with the Niles are that it is a modular lathe, meaning that each of the key machine components is a separate piece, making it extremely difficult to align, and that it was designed to machine shorter, lighter components such as pieces of pipe or rings. The design and capacity of the Niles lathe make it extremely difficult to use and very time-consuming to set up.

Although the Niles lathe has not performed as intended, staff considers that there is a need for a large lathe and recommends that the Niles be salvaged and replaced with a large lathe that is more suited to Metropolitan's type of work. A large horizontal lathe that can handle parts that are too large for the 48-inch horizontal lathe would support DWR's needs as well as providing a backup for the 48-inch lathe, which currently has no backup. The backup function is important because Metropolitan often has two large shafts in-house at the same time that need to be machined. Currently, the shafts must be machined one after the other, and this creates a potential for conflicts and delays, particularly if both shafts are of the same relative priority.

The vertical lathes (the "vertical" refers to the fact that the spindle or rotating element is in the vertical position) include two of the machines used most often in the shop. The primary differences among the four large vertical lathes used in the shop are size and capacity. The two largest verticals are used for the large, heavy pump components such as impellers, housings, and covers. One of the large lathes can handle parts up to almost 10 feet in diameter and up to 10 feet high that weigh up to 34,000 pounds; the other large lathe is used for the larger components (up to 120,000 pounds).

The two remaining large vertical lathes are used for some of the smaller pump components such as wear rings and bearing sleeves. These two lathes also differ in size, with one able to handle roughly twice the weight capacity of the other and parts that are larger in diameter.

Mills:

The Machine Shop currently has seven mills as summarized below:

Mill Mfr.	Size	Type	Control	Capacity	Mfr. Year	Comments
Atrump	Small	Vertical	Manual	1,000 pounds	1998	No refurbishment required.
Chevalier	Small	Vertical	CNC	500 pounds	1992	No action required at this time.
Cincinnati Toolmaster	Small	Vertical	Manual	750 pounds	1962	No refurbishment required.
K&T	Medium	Vertical	Manual	3,000 pounds	1960	Staff recommends replacing with a new CNC.
Cincinnati Versimill	Medium	Vertical	Manual	8,000 pounds	1955	To be salvaged (will be replaced by new 4" horizontal).
5" G&L	Large	Horizontal	Manual	88,000 pounds	1963	Recently refurbished. No additional work required.
6" Carlton	Large	Horizontal	Manual	250,000 pounds	1958	High capacity, but made for lighter-duty work.

As with the lathes, each of the mills serves a different purpose in the Machine Shop, so there is little redundancy in use and function.

In terms of basic function, mills operate on the principle of the cutting tools being rotated against the part, which is stationary (unlike lathes, where the part is rotated and the cutting tool is stationary). Mills are used to remove material from flat and irregular shaped surfaces and for gear and thread cutting, drilling, boring, reaming, and slotting operations. Typical components machined in mills at Metropolitan include nuts, bolts, and the tooling used in several of the other machines.

Small Mills:

Most of the work performed on the Machine Shop's small mills comes from within Metropolitan. Metropolitan currently has three small mills, each of which is used to handle different types of parts. Of these, one is CNC and two are manual. The CNC mill handles very small parts and requires no activity as a part of this project. One of the manual mills is also in acceptable condition. The remaining manual mill is the largest of the three small mills and is used extensively to machine the flat surfaces on the nuts and bolts used for both the CRA plants and DWR's facilities. It is also used extensively to machine tooling for the other machines.

Staff has reviewed past work as well as the anticipated workload, including the sizes and quantities of parts, and has determined that the existing K&T mill should be replaced and that the new mill should be CNC. This will improve the Machine Shop's ability to perform milling operations on small-to-medium parts and will improve efficiency and productivity, since Metropolitan currently does not have a small CNC mill and has addressed the need in the past by using a larger mill, which is difficult to use for small parts.

Medium Mills:

Metropolitan currently has two medium-size mills, and both are manual. Staff has determined that one of these mills can be salvaged if a new horizontal milling machine is purchased as recommended in this document. The new smaller CNC mill will be capable of handling much of the work currently performed on the medium-size mill.

Large Mills:

The Machine Shop has two large milling machines. The smaller of the two, manufactured by G&L, is probably the most-used machine in the shop, with average annual usage of approximately 1,500 hours per year (prior to 2000–the machine was out-of-service for several months in 2000 while it was being refurbished). The machine is very versatile and is used extensively on all of the key projects performed in the shop for the CRA pumping plants

and DWR. The larger machine, manufactured by Carlton, was designed for light-duty work and is generally not particularly well suited to the Machine Shop's needs because of its size, the fact that the machining table is several feet above ground level, and the rigidity of the main column. Staff recommends a minor refurbishment of the Carlton milling machine to improve its performance, make it more suitable for the type of work done by the Machine Shop, and extend its life at least an additional five years, at which time the machine will be re-evaluated.

Hydraulic Press Brake:

The hydraulic press brake is a large machine currently located in the Machine Shop's sheet metal area that is used to form sheet metal. It consists of a 200-ton press and associated hydraulics that can bend, cut, or otherwise form materials up to 1-inch thick and 18 feet long. The press brake has been used extensively on several recent projects, including electrical cabinets for Diamond Valley Lake, louvered panel doors for Lake Skinner, meter panels for several different facilities, and flow meter cabinets. The existing press brake is at least 20 years old and was purchased used from government surplus.

Staff's evaluation of the press brake concluded that the press brake is an essential piece of equipment but that it has the following problems:

- Most of its systems and components, including the hydraulic system and the plate used to actually form the material, are in serious disrepair;
- The electrical system is also deteriorating;
- The capacity is slightly smaller than necessary for some of the required work.

Estimates to repair just the press brake's hydraulics and plate range between $80,000 and $90,000, which is near the estimated cost to replace the entire machine with a slightly used press brake that has a higher capacity (250 tons). Purchasing a 250-ton press will allow the Machine Shop to salvage the existing machine and also to salvage a much larger machine (500-ton capacity) currently located in the Fabrication Shop. The 500-ton press was found to be much too large for most of the sheet metal work required in the Machine Shop and tended to damage the material, rather than form it to the proper shape.