REBUTTAL TESTIMONY

of

PAUL GADOURY

before the

PUBLIC UTILITIES COMMISSION

for

PROVIDENCE WATER

DOCKET #3832

August, 2007

PROVIDENCE WATER SUPPLY BOARD
REBUTTAL TESTIMONY OF
PAUL GADOURY

Q. Please state your full name and title?

A. Paul Gadoury, Director of Engineering for the Providence Water Supply Board (Providence Water).

Q. Are you the same Paul Gadoury who submitted pre-filed direct testimony in these proceedings?

A. Yes I am.

Q. What is the purpose of your testimony?

A. To respond to some of the issues raised in the letter report dated July 17, 2007 prepared for the Division by its consulting firm, Woodard & Curran, relative to their review of our planned filter upgrade project at our treatment plant.

Q. What issues will you address in this rebuttal testimony?

A. My testimony will specifically address Woodard & Curran's (W&C) comments relative to the filter effluent piping improvements associated with the filter upgrade project.

Q. Have you reviewed Woodard & Curran's report relative to this.

A. Yes I have. Woodard & Curran concurs with the need for upgrading the plant's existing filters. W&C also concurs with the need to demolish the existing underground filter box roof slabs and construct new building enclosures above the filters to expose the what are now primarily hidden filter surfaces to enable access and visual performance monitoring and inspection. W&C also concurs

with the need for upgrading the washwater and effluent piping associated with the filters but feels that this piping work may be severable from the filter upgrade work and, in light of what W&C considers its potential for producing cost overruns, that it might be included within the bid documents as an optional item. W&C also states that they believe that a smaller diameter replacement washwater header pipe along with the installation of new low head high volume pumping equipment might represent a less costly option than replacing the existing 48" diameter washwater pipe.

Q. Do you agree with W&C's opinion that the filter piping improvements are severable from the filter upgrade work and that the piping improvements should be considered as an optional item?

A. No. Concerning the concept of severability, there are no doubt several items in most construction projects that could be made severable or optional if desired. The issue is whether doing this is beneficial or detrimental to the project as a whole. In my opinion, foregoing or delaying the piping improvements is impractical, will result in higher overall costs in the end, and will result in significantly more plant disruption and risk. the project.

Q. Please explain.

A. First of all, it is not be possible to make all of the piping work severable. Virtually all of the washwater

valves on each filter leak and do not provide a positive shutdown. At a minimum, all of these need to be replaced before any work within the filter structures can be done. These valves are located within the congested pipe gallery and on the side of the existing 48" washwater pipe to which access is extremely difficult. As it stands, personnel need to duck down within the 3' vertical clearance opening underneath the pipe to get to this other side. Maneuvering and installing thirty six(36) 24" valves and actuating equipment within this area would be problematical, time consuming, and potentially dangerous. Installing these valves while not replacing the connected piping would amount to new valve installations to old lead-joint cast iron piping, potentially disturbing these sensitive joints and causing leakage problems. Deferring the pipe replacement work to a later date would also then require these new valve installations to be dismantled and once again reinstalled. Replacing all of the washwater piping at this time is clearly the proper approach.

Relocating the washwater pipe at this time is also clearly warranted. Removal of this pipe as a major obstruction within the pipe gallery greatly facilitates and simplifies the planned work under this project and provides safer conditions both for workers engaged in the project work and for plant staff in the future.

We also do not agree with the idea of possibly putting off the piping work only to do it later under a separate

contract. We have no doubts that this will result in an overall higher cost for all of the work performed when all is said and done. With the easier physical access and economies of scale afforded, as well as the opportunities provided for doing this work while select filters are alternatively out of service for periods of time over the next four year period, it only makes sense to do this work concurrent with the filter upgrade work.

Q. Are you in agreement with W&C's opinion that a less costly option to the 48" washwater pipe might exist by utilizing high volume pumps to deliver the washwater through a smaller diameter header pipe?

