REGIONAL WATER SYSTEM MASTER PLAN STUDY

FOR THE

SOUTHERN MAINE REGIONAL WATER COUNCIL

OCTOBER 2008

Grant Funding provided by the
Maine Municipal Bond Bank

WRIGHT-PIERCE
Engineering a Better Environment

SMRWC
Southern Maine Regional Water Council

REGIONAL WATER SYSTEM
MASTER PLAN STUDY
FOR THE
SOUTHERN MAINE REGIONAL
WATER COUNCIL

OCTOBER 2008

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SOUTHERN MAINE REGIONAL WATER COUNCIL

REGIONAL WATER SYSTEM

MASTER PLAN STUDY

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EXECUTIVE SUMMARY

ES.1 SOUTHERN MAINE REGIONAL WATER COUNCIL

ES.1A Background and Vision

The Southern Maine Regional Water Council (SMRWC) was originally formed in 2005 with the goal and mission of promoting regional cooperation among water utilities in southern Maine, improving customer service, and lowering the cost of water for the customer base served by the member water utilities. The SMRWC membership includes all the major water utilities serving drinking water to the public in York and Cumberland County. Combined, the SMRWC serves over 250,000 persons within 23 communities, nearly 20% of the State of Maine's total population. In addition, the public water supplies serve a much larger population in the region through businesses, public schools and other entities which receive the benefits of public water but may not be connected to a water system as a customer.

SMRWC member systems include:

- Biddeford & Saco Water Company
- Kennebunk, Kennebunkport & Wells Water District
- Kittery Water District
- Portland Water District
- Sanford Water District
- South Berwick Water District
- York Water District

The utility members formed this organization under the common realization that sustainable drinking water supplies in the region are a limited resource and that regional cooperation will likely be required in the future to meet the region's growing water supply needs.

Since its formation, SMRWC members have collectively considered a number of initiatives to reduce costs, improve the efficiency of operations and to refine contingency plans for providing water service through the region. These initial efforts have resulted in measurable cost savings to the benefit of the region's water customers.

The purpose of this study, consistent with the SMRWC's mission, is to explore opportunities to preserve the long-term water supply sustainability throughout the southern Maine region.

ES.1B SMRWC Goals and Objectives

The primary goal and objective of this study was to gain a technical understanding of existing supply capacity and supply vulnerabilities, as well as determining what the future water supply needs will be locally and regionally. These findings have led to the development of specific action plans for each utility and have identified preliminary technical solutions needed to assure long-term service to the region's customers.

In order to attain the goals and objectives of this study, we have:

- Identified existing and potential sources of supply in the region.
- Established the present and projected water needs in the region.
- Identified the limitations and risks of the existing and future supplies.
- Explored the logistics, benefits and impediments of creating an integrated, regional water supply system.
- Detailed the hydraulic considerations and infrastructure required to supply water over a large geographical area.
- Evaluated potential water quality issues associated with blending various supplies.
- Considered existing and future interconnections between systems.
- Developed short-term strategies for mutual-aid and sharing of resources.
- Developed an action plan to protect identified resources for future generations.
- Developed an integrated water supply plan for the entire region.

- Considered potential governance models for a regional supply organization.

ES.2 EXISTING AND PROJECTED WATER NEEDS IN THE REGION

The southern Maine region is the economic engine for the State of Maine. Adequate supply and reliable transmission of potable water is essential to maintaining and attracting future population and economic development to the region.

Under current conditions, there appears to be a reasonable short-term balance between existing supply capacity and projected water supply needs. However, this condition is changing rapidly. The region is projected to need a sustained supply of approximately 95 million gallons per day (MGD). Additional supply will be needed to support further economic development in the region.

Continued demands for additional water supply will eventually, and in some cases are beginning to already, stress supplies locally at the utility level. This reality combined with future environmental limitations on water withdrawal, economic development and population growth, climate change, and other factors may eventually drive utilities to consolidation and enhanced protection of the few remaining sources of potable drinking water.

ES.3 WATER SUPPLY RESOURCES OF REGIONAL SIGNIFICANCE IN SOUTHERN MAINE

ES.3A Existing Public Water Supplies

Existing local sources of public water supply appear be adequate for the near term. Current sources of supply identified in York and Cumberland County are presented in Table ES-1.

Of these sources, only the Saco River and Sebago Lake have sufficient surplus yield or supply capacity to serve as regional supplies far into the future. The projected combined surplus safe yield of Sebago Lake and the Saco River may be as high as 1,000 MGD, more than 10 times the projected need for the region. The remaining supplies will be challenged in the future to meet the local needs due to environmental constraints of water withdrawal, limited yield or capacity and constraints on expansion.

The surplus supply in the Saco River and Sebago Lake could be further developed to attract businesses to the southern Maine region. Unlike many large urban centers in the northeast, the State of Maine could identify surplus supply as a marketing tool to draw industry to the region and to expand the economic climate in southern Maine. The SMRWC should initiate a dialogue with State government to establish a process to clarify and define both water supply goals and development opportunities for the region.

