

PARE PROJECT NO. 08192.00

WATER SUPPLY SYSTEM MANAGEMENT PLAN

5-YEAR UPDATE

FOR

PROVIDENCE WATER SUPPLY BOARD

EXECUTIVE SUMMARY

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Executive Summary

This Water Supply System Management Plan (WSSMP) has been prepared as required under Rhode Island General Laws 46-15.3, as amended and titled “The Water Supply System Management Planning Act” (Act). The legislative authority to effectuate the goals and polices of this Act has been conferred to the Rhode Island Water Resources Board (RIWRB). To this end, the RIWRB has promulgated the Rules and Regulations for Water Supply System Management Planning, October 2002, as amended to implement the provisions of this Act.

Under this legislation, Providence Water Supply Board (PWSB), as a water purveyor that produces, treats, transports and supplies over 50 million gallons per year, is responsible for the preparation and adoption of a WSSMP. It is also incumbent that PWSB update this WSSMP periodically as significant system modifications may warrant and every five years, or as otherwise stipulated in the Regulations.

This WSSMP has been prepared to provide the proper framework to promote the effective and efficient conservation, development, utilization and protection of the natural water resources of the State and specifically the Scituate Reservoir Complex, as utilized exclusively by PWSB. Furthermore, the overall goals shall be consistent with State Guide Plan Element 721, “Water Supply Policies for Rhode Island.” As such, this WSSMP outlines specific objectives of the water supply system management planning process for the PWSB system, and will also serve as a guide to aid in employing proper decision-making processes.

The WSSMP has been prepared in three separate documents, identified as the main WSSMP document, the Emergency Management Plan (EMP) Volumes I and II, and the Water Quality Protection Plan (WQPP). The EMP relates a vulnerability assessment of the water system to emergency management planning. The WQPP encompasses the water quality protection aspect for the surface water supply/reservoir complex. This entire submission comprises the WSSMP, as presented herein.



Background

The Rhode Island General Assembly that enacted Chapter 1278 of Public Laws of Rhode Island on April 25, 1915 established the original PWSB. The City of Providence in turn developed an increased and safe supply of water for the residents of the city. This consisted of the construction of a large reservoir and water treatment plant on the north branch of the Pawtuxet River in the Town of Scituate. From 1929 to 1941, operation of the Scituate Supply system fell under the Water Supply Division of the Providence Department of Public Works.

In 1941, the presently constituted Water Supply Board was established by authority of the Providence City Charter as amended under Chapter 832 of the Public Laws of Rhode Island. This current reservoir system, which today provides water to approximately 60% of the State's residents, consists of the main Scituate Reservoir supply and its five tributary reservoirs, all of which combine to make up the Scituate Reservoir Complex.

Scituate Reservoir was formed by the construction of a dam across the Pawtuxet River at the former village of Kent. The Gainer Dam, constructed principally of earth, is approximately 3,200 feet long and upwards of 109 feet in height. Water was initially stored in the reservoir on November 10, 1925. An aqueduct from Gainer Dam feeds the nearby treatment plant that was put into operation on September 30, 1926.

PWSB maintains a single water purification plant, the Philip J. Holton Water Purification Plant (PJHPP), to process 100% of the surface water supply used from the Scituate Reservoir Complex. Presently, the PJHPP has a maximum capacity of 144 million gallons per day (MGD) and continues to remain the largest of its type in New England.

Since the mid 1920's, PWSB has implemented various improvements to the water system infrastructure and continues to maintain and operate the existing treatment plant and reservoir complex. This has consisted of various infrastructure improvement projects related to all aspects of the system including source protection, supply, treatment, transmission and distribution, storage, consumer demand management and water quality monitoring. In 1996, PWSB



embarked on a progressive infrastructure improvement and capital improvement program. The PWSB has maintained this program with millions of dollars invested into existing infrastructure each year and over \$163.1 million proposed for existing infrastructure improvements over the next five fiscal years.

Water System Description

The PWSB supply and distribution system is classified by the RIDOH as a “Community” water supply system. As such, the system is required to conform to applicable rules and regulations mandated by the RIDOH as well as meet requirements of the federal Safe Drinking Water Act (SDWA). Currently, the system maintains full compliance with the stipulations of all applicable rules and regulations of both the RIDOH and the SDWA. As new SDWA regulations are implemented PWSB continues to remain at the forefront of optimizing process control and providing treatment technology to ensure the continuance of a safe, reliable and adequate source of potable water to the consumer base.