A. I do not believe that this would be a wise course of action for our plant. First of all, a tank-fed washwater system in which washwater pumps pump water to our 400,000 gallon washwater tank currently exists at our plant. The two washwater pumps have just recently been replaced and the washwater tank has recently been inspected and found to be in good condition with only some minor improvements needed which we have since completed. The system has operated fine for decades and offers greater operational simplicity and less operational cost than a direct pumping system would.

We are also not sure if W&C has fully considered the magnitude of pumping capacity that would be required for such a system. Plans for the new filter upgrades envision backwash rates as high as 25 gallons per minute

per square foot of filter area. Considering the size of our filters, this would require pumps that could pump at a rate of 44,000 gpm or 63 million gallons per day (63 mgd). This high rate also limits the downsizing in pipe header size that could be achieved. We clearly see the existing tank-fed gravity system as the proper way to continue.

Q. W&C has expressed some concerns over the possible unpredictability of some of the costs associated with the project, particularly those that might be related to the piping improvements. What is your response to this?

A. While we appreciate W&C's concerns on this, it needs to be kept in mind that our design consultants have been working on this project for over a year and have also been engaged in numerous other design projects for our treatment plant over the years. They are thoroughly familiar with the treatment plant and with the filter project under design to a level of detail certainly not possible through a relatively brief review. They have utilized this knowledge and understanding to develop cost estimates for the project on which we rely.

Q. Has the design consultant for this project also been given the opportunity to review and respond to W&C's report?

A. Yes. Maguire Group has reviewed the report and has prepared responses related to the above and to other points raised in the report. Maguire has prepared their

response to the report comments and these are included as an Exhibit and incorporated by reference into my testimony.

Q. Do you concur with points made in Maguire's response?

A. Yes. Based on my 30 years experience as a Registered Professional Engineer and 33 with Providence Water, I fully concur with their assessment. It is my opinion that the current approach and course that we are pursuing with this project is correct and proper.

Q. Does this conclude your testimony?

A. Yes.

Maguire Group Inc.
Architects / Engineers / Planners

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August 16, 2007

Providence Water Supply Board
552 Academy Avenue
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Attention: Paul J. Gadoury, P.E.
Director of Engineering

Reference: RI Division of Public Utilities and Carriers
Woodard & Curran letter correspondence, dated July 17, 2007
PW Filtration System Rehabilitation and Improvements Project

Dear Mr. Gadoury,

Maguire Group Inc. is in receipt of Woodard & Curran's July 17, 2007 letter correspondence to the RI Division of Public Utilities and Carriers (PUC) regarding the firm's independent review of ongoing infrastructure improvement works at the Philip J. Holton Water Purification Plant in Scituate, Rhode Island. In this correspondence Woodard & Curran expressed formal comment regarding many of the ongoing design activities associated with rehabilitating and modernizing the plant's filtration facilities. Woodard & Curran recognizes the need to modernize and upgrade the plant's filtration systems. However, the letter also expresses concern regarding certain aspects of the improvements program. We respectfully disagree with these comments and believe Woodard & Curran's limited access to design strategy and details may be the cause of these concerns. As such, the purpose of our letter is to clarify certain misunderstandings or incorrect assumptions made in the Woodard & Curran letter while expressing a professional opinion on the scope of the referenced project.

Based on a limited review of the referenced project and its available draft design details, Woodard & Curran recognizes the need for the proposed filtration system improvements in order to ensure compliance with evolving drinking water regulations and to address concerns associated with the aging infrastructure and filtration facilities at the treatment plant. Once complete, the proposed filtration system rehabilitation improvements will result in improved drinking water quality and position Providence Water to meet current and future drinking water standards and levels of treatment.