TABLE ES-1
EXISTING PUBLIC WATER SUPPLY'S
YORK AND CUMBERLAND COUNTIES

Sources of Supply	Utility	Location of Supply
Bell Marsh Reservoir Boulter Pond Middle and Folly Pond Chase's Pond	York Water District Kittery Water District	York
Saco River	Biddeford & Saco Water Company	Biddeford & Saco
Sebago Lake	Portland Water District	Standish
Branch Brook and Groundwater Supplies	Kennebunk, Kennebunkport & Wells Water District	Kennebunk, Wells
Groundwater Supplies	Sanford Water District South Berwick Water District	Sanford, South Berwick

ES.3B Potential Regional Resources

The study included an evaluation and screening of all large potential sources of regional supply within the York and Cumberland County region. The Saco River and Sebago Lake were the only sources identified as having sufficient quantity and quality to meet the projected needs of the southern Maine region. The Saco River and Sebago Lake are and will continue to be the primary sources of drinking water supply in southern Maine far into the future. The Saco River is the only source of supply for the Biddeford & Saco Water Company while Sebago Lake serves as the primary source of supply for the Portland Water District.

The Saco River and Sebago Lake sources offer a number of unique attributes which make them valuable resources for the region and State of Maine. These attributes include:

- Large supply capacities.
- Excellent water quality.
- Established watershed protection activities.
- Established heritage and history as public water supplies.
- Best opportunity for increased withdrawal of water for public use while satisfying environmental concerns.
- Opportunities for centralized treatment and distribution facilities.

In addition to serving the customer base of the Biddeford & Saco Water Company in the communities of Biddeford, Old Orchard Beach, Saco, and Scarborough, the Saco River is already to some extent utilized as a vital regional supply for the customers of the Kennebunk, Kennebunkport & Wells Water District, Kittery Water District and the York Water District, which can obtain water through interconnection or supply agreements for mutual aid purposes. The Saco River also serves as an emergency supply through these same interconnection agreements. The Saco River has sufficient surplus yield to serve all of the water supply needs throughout the region.

Similarly, Sebago Lake is a large pristine source of supply which serves as the primary source of drinking water for customers located throughout the greater Portland area. With proper infrastructure enhancements, Sebago Lake can also be expanded to serve the region's needs beyond the current customer base of the Portland Water District.

Protection of these valuable resources and preservation of the capacity of these two sources of supply is essential to meet the growing needs of the region in the future.

ES.3C Protection of the Saco River and Sebago Lake

Protection and preservation of the water quality in the Saco River and Sebago Lake is essential to assure a safe and reliable supply for future generations. Local utilities and grass root conservation organizations have made excellent strides in protecting the watershed of both supplies. However, many of these initiatives could be better integrated towards common goals, are generally advocacy driven, and could better embrace common goals or objectives that cross town boundaries. More importantly, very few of these efforts focus on the resources for drinking water purposes. Long-term protection of these sources will require bold actions at the regional, State and federal levels to assure these supplies are protected and remain viable well into the future. Neither the Portland Water District nor the Biddeford & Saco Water Company has the financial or political capacity to manage and control land-use activities in these large watersheds. Protective measures and financial support at the state or federal level are essential.

The following action items are recommended to protect these valuable resources:

- <u>Establish a Stakeholder Relationship with the Saco River Corridor Commission</u> - The SMRWC should attempt to establish its rights as a formal stakeholder with the Saco River Corridor Commission (SRCC) and advocate for expanding the role of the SRCC for drinking water protection through the legislative process.
- <u>Create a Sebago Lake Watershed Commission</u> - Presently, the Sebago Lake watershed does not have a consolidated entity focused on the protection of Sebago Lake as a source of drinking water. We recommend establishing a formal commission empowered to over-see land use activities, land protection, non-point source pollution, recreational and water management and allocation and other competing uses. Legislation should be introduced to establish the mission of the commission.
- <u>Saco River and Presumpscot River Federal Energy Regulatory Commission (FERC) Licensing Proceedings</u> - The SMRWC should register as a formal stakeholder during all National Environmental Policy Act (NEPA) actions to relicense any hydroelectric facility

on the Saco River and Sebago Lake in order to protect regional interests in water quantity and quality.

ES.4 REGIONALIZATION OF WATER SUPPLY IN SOUTHERN MAINE

A conceptual regional water supply plan was developed to illustrate how the Saco River and Sebago Lake supplies might be expanded as regional supplies and integrated into a regional supply system in the future. The general infrastructure requirements identified for a regional system include the following:

ES.4A Description of a Regional Water System

A large regional treatment facility would be needed to treat the Saco River as a regional supply. The facility would be located along the Saco River at a logical point of intersection of a new water transmission system which would extend northerly to interconnect with the Portland Water District system, and southerly to interconnect with the York County utilities.

The primary transmission network for a regional system will likely be constructed along one of several existing utility and transportation corridors identified in this report. Pumping and storage facilities would be located at key hydraulic points would be determined in the future using a hydraulic analysis. And finally, metering locations would be located a logical points of intersection along the transmission system to supply each local utility. Further details regarding specific assets follows.

ES.4B Regional Water Treatment Facility at the Saco River

A new regional water treatment facility could be constructed along the Saco River, sized to meet the projected needs of the entire region. Utilities located to the south of the treatment facility would be supplied water from the Saco River, while the Portland Water District would retain Sebago Lake as their primary source of supply. The exact size of a regional treatment facility would be determined in part based on final water withdrawal permitting, further safe yield studies, more detailed water needs assessments, hydraulic considerations of major pipelines and other factors.