The existing PWSB system is developed primarily from the original water supply system infrastructure developed in the 1920’s. Improvements have been implemented over the years to maintain and upgrade the system and to keep pace with increasingly stringent water quality regulations. The water quality has consistently been rated as good to excellent and is continually monitored and tested to insure compliance and consumer confidence.

The Scituate Reservoir watershed contains 92.8 square miles of land, of which PWSB owns or controls approximately 27 square miles. Local governments and the Rhode Island Department of Environmental Management (RIDEM) also assist in source water protection through a combination of land ownership, ordinances and “open space” protection strategies. The reservoir complex consists of the Scituate Reservoir and five smaller reservoirs that are tributary to the main reservoir. The five tributary reservoirs are the Regulating, Barden, Moswansicut, Ponaganset and Westconnaug Reservoirs. The complex has a total storage capacity of 41.3 Billion Gallons (BG), a net storage capacity of 39.8 BG and a safe yield of 92 MGD, leaving a



net safe yield of 83 MGD after the allocation of 9 MGD for downstream release to the Pawtuxet River.

A conventional water purification plant is situated downstream of the Gainer Dam located on the Scituate Reservoir. Water is withdrawn from the Scituate Reservoir through a concrete structure and conveyed by gravity into the influent control chamber. If insufficient head exists in Scituate Reservoir to meet demand, a raw water booster pump station may be utilized. The treatment process consists of aeration coagulation-flocculation, lime addition for corrosion control and pH adjustment, sedimentation, rapid sand filtration, disinfection and fluoridation.

Water flows from the influent chamber to the aeration basin. The aeration system works under gravity pressure and sprays water into the air in a fountain style. This treatment step serves to remove volatile organics and other dissolved gases (CO₂, etc.). The aerated water travels from the influent control chamber into two venturi tubes that measure the influent flow and then to the tangential mixer. Quicklime is added in the basin influent tunnel and reacts with ferric sulfate to form ferric hydroxide floc. The floc is encouraged to form through the use of a tangential mixer. The mixer works under gravity feed and imparts a slow cyclical motion to the water. The cyclical motion aids in the destabilization of colloidal material and the formation of floc, commonly known as coagulation and flocculation.

The next step is the removal of the flocculated colloidal material through sedimentation. The resulting ferric sludge must be removed by draining and flushing the basins manually. Settled water travels from the open basins through a 10-foot wide, 11-foot high conduit to the sand filters. A second lime injection point is located in this conduit to raise the pH from 7.0 to 9.7. Chlorine is also added in this conduit for disinfection purposes. Following the coagulation, flocculation, and sedimentation stages water then goes to eighteen (18) filters that remove remaining non-settleable floc and impurities. The backwash water is supplied by gravity via a 400,000-gallon wash water tank and is discharged to waste lagoons. Water then goes to the clearwell where hydrofluosilicic acid and fluoride are added.



The transmission and distribution system consists of approximately 4 miles of concrete lined tunnel, 10 miles of concrete aqueduct, 102 miles of transmission piping (16 to 66 inches) and 835 miles of distribution piping (6 to 12 inches). Transmission and distribution piping materials primarily consist of cast iron, ductile iron, asbestos cement and polyvinyl chloride. New and replacement mains consist of ductile iron and polyvinyl chloride pipe.

The distribution system contains five water storage reservoirs that are utilized to optimize system efficiency by equalizing demands, improving and stabilizing water flows and pressures and providing fire reserve storage. These consist of the Aqueduct Reservoir, located in Cranston, with a storage capacity of 43.3 MG and overflow of 231 feet Mean High Water (MHW); the Neutaconkanut Reservoir, located in Johnston, with a storage capacity of 42.1 MG and overflow of 227 feet MHW; the Longview Reservoir, located in North Providence, with a storage capacity of 24.8 MG and overflow of 306 feet MHW; the Ridge Road Tank, located in Smithfield, with a storage capacity of 3.5 MG and an overflow of 398 feet MHW; and the Lawton Hill Reservoir, located in Cranston, with a storage capacity of 5.0 MG and an overflow of 485 feet MHW.

The retail service area of PWSB is divided into four major separate pressure zones termed low service, high service, extra high service, and Western Cranston service. There is also a separate high-pressure fire system within the downtown area of the City of Providence. The low service is the largest area comprising approximately 70% of the retail area. The high service area is the second largest comprising over 29% of the retail demand. The extra high service area consists of a small isolated area in the Fruit Hill section of North Providence with elevations ranging from 220 to 310 feet MHW. In 1977, PWSB acquired the Western Cranston Water System (a former wholesale customer) from the City of Cranston. This high service area serves the western retail portion of the City of Cranston and the Johnston Water Department wholesale interconnections.