Maguire's 2006 Design Concept Report recommended program renovations including:

- Filter Rehabilitation Improvements –Filters
- Filter Piping Gallery Rehabilitation Improvements
- Filter Roofing System Improvements – Central Filter Gallery – Roofs and Architecture
- Supplemental Program Improvements (electrical, instrumentation and control systems)

As stated in its July 17, 2007 letter, Woodard & Curran is supportive of the recommended program improvements, but expressed concern with the outlined scope-of-work within the lower Filter Piping Gallery (that is, the extent of process piping work within the gallery area). Maguire respectfully disagrees with many of Woodard & Curran's conclusions concerning this matter and believes the primary reason for its conclusions are a result of not having an "in-depth" understanding/knowledge of related program issues, design details, and other related complexities associated with completing renovation works within the aging pipe gallery. This is a function of the conceptual nature of the design review by Woodard & Curran and additional details Woodard & Curran may not have been aware of at the time of its review. Of significance is the paramount need to keep the 144-million-gallon-per-day (mgd) water purification plant in service at all times during the multi-year construction program. As such, it is critical that all proposed process piping and valve replacement works be well planned, designed and detailed in order to minimize and manage known potential risks during construction.

Project Understanding/Clarification

As part of the rehabilitation efforts to modernize, update and improve the filtration system at the treatment plant, it is necessary to perform work on various process piping systems associated with the filters. For the most part, the vast majority of process piping systems that service the plant's eighteen (18) filter units are located in the lower Filter Piping Gallery area. Having been installed when the filters were constructed, much of the process piping system is composed of materials used at the time (i.e., a combination of cast-iron pipe with open lead/oakum pipe joints and riveted steel). Over the years, Providence Water has experienced significant problems with the system's leaded pipe joints as routine pipe or valve maintenance was performed. This type of piping system has no deflection tolerance and is highly subject to leakage if there is any joint movement or pipe settlement.

The overall objective of Providence Water's stated rehabilitation efforts within the lower Filter Piping Gallery area is to replace aging filter piping systems, replace defective process control equipment, replace leaky wash water valves, and improve overall functional layout of the associated process systems within the congested pipe gallery. As evidenced throughout the gallery, the current pipe layout does not permit easy access by maintenance or operations personnel to critical piping and associated process control valves [i.e., (36) 24-inch backwash supply BFVs, (36) 12-inch filtered

water valves, and (36) 6-inch filter drain valves]. The existing 48-inch backwash header pipe, which runs the length of the pipe gallery, essentially bisects the gallery and prohibits free movement throughout the area.

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Issues and Concerns

During the preparation of the project's Design Concept Report, Maguire conducted multiple inspections of the pipe gallery to better assess its current condition and determine what impacts filter rehabilitation work might have on existing infrastructure, plant operations, and related process systems. Working closely with Providence Water staff, we identified several significant issues and concerns within the piping gallery, including:

- ***Poor Access/Maintenance Obstructions*** – The location of the 48-inch backwash header currently obstructs and restricts access to the filtration system's effluent flowmeters, valves and process piping systems. Currently, in order for maintenance or operations staff to gain access to the majority of these critical process systems they must pass below the backwash header (where this is a ~36-inch clearance below the header pipe) or climb over the header pipe using a portable ladder. Both practices are considered unsafe and inappropriate for plant personnel.
- ***Leaded Pipe Joints*** – With the exception of the 48-inch backwash header, the vast majority of process pipe joints are problematic in that lead/oakum joints are used exclusively to join all process piping systems. Over the years routine maintenance and valve replacements have resulted in weakening of these leaded joints, which have resulted in the development of numerous system leaks. The weakened pipe joints and the difficulty to properly repair them has been identified as an area of great concern, as the risk of potential piping system failure and leakage is significant. Similarly, it is difficult to replace process valves, flow meters, and pipe fittings without use of extensive and expensive pipe supports and specialty fittings to support the weaker open lead/oakum joints. Because of these concerns it is recommended that the leaded pipe joints be eliminated in order to better manage and control risks during the multi-year construction project.
- ***Replacement of Leaky Filter Valves*** – Each of the eighteen (18) filters is equipped with eight (8) primary process control valves, ranging in size from 6 to 42 inches. These valves, many of which are over 40 years old, are located behind the 48-inch backwash supply header in the piping gallery, thereby making access to the valve assemblies extremely difficult. Due to their age and maintenance requirements, the majority of these valves need to be replaced. In the case of the wash water valves, the valves are known to leak and need to be replaced prior to commencing any work on the filters. Replacing the multitude of larger-diameter process valves as required on this assignment and working with an aging, open-leaded joint type piping system combined with the major

obstruction presented by the existing 48-inch wash water header is impractical and would impose elevated risk during the multi-year construction project.