ES.4C Regional Water Transmission System

A new large diameter transmission network could be constructed north and south from the regional treatment facility at the Saco River as described above. The transmission system should include capacity for east/west transmission laterals to supply the Sanford and South Berwick Water District systems along existing natural gas, electric transmission or highway corridors identified in this study. The supply pipeline would interconnect to local distribution systems at logical points along the transmission system. Transmission to the north would allow for the exchange of water to the Portland Water District service area as needed using existing electric transmission or state highway corridors. Selection of the preferred corridors, sizing of the transmission system, pumping requirements and other hydraulic considerations will require detailed future study and evaluation.

ES.4D Retain the Sebago Lake Water Treatment Facility for Greater Portland

The Portland Water District's existing water treatment facility at Sebago Lake would be retained as a primary regional water supply for the Portland Water District Service area. Any future upgrades to this treatment facility or the District's existing primary transmission feeds from Sebago Lake should consider the addition of reserve capacity for a regional and redundant treatment source to the Saco River supply as previously described.

ES.5 IMPROVE LOCAL WATER UTILITY COOPERATION

The original mission of the SMRWC to cooperate and share resources should continue and be expanded. The current efforts have lead to cost savings, improved customer service and improved emergency planning.

The following areas for expanded cooperation were identified:

- Expansion of existing points of interconnection between systems to reduce system vulnerabilities. A list of specific improvements at each existing point of interconnection between local utilities is included in the report findings.
- Addition of new interconnections between water distribution systems for emergency support and to reduce system vulnerabilities.
- Improved sharing of resources and cooperation to leverage the memberships buying power. Areas for future cooperation might include joint procurement of material, professional services, Supervisory Control and Data Acquisition (SCADA) support, consolidation and maintenance, GIS support, operations services, billing and administrative consolidation,

ES.6 OTHER FINDINGS AND RECOMMENDATIONS

Several planning initiatives have been identified to advance the knowledge and technical requirements to form a regional water utility or supplier in southern Maine.

ES.6A Establish a Liaison with State of Maine Planning Office

The SMRWC should establish a liaison to provide advice and consultation on regional planning and development initiatives with State government. Primary contacts could be the State of Maine Planning Office, Maine Department of Transportation or other key legislative committees and subcommittees to assure that major project developments and funding are communicated directly to the SMRWC membership.

ES.6B Establish a Liaison with State of Maine Governors Office and other Governmental Water Use Stakeholders

Preservation and protection of the Saco River and Sebago Lake should be high priorities for the region's public water needs and economic livelihood. The SMRWC should engage state agencies to impress the local, regional and statewide benefits of preserving these supplies for drinking water purposes in addition to other competing interests. The SMRWC and it membership will require political support at the highest level of government to assure that these supplies are protected for years to come.

ES.6C Establish SMRWC Rights within Existing Utility Corridors

The SMRWC should engage all the primary owners of utility corridors in Southern Maine to preserve rights of access for future water transmission infrastructure. Existing utility corridors may include railroad, highway, electric transmission and natural gas.

ES.6D Consider Expansion of SMRWC to New Partners

The SMRWC should consider extending membership to other key constituent utilities in the region. Potential new partners in the region might include the water utilities north of the Portland Water District including; (1) Yarmouth Water District, (2) Brunswick & Topsham Water District, and the (3) South Freeport Water District. Within York and Cumberland County, other potential partners would include: (1) Berwick Water Department, (2) Alfred Water District and the (3) North Berwick Water District.

ES.6E Consider Future Interconnection Opportunities with Seacoast Border Communities

The seacoast region of New Hampshire has experienced an unresolved supply deficit for decades. A possible outcome of a regional water supply system for southern Maine could be extension of the system to New Hampshire seacoast border communities. This concept could fund portions of the regional distribution infrastructure and be a driver towards formation of a regional water supply entity. Several interconnections between Maine and New Hampshire utilities currently exist. The SMRWC could in the future, consider interconnection opportunities with the seacoast water communities.

In addition, the SMRWC should establish relationship with environmental interest groups in New Hampshire having a stake in the preservation and protection of the Saco River watershed.

The Saco River watershed covers a vast land area. Protection of the water quality of the river will require management and control of land-use activities.

ES.6F Establish SMRWC as Constituent and Stakeholder in Critical Organizations

The SMRWC should develop a plan to identify and interface with local and state agencies in the region to benefit water supply. Key agencies are identified in the study.

ES.6G Pursue Grants and Other Funding Opportunities

Develop a strategy to pursue grants and funding opportunities to advance knowledge and to further define technical requirements for this project. This effort could involve hiring a grant specialist that can focus on securing funds for additional studies. These efforts could be coupled with other major infrastructure projects under consideration in southern Maine such as the planned expansion of the existing major electrical transmission system.

ES.6H Partner with Regional and State Economic Development Organizations

Public drinking water is essential not only for the residential community at large, but is essential for developing, servicing and maintaining a healthy economic base. The vast majority of private business relies heavily on public infrastructure for their every day operational needs. The SMRWC membership is blessed with an abundance of high yield, high quality renewable drinking water to support future economic development in the southern Maine region and other areas within the State. The SMRWC should consider partnering with regional and State economic development organizations to include the availability of public water to serve new business.