PWSB also owns and operates ten (10) potable water pump stations in the distribution system and a raw water pump station in proximity to the treatment plant. These pump stations are located at various locations throughout the system and serve to supply isolated higher elevations in the service area or as primary supplies to maintain the water elevation in the high and extra high service pressure zones (i.e. supply storage reservoirs). The raw water pump station is



utilized to supplement pressure head to supply raw water to the treatment plant during periods of extreme low water level in the reservoir(s).

PWSB services approximately 60% of the residents of the State of Rhode Island either directly through the retail service area or through wholesale service to various water purveyors that in turn supply various communities. The current retail service area includes portions of North Providence, Cranston, Johnston and all of Providence. In addition, PWSB provides wholesale water to nine water utilities. These include the Bristol County Water Authority, East Providence Water Utilities Division, East Smithfield Water District, Greenville Water District, Johnston Water Department, Kent Count Water Authority, Lincoln Water Commission, Smithfield Water Supply Board, and Warwick Water Department. Through these wholesale interconnections the following additional communities are served: Lincoln, Smithfield, Coventry, East Greenwich, Scituate, Warwick, West Greenwich, West Warwick, East Smithfield, Bristol, Barrington and Warren.

The source and distribution system, including all wholesale interconnections, are 100% metered. Master meters are located at various locations throughout the purification plant, which are monitored and controlled by the new SCADA (supervisory control and data acquisition) system. Every service connection within the PWSB distribution system is metered at the point of sale, thus providing 100% distribution metering. Meters are read on either a monthly, quarterly or semiannual basis, depending on metering route, meter size, and water consumption. Wholesale meters are located at each point of interconnection with the nine wholesale customers. The wholesale customers are required to maintain the meters in good working condition and to calibrate them as required. In recent years, PWSB has instituted a program of meter replacement with a conversion from manual to an automated meter reading (AMR) system with the intent of recovering operating and capital costs of system operations and reducing the rate of non-account water. To date, approximately 99.7% of the meters have been upgraded to the AMR system, which also incorporates a radio read function.



Policy and Procedure

PWSB maintains both a wholesale and retail service sector. The retail service population is comprised of residential, industrial, and commercial customers serving approximately 296,000 customers through 72,938 service connections. Among the 72,938 retail customer service connections, PWSB supplies 282 major water users. Major water users are defined by the WSSMP regulations as those customers utilizing over 3.0 MG per year.

In fiscal year 2007, PWSB supplied an average 68.14 MGD of which 38.87 MGD (57.0%) was utilized by retail customers and 29.27 MGD (43%) was supplied to the nine wholesale customers. The per capita demand for the PWSB retail service area is estimated to be 112.8 gallons per capita per day. Utilizing retail consumption and population data the per capita demand can be more realistically estimated. The PWSB's retail consumption for 2007 was 7,499 MG and the retail service population was 296,000, which yields an estimated 69.4 gallons per capita per day. Since 1997, the system has had a maximum day peaking factor that varied from 1.54 to 1.88 with an average of 1.73. In 2007 the maximum day system demand was 113.5 MGD or a maximum day peaking factor of 1.67.

Non-account water, which consists of the difference between the volume of water metered at the point of supply and that recorded at all points of sale, has averaged 10.2% since 1998. Most recently, in fiscal year 2007, PWSB maintained non-account water at 11.0 percent. In short, both the 10-year average and the fiscal year 2007 non-account water rates surpass the goal established in the State Guide Plan Element 721. PWSB shall continue striving to maintain or improve upon this goal in the future. This will largely be accomplished through continued leak detection survey and repair, meter maintenance and replacement programs, and public education programs.

In its previous WSSMP submissions, PWSB has utilized population projections issued by Statewide Planning to formulate its future demand projections over the entire service area. PWSB still believes this to be the best methodology based on current available data. Review comments to past WSSMP submissions have, however, suggested that the demand projections of PWSB's individual wholesale customers be incorporated into PWSB's demand projections. As



such, PWSB utilized two alternative demand projection methods in this submission. The first combines PWSB's own retail area population-based demand projections with the available demand projections formulated by each wholesaler. The second is PWSB's demand projection based on the methodology of previous submissions utilizing projected rates of population growth within the entire service area as developed by Statewide Planning. PWSB believes this latter analysis to provide the more reliable future demand estimates. The following details the current average day demand (ADD) and maximum day demand (MDD) and the future projections for ADD and MDD utilizing both methods.