- ***Lack of Filter-to-Waste Piping Systems*** – When the filtration systems were originally designed and constructed, no provisions were made to afford the installation of a filter-to-waste piping system. As acknowledged by both Providence Water and Woodard & Curran, under current water treatment system design practice and standards, provisions are often provided to prevent discharge into the Clearwell of the initial high-turbidity water which may occur at the start of a filter run. As such, in order to better assure compliance with existing drinking water regulations and be consistent with current design practice, it is necessary to install an appropriately designed filter-to-waste piping system within the lower Filter Piping Gallery. Through use of modern process instrumentation, the initial filtered water flow will be temporarily routed to drain until time or turbidity measurements dictate that flow can be directed to the Clearwell, thus satisfying water quality concerns.

  (NOTE: Supplemental field work and investigations performed since publishing the project's Design Concept Report have identified hydraulic concerns within the existing 24-inch drain line within the lower Filter Piping Gallery. Because of this concern, the filter-to-waste piping system is being designed to discharge to the north of the gallery and into the common drain conduit below the Central Filter Gallery.)

Previous evaluations and studies (performed by Providence Water) recognized the need to replace the wash water valves, filter effluent valves, effluent venturi meters, drain valves, and associated piping and appurtenances as the treatment plant filters were upgraded and modernized. At the time, it was recognized that the critical need was to eliminate and/or prevent future joint leaks, which are a documented chronic concern with the existing older cast-iron leaded-joint piping systems. In making these recommendations, it was generally assumed that all piping and valve modifications would have to be constructed around the large-diameter backwash header bisecting the gallery. Previous studies recognized the need to replace all associated smaller-diameter process piping and valves; however these studies failed to fully identify the elevated costs for completing needed construction activities around the 48-inch diameter backwash header or the associated adverse impacts to operations and maintenance personnel during the multi-year construction program. Similarly, it was envisioned that all associated actuated process valves and the proposed filter-to-waste piping systems would be located in the congested areas behind/above the backwash header and routed to the end of the gallery for discharge into the treatment plant drain system.

Concerns Summary

While completing initial facility assessments and subsequent evaluations of the originally envisioned piping replacement concepts, it became immediately apparent that the construction by this approach would require numerous shutdowns of the plant's aging infrastructure in order to construct necessary piping system improvements. Due to the age of the existing piping systems, sensitivity of the leaded pipe joints within the system, and frequencies to the disruption to the plant's filtration system, *the risks associated with this construction approach are significant.* In addition to subjecting Providence Water to prolonged periods of elevated risk during the multi-year construction period, this rehabilitation approach would result in elevated construction costs and high-risk construction practices. Furthermore, this approach fails to improve access within the lower piping gallery. In addition to these concerns, there is also the inherent risk associated with not replacing one of the oldest piping systems at the treatment plant.

Filter Piping Gallery Rehabilitation Improvements

Recognizing many of the above-noted concerns, efforts were taken to evaluate alternative solutions which would help minimize and best-manage potential risks and costs during construction. While exploring alternatives, emphasis was placed on maximizing the associated long-term program benefits to Providence Water, as the overall objectives of this infrastructure improvement program are to modernize and improve operations at the purification plant.

In order to address many of these concerns, it is readily apparent that retaining the 48-inch-diameter backwash header within the lower Filter Piping Gallery is not desirable. Nor is it a practical option to leave the large-diameter backwash pipe in its current location, as suggested in Woodard & Curran's peer review response letter. Due to construction challenges, congested work area, costs, risks and limited long-term improvement limitations it is most appropriate to relocate the system's backwash header outside the piping gallery and above the adjacent Clearwell structure. The immediate and long-term program benefits associated with locating the large-diameter pipe header above the Clearwell are considered significant and warranted.