ES.7 ADDITIONAL STUDIES, INFORMATION NEEDS AND INTERIM PLANNING STEPS

Several technical and information gaps were identified in the study. As previously stated, the natural resource or source of supply is always a limiting factor and the core asset of any water system. The following studies are suggested to better refine the feasibility of the conceptual regional plan identified in this study. These studies are deemed essential to advance this preliminary understanding of how a regional water system might be implemented and integrated to existing systems, since a project of this complexity would take many years to plan. A basic understanding of what assets would be needed and where these assets would be located would allow property considerations and rights to be secured or reserved as major infrastructure projects in the region are planned, designed and constructed.

- Safe Yield Study of Saco River and Sebago Lake - A formal safe yield study and water withdrawal plan for these two key sources is essential to understanding their capacities and limitations. Since these two resources are inextricably linked to hydropower projects, and a National Environmental Policy Act (NEPA) review is a routine requirement of the hydropower relicensing process, a detailed safe yield analysis of these two supplies should be developed. Funding for safe yield analysis might be obtained from the hydropower licensee as part of a NEPA requirement to assure proper environmental and socio-economic balance in any new hydropower license.
- Conceptual Transmission Main Routing and Treatment Facility Siting Study - The SMRWC should consider development of a more detailed transmission main routing study and consider alternatives for locating a regional water treatment facility on the Saco River. Securing property rights is a lengthy process that could take years to complete. Understanding where infrastructure should be located would allow for the gradual establishment of property rights over time as opportunities to collaborate with other utility owners.
- Hydraulic Study of Portland Water Transmission System - The Portland Water District is presently in the planning stage of upgrades to the District's existing water treatment facility and transmission system. These efforts should be expanded to consider regionalization impacts on siting and design of upgrades.

ES.8 ACKNOWLEDGEMENTS

Wright-Pierce would like to acknowledge the efforts and contributions of the following individuals in preparing this report. We would also like to thank the Maine Municipal Bond Bank for proving the funding to complete this important study. This endeavor could not have been completed without the dedication, hard work and support of these key individuals:

- Christopher Mansfield, Deputy Manager, Biddeford & Saco Water Company
- Normand Labbe, P.E., Superintendent, Kennebunk-Kennebunkport-Wells Water District
- Michael Rogers, Superintendent, Kittery Water District
- Guy Hodgdon, Technical Services Manager, Kittery Water District
- Gary S. Lorfano, President - Board of Trustees, Portland Water District
- Ronald Miller, General Manager, Portland Water District
- Christopher Crovo, Executive Director of Asset Management and Planning, Portland Water District
- Gordon S. Johnson, P.E., Engineering Services Manager, Portland Water District
- Dennis Knowles, Superintendent, Sanford Water District
- David Parent, Assistant Superintendent, Sanford Water District
- Michael Nadeau, Superintendent, South Berwick Water District
- John Leach, Assistant Superintendent, South Berwick Water District
- Don Neumann, Superintendent, York Water District
- Ryan Lynch, Treatment Plant Manager, York Water District

SECTION 1

INTRODUCTION

1.1 BACKGROUND

In 2005, the State of Maine passed water utility-sponsored legislation for the formation of regional water councils to explore solutions to common water supply issues within regional areas of the state. The legislation (Maine Public Utilities Commission Rules and Regulations - Chapter 68: Regional Water Councils) authorized "two or more water utilities" to organize and form a non-profit corporation as a forum to address issues to the water suppliers within the region which the council is formed.

The Southern Maine Regional Water Council (SMRWC) was formed under the authorization of Chapter 68 in 2005 with the sole purpose of promoting regional cooperation in southern Maine. The overarching goal of the council is to improve service and to lower the cost of water for the customer base served by the water systems. Combined, the SMRWC members serve over 250,000 persons throughout 23 communities in York and Cumberland County. The public water utilities also supply the commercial, industrial and tourism industries in southern Maine, the economic engine and employment base for many citizens in the State of Maine.

SMRWC member systems include:

- Biddeford & Saco Water Company
- Kennebunk-Kennebunkport & Wells Water District
- Kittery Water District
- Portland Water District
- Sanford Water District
- South Berwick Water District
- York Water District

In recent decades, communities in southern Maine, particularly those along the coast, have seen increases in population growth. This growth in population has been supported by commercial and business growth resulting in increases in need for public water. The region has always supported a robust seasonal population.

The growth has resulted in predictable increases in water demand which has stretched the resources and capabilities of many of the water systems which service these areas. These realizations lead the utilities in the region to form the SMRWC as a means of identifying synergies between systems and to leverage common interests for the better of the public at large.

Since its formation, SMRWC members have considered a number of initiatives to collectively reduce costs, improve the efficiency of operations and to refine contingency plans for providing water service through the region. Mutual aid agreements exist between many adjoining water systems for use during supply emergencies. The mutual aid agreements and ensuing cooperation lead to an in increased preparedness for a major disaster or emergency and each member has pledged to lend a hand to their fellow council members in the event of a significant emergency. The SMRWC has also implemented cost saving and sharing initiatives which have included joint chemical purchasing programs, man-power and operations staff sharing, training assistance and pooling of design and bidding resources for water storage tank coating replacement projects. These initial efforts have resulted in measurable cost savings to the benefit of the regions water customers.