Year	ADD (MGD)	MDD(MGD)
2007	68.14	113.5

Year	METHODOLOGY 1 w/ Wholesaler Based Projections		METHODOLOGY 2 PWSB Population Based Projections	
	ADD (MGD)	MDD (MGD)	ADD (MGD)	MDD (MGD)
2015	71.3	119.0	68.7	114.7
2030	76.0	126.9	71.0	118.6

The safe yield of the Scituate Reservoir Complex has been identified as 92 MGD, which when accounting for the required 9 MGD downstream release to the Pawtuxet River, provides a net of 83 MGD of available water. This safe yield provides PWSB with ample supply for the current and projected future average daily water demand. The maximum day demand is available through reserve system storage (storage reservoirs) and short-term drafting of the reservoir complex to meet this increased demand. Nevertheless, PWSB continues to maintain an aggressive approach to supply augmentation. There have been numerous studies and reports, both ongoing and complete that investigate the feasibility of increasing available supply.

PWSB maintains an aggressive and ongoing approach to watershed management for the purpose of the protection of adequate supplies of water for treatment and distribution to all PWSB customers. The Water Quality Protection Plan (WQPP) section of this WSSMP establishes and continues to develop and implement watershed management and source protection measures to



ensure the future quality and availability of its raw water sources within the Scituate Reservoir Complex watershed.

This WQPP is consistent with the requirements of the Water Quality Protection Act of 1987, as amended, the Rhode Island Comprehensive Planning and Land Use Act of 1988, and the Comprehensive Plans of watershed municipalities. It is intended that this WQPP be modified in the future in response to changes in land uses and applicable federal, state and local regulations. PWSB continues to take steps to address, and remove where possible, conditions that may impact source water quality. One aspect of this is fostering relationships with the watershed communities and other public and private entities to educate the public on source water protection and to encourage land uses and best management practices aimed at protecting the surface and groundwater resources of the region.

PWSB shall employ demand management procedures of a suitable nature to promote the ultimate goal of permanent long-term savings through efficient water use. Water use trends can be affected significantly by changes in water use practices, which can occur as a result of technologic changes and demand management and/or water conservation policy and practice. This is to be achieved through a combination of measures that promote efficient water use, recycling, conservation, retrofit and new installation of low flow plumbing fixtures, public education and the appropriate use of fees, rates and charges. It is the ultimate goal to minimize peak demand use requirements and to minimize average day demand use requirements. As an example, the residential retrofit program (RRP), instituted in 1989, has been an ongoing successful program which to date has targeted the entire 70,000 plus retail customer base. An inventory of residential retrofit kits are maintained by PWSB and are made available to retail service customers upon request.

PWSB shall continue to employ proper system management procedures including programs for meter management (source and distribution), leak detection and repair, implementation of a preventive maintenance plan, infrastructure rehabilitation, and a billing rate schedule that promotes efficient and non-wasteful water use. PWSB will continue to employ proper system



management procedures aimed at increasing the overall efficiency of its water supply distribution system with the underlying theme of water conservation.

PWSB operates as a “self-supporting” water department. The Rhode Island Public Utility Commission (PUC) approves rates with the intent on providing water service at the lowest possible cost while retaining funds sufficient to develop operating reserves. The intent is to maintain long-term revenue levels sufficient to cover all fixed and variable capital and operating costs of running the water utility. PWSB operates financially as a separate accounting entity within the City of Providence organizational structure. The operations of the water utility are accounted for with a separate set of self-balancing accounts organized on an Enterprise Fund basis. The City of Providence also provides various administrative and support services to the utility in most instances to comply with Home Rule Charter requirements. Appropriately, PWSB reimburses the City for services provided in accordance with approval of the PUC.

It is intended that the financial management of the system will be one in which normal operation, maintenance and rehabilitation will be funded through operating revenue from the customer base. Where possible, and as the need may arise, PWSB shall seek alternate funding sources such as State and Federal loans and grants, for major capital improvement projects. In addition, an Infrastructure Replacement Fund (IFR), which is a surcharge placed on the customer rate schedule and maintained in a separate dedicated account, has been implemented and is intended to collect fees for replacement and upgrade of aged infrastructure.

Finally, the Emergency Management section of the WSSMP establishes the responsibilities and authority within PWSB for responding to most probable emergencies and outlines specific tasks for carrying out functional and constructive solutions based on a review of the potential emergencies and risks. The procedures outlined are consistent with the goals of the State Emergency Water Supply System Management Plan. It is the intent that this document provides guidance to ensure that the primary aspects of recovery from an emergency are addressed in an organized manner to aid in an efficient response and in maintaining drinking water of a high quality and quantity.