This recommended approach provides many process and program benefits which may not have been evident at the time of the independent document review. Associated program enhancements, which are otherwise not achievable by leaving the 48-inch backwash header in its current location, include such benefits as:

- Simplified construction techniques and methods to complete necessary process improvements and system alterations (interface with aging, on-line piping and process valve systems).
- The opportunity to reduce and better manage risks during multi-year construction period.

- Less disruption to plant personnel and risks to facility operations during multi-year construction period (reduced number of temporary facility shut-downs, and enhanced access to existing on-line process equipment and instruments).
- Ease of construction above on-line Clearwell (no significant structural modifications or operational concerns to the existing Clearwell, as proposed pipework will span above the existing concrete arched structure).
- Improved completed Pipe Gallery layout (long-term benefit to Providence Water, reduces area congestion, improves access, fully modernizes lower Piping Gallery, addresses current access concerns/code limitations and safety hazards).

Similar to Woodard & Curran's suggestion to investigate the possibility to modify the size of the large-diameter backwash line, Maguire already completed various hydraulic analyses of the backwash system hydraulics while developing preliminary design concepts. The primary purpose for these hydraulic investigations was to explore the practicality and feasibility to downsize the backwash header (i.e., gravity backwash service line) in conjunction with its replacement/relocation.

Completed hydraulic analyses confirm that a reduction in the backwash header pipe size will result in a reduction of available backwash flow. As this is a gravity-supplied system (not requiring direct backwash pumping and controls), a reduction in pipe size reduces available backwash capacity. As the recommended rehabilitation plan for the filter boxes includes an increase in effective media depth and possibly the option for GAC media use, the filtration system's effective backwash rate will contrarily likely increase. Because of this increase and so as to avoid introduction of a complex mechanical direct pumping system, it is recommended that the backwash header not be reduced. It is recommended that the modified piping systems continue to use a 48-inch-diameter supply header to maximize process flexibility of the backwash system. As such, we respectfully disagree with Woodard & Curran's preliminary suggestion that installation of a high-volume direct backwash pumping and control system would be less costly and more beneficial for Providence Water than the continued use of the existing tank fed gravity system.

As referenced above, it is recommended that the filtration system's process piping systems modifications within the Lower Piping Gallery include the relocation of the system's backwash supply header outside the gallery. This system improvement is preferred, as it decreases risk during construction, simplifies construction techniques and methods, improves gallery access while decreasing area congestion, provides a safer working environment for personnel, and decreases the impact on plant operations during the multi-year filtration system construction project.

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Summary of Reasoning		
Issue	**W&C Comment**	**Maguire Response**
Lower Filter Piping Gallery (W&C term: filter effluent piping gallery)	- Replacement of backwash header should be considered optional	Replacing the pipe is integral to construction process - economic benefits - lower risk - simplified construction - immediate/long-term gallery improvements - sensitive to multi-year operation needs - more expensive and disruptive to do later
Backwash Header Size	- Use smaller pipe size - Believes less costly (but will require mechanical pumping and controls)	- With gravity system, cannot reduce pipe size - Installation of new direct pumping systems is more expensive and complex than current gravity feed system - Higher backwash rate will be required for future GAC - High-capacity pumping system more expensive long-term than gravity pipe replacement - Introduces direct mechanical pumping, impacts other existing pumps - Direct mechanical pumping has higher operational risk of failure
Moving Backwash Header above Clearwell Roof	- Believes costly structural modifications are required to the Clearwell roof (to support the backwash header)	- No complex structural work required to Clearwell - Requires only simple structural pipe supports

We trust this response helps clarify areas of concern identified by Woodard & Curran's independent peer review of the assignments draft design documents. Should you have any questions or comments regarding this matter, please do not hesitate to call. As appropriate, we can certainly attend an informational meeting or workshop to review and/or discuss any remaining areas of concern as they relate to this most important infrastructure improvements project.

Very truly yours,

MAGUIRE GROUP INC.

David C. Bowen, P.E.
Sr. Project Manager

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CC: R. Razza – Providence Water
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