The SMRWC membership recognizes that water supply in the region is limited. The SMRWC also realizes that regional cooperation is needed to understand how these limited supplies can be best used to supply water to the large region. The purpose of this study is to identify what these resources are and to determine if the present system of delivery of public water through local water utilities is sustainable into the future. This study will advance knowledge in this area as well as identifying additional areas for cooperation. The logistics and technical aspects of further joining individual water systems for emergency needs, mutual aid or regional cooperation will also be examined.

The study has been financed by a $100,000 grant from the Maine Municipal Bond Bank under the Bank's Credit Quality Improvement Grant Program.

1.2 SMRWC GOALS

The stated goal of the SMRWC is to collectively seek ways of improving public water service to the customers in the southern Maine region at the lowest possible cost by focusing on regional issues common to the member systems, by sharing best practices, by identifying and minimizing duplication of services, and by strengthening current efficiencies. The goal of this study is to examine and quantify the water supply in the region and to determine if a regional water system concept can improve delivery of service to meet the growing needs for more water in the region. More specifically, the study will identify water supplies of significance in the region, project local and regional need for water in the future, and examine the technical requirements to deliver water to this growing customer base. Technical issues will include understanding the water balance locally and regionally, hydraulic constraints and issues between existing water systems, water quality issues, opportunities for interconnections between systems to share water, and other considerations and issues of associated with developing an understanding of public water on a regional basis in the SMWRC service territory.

1.3 PURPOSE

The purpose of this study is to create a basic understanding and develop the conceptual framework associated with creating a combined distribution and supply system for the southern Maine region which aligns with the goals stated above. More specifically, the SMRWC has identified several specific goals and objectives for the project:

- Understand the limitations and risks to the local and regional water supply capacity.

- Develop strategies to preserve and improve local and regional water supply capacity for all council members.
- Identify key water supply resources in the region and establish their capacity and limitations.
- Establish present and projected water needs in the region.
- Identify initiatives needed to protect key water resources in region.
- Assess the need and value in regionalizing southern Maine water supplies.
- Assess and develop a service plan for the possible integration of the member utilities. The plan will identify required infrastructure, system upgrades and hydraulic characteristics.
- Identify water quality implications of blending system water and where warranted, develop concept treatment plans required to satisfy regulatory requirements and maintain a high quality product to the customers.
- Seek opportunity to leverage funding and lower costs of required capital improvements.

This study will lay the groundwork for these more complex, future decisions. During the interim, this report will guide day to day decisions on the preservation of the regions water resources as well as planned infrastructure replacement within each utility service territory.

The study will also provide the basic technical framework to address organizational and business issues in the future:

- Can the member utilities join to form a single entity in the future? If so, how might transmission assets be owned, managed and interconnected?
- Are there important large water supply resources that can meet all the needs in the growing region?
- Do large resources require state or federal support for protection and preservation as drinking water supplies?

This study will identify existing hydraulic limitations, propose locations for critical facilities, identify logical interconnection corridors and provide information to allow decisions by each utility to be weighed against the broader need regionally. It will also facilitate discussion on how each utility might finance and share costs for infrastructure that benefits the broader needs of the region beyond each utilities local customer base.

Most importantly, it is the SMRWC's desire to develop a report that instills a vision and passion throughout the public-at-large, local and state government and other interest groups to preserve, protect and plan for the long-term sustainability of drinking water in the State of Maine.

SECTION 2

DESCRIPTION OF THE SMRWC MEMBER SYSTEMS

WHO WE ARE

2.1 OVERVIEW

The purpose of Section 2 of this report is to describe each SMRWC water system, its existing relationships with adjoining water systems, and to identify local resources that may have broader regional value to the southern Maine service area. The discussion includes a brief description of the history of the system, statistics and other pertinent details including:

- *Legislative Rights, Chartered Service Territory and Existing Service Area*
- *Existing Infrastructure and Service Trends*
- *Existing Interconnection Agreements and other Cooperative Initiatives*
- *Prior Studies and Reports*

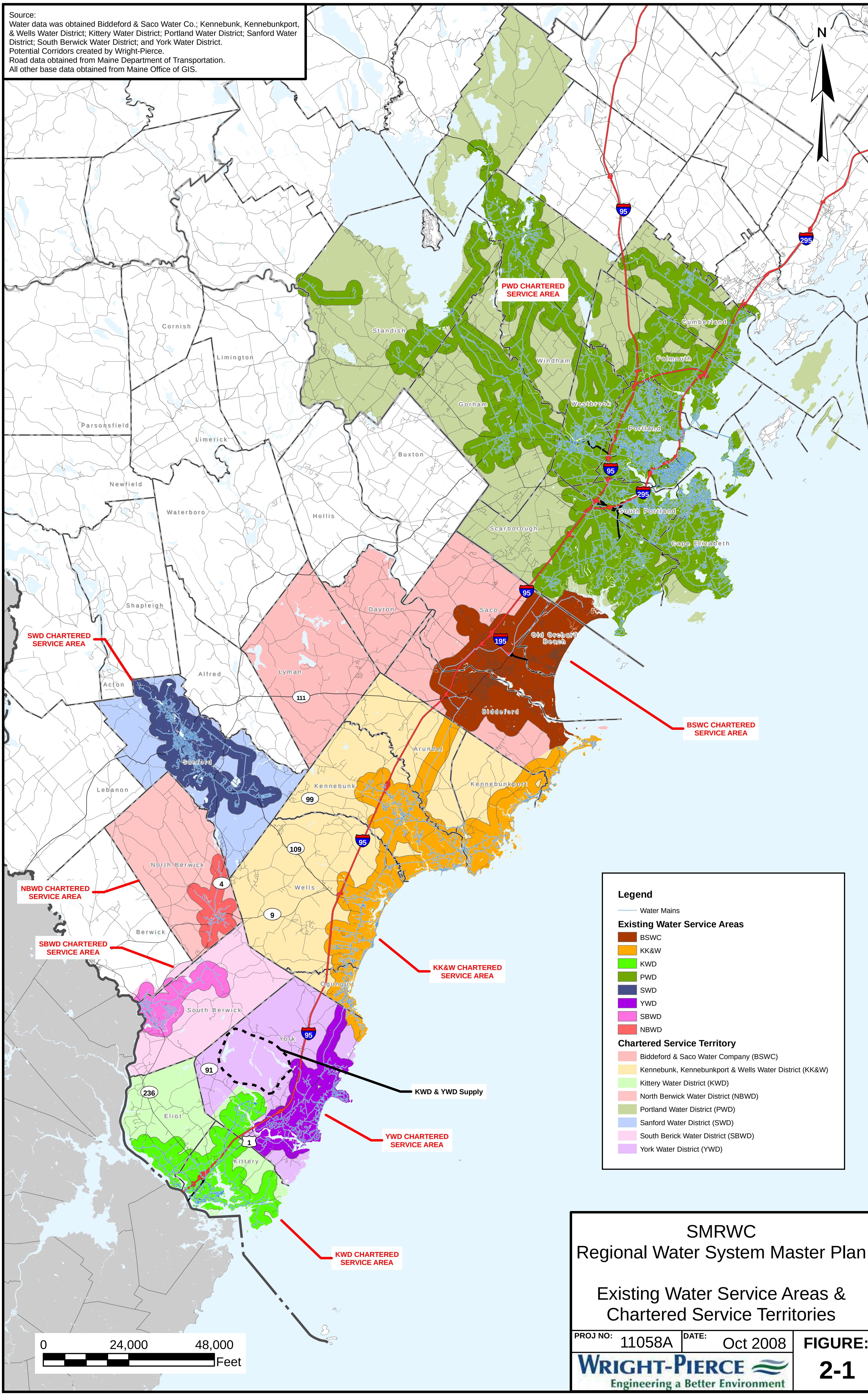
Each member system is chartered by the State of Maine to serve a distinct area of the region. Generally, the service territory of each utility coincides with municipal boundaries but sometimes extends into portions or specific designated areas of other municipalities. The general extent of the service territory of each SMRWC utility member is shown on Figure 2-1.

The figure also depicts current areas served by public water, located within the chartered service territory of each member system. The current service area depicted in the figure represents the water distribution system of piping, tanks and pumping stations that deliver water to customers.

2.2 BIDDEFORD & SACO WATER COMPANY

2.2.1 Legislative Rights, Chartered Service Territory and Existing Service Area

The Biddeford & Saco Water Company (BSWC) is a privately held water utility that was established in 1883 by an act of the Maine State Legislature. The chartered service area of the BSWC includes the City of Biddeford, the Towns of Saco, Old Orchard Beach, Dayton, and



SMRWC
Regional Water System Master Plan

Existing Water Service Areas & Chartered Service Territories

PROJ NO: 11058A	DATE: Oct 2008	FIGURE: 2-1

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Lyman as well as a small isolated portion of Scarborough. The general area served by public water includes the area east of Interstate 95 in Biddeford and Saco, all of Old Orchard Beach, and a small section of Scarborough.

2.2.2 Existing Infrastructure and Service Trends

2.2.2.1 Source

The BSWC obtains its water from the Saco River through two river intakes. The intakes are located approximately 1.5 miles upstream (at the water treatment plant site) from the downtown businesses and factories in Biddeford and Saco. It is estimated that the Saco River contains about 4 billion cubic feet of useable storage. The average flow of the river is estimated to be approximately 3,550 cubic feet per second (1,600,000 gallons per minute). The total drainage area of the river is 1,703 square miles at the tidal interface of the Cataract Dam. The Saco River at the point of withdrawal has an estimated safe yield of approximately 1.02 billion gallons per day.

River water quality is generally very good due in part to limited upstream discharges of contaminants and the regulation of shoreline development in the State of Maine by the Saco River Corridor Commission. Hydropower resources are highly developed in the Saco River and tributaries. All of the hydropower plants are run-of-river facilities with limited head water storage capacity. During periods of high water/runoff events, water quality deteriorates predictably. In any event, the source requires treatment to make it suitable for potable water purposes.

2.2.2.2 Treatment and Finished Water Quality

Raw water from the Saco River is treated at the BSWC water treatment plant. The plant is located along River Road in Biddeford, approximately 1.5 miles north of the Biddeford city center. The plant was originally constructed in 1884 and since has been upgraded on a number of occasions. The plant is designed to treat and pump slightly more than 14 million gallons per day (MGD). The treatment facility includes raw water and finished water pumping and a conventional treatment process consisting of coagulation, flocculation, sedimentation, filtration and disinfection using chloramines. The filter system includes six (6) high rate units operated at a maximum loading rate of approximately four (4) gallons per minute per square foot of surface area (gpm/sf). Chemicals used in the treatment process include sodium aluminate, aluminum sulfate and polymer for coagulation, lime for adjustment of pH in the clearwell, polyphosphate for corrosion control and fluoride for dental hygiene. Primary disinfection is provided by free chlorine while chloramines are used as a secondary disinfectant.

The major pumping units associated with the treatment facility include two raw water pumps, each rated for 8,200 gallons per minute (GPM) (11.71 MGD). Three high lift pumps rated for 6,000 GPM (8.57 MGD), 5,400 GPM (7.71 MGD) and 4,000 GPM (5.71 MGD) respectively, pump finished water to the distribution system. Only two of the three high lift pumps are used at any one time.

The finished and distribution water consistently meets or exceeds all drinking water standards. Total trihalomethane (THHM) and haloacetic acid (HAA5) formation concentrations are generally within 30 - 40 parts per million (ppm), meeting the requirements of the Stage 2 Disinfectants/Disinfection By-Products Rule (D/DBPR). Concentrations however, do not meet the wavier provisions in the Stage 2 Rule for THHM and HAA5 and thus are subject to extended monitoring. Other finished water quality goals are presented in Table 2-1.

TABLE 2-1
FINISHED WATER QUALITY TARGETS FOR THE BSWC

Parameter	Target
pH	7.0 units
Alkalinity	0-15 mg/L
Turbidity	0.10 NTU
Color	0-3 units
Iron	0.03 mg/L
Total Organic Carbon	1-2 mg/L

2.2.2.3 Storage

Distribution storage is provided in the system by four storage facilities in three service zones. The low service zone includes the 1.0 million gallon (MG) Bradbury Street standpipe, the 7.5 MG South Street reservoir, and the 1.0 MG Pine Point tank. The South Street Reservoir is a former stone quarry which has been lined and covered by a flexible membrane cover. Storage in the high service zone is provided by the 1.25 MG Forest Street standpipe.

2.2.2.4 Water Distribution System

The BSWC's transmission and distribution system includes over 200 miles of pipe ranging in size from 2 - 24 inches in diameter. The primary large diameter transmission mains from the treatment plant extend both north and south of the City of Biddeford.

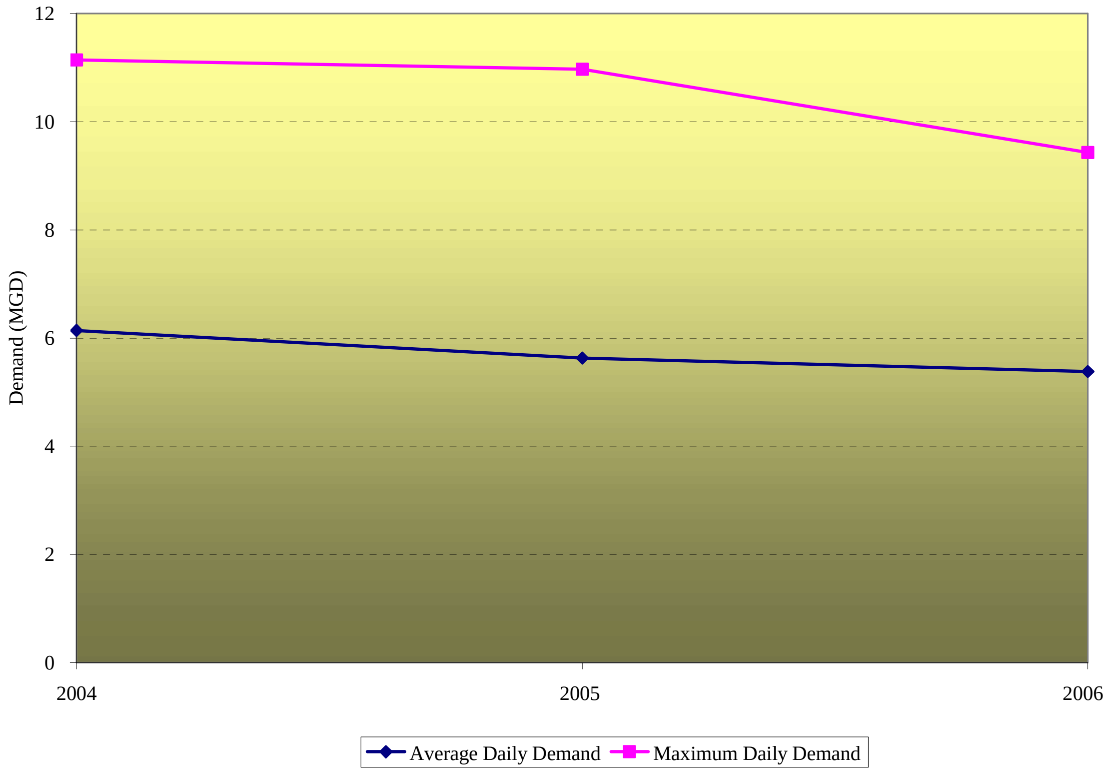
The distribution system consists of two separate pressure zones; (1) the low service zone which includes the majority of the system and (2) a small high service zone which serves a limited area south of the urban area of Biddeford and the Hills Beach area near Biddeford Pool. The low service zone operates at a hydraulic gradeline of EL 206 feet (USGS). The high service zone operates at a hydraulic gradeline of approximately EL 264 feet (USGS). Supply to the high service zone is provided by the Alfred Road booster pump station which draws suction from the low service zone. The station has a maximum capacity of approximately 1,800 GPM (2.6 MGD) and is hydraulically limited by the suction main to the station.

2.2.2.5 Demand Trends

The BSWC currently provides service to nearly 15,000 accounts, approximately 90% of which are residential. The BSWC estimates that they serve more than 60% of the population within their service territory. Data collected from the 2004 - 2006 Public Utilities Commission Annual Reports indicates an average daily demand (ADD) of 5.72 million gallons per day (MGD) and a maximum daily demand (MDD) of 10.51 MGD which includes water wholesaled to the

Kennebunk, Kennebunkport & Wells Water District. Historical demand data from 1980 - 2006 is presented on Figure 2-2.

FIGURE 2-2
DEMAND HISTORY FOR THE BSWC



2.2.3 Existing Interconnections and Inter-Municipal Cooperation

In 1980, the BSWC entered into a wholesale agreement to provide water to the Kennebunk, Kennebunkport & Wells Water District (KKW) during periods of peak demand, typically during the summer months, and for emergency purposes. The agreement was updated in 2005 to allow KKW to purchase up to a maximum of 2 MGD of treated water from the BSWC. Additional surplus flow is available in emergencies.

The agreement contains several stipulations which establish the cost of water. For flows up to 1.0 MGD, water is billed at the BSWC's published annual rate. Daily flows over 1 MGD are billed at the published seasonal rate. The agreement also includes a "kicker" threshold which if exceeded, allows for both parties to renegotiate the contract price. The agreement contains two specific thresholds; (1) a limit of up to 75 MG's of total water sales during the months of July and August for two consecutive years and/or (2) the sale of no more than 150 MG's of water during the remaining 10 months of the year for two consecutive years.

There are two (2) interconnections between the BSWC and KKW. The primary interconnection consists of a 20-inch transmission main and a pump station located along Route 1 at the Arundel town line. The second interconnection is located at the intersection of Route 9/Bridge Street/Old Pool Road near KKW's Biddeford Pool tank. Water exchange at the second interconnection is through an altitude valve. Transfer of water at this location is typically minimal. The BSWC reported sales of water to KKW of approximately 7 MG in 2004, 14 MG in 2005 and 18 MG in 2006.

To the north, BSWC's distribution system piping extends to within approximately 1,000 linear feet of the Portland Water District distribution system along Pine Point Road and along Route 1. A future interconnection between the systems at Pine Point Road is preferred as it would not require as much improvements as compared to the Route 1 location. Currently, there are no plans to interconnect the two systems.

2.3 KENNEBUNK-KENNEBUNKPORT & WELLS WATER DISTRICT

2.3.1 Legislative Rights, Chartered Service Territory and Existing Service Area

The Kennebunk, Kennebunkport & Wells Water District (KKW) is a public quasi-municipal water utility that was established in 1921 by an act of the Maine State Legislature. The District’s service area, the longest in Maine, extends over 25 miles along the York County coastline and includes the Towns of Kennebunk, Kennebunkport, Wells, Ogunquit, Arundel as well as approximately 1-1/2 square miles along the coastal portion of the City of Biddeford and approximately 2 square miles in the town of York in the Cape Neddick area.

With the exception of a small section within the Town of York along Route 1 south of the Ogunquit/York town line that is served by, the York Water District (YWD), KKW's service area includes the northern most portion of York. The service territory boundary is approximately 4,000 feet south of the Ogunquit/York town line, extending from the coastline to the Maine Turnpike.

2.3.2 Existing Infrastructure

2.3.2.1 Source

The District's primary source of supply is Branch Brook, a Class A surface water that has been used continually as a public drinking water supply by KKW since 1895. Protection of this valuable resource remains a top priority to the District. The District currently owns nearly 2,000 acres of Branch Brook's 8,000 acre watershed. In addition, KWW has been successful in promoting protective zoning ordinances throughout the watershed in addition to supporting conservation efforts by outside organizations such as the local land trust, the Nature Conservancy and other conservation interests. These initiatives have resulted in the protection of more than 50% of the watershed from future development. The District estimates that Branch Brook has an average flow rate in excess of 10 MGD and a safe yield during extreme drought conditions of 3 MGD. The Branch Brook supply accounts for 60-70% of the District's supply needs and is used on a year round basis.

In addition to Branch Brook, the District owns and maintains three groundwater sources. These sources include the Branch Brook or Plant Wells, Harriseckett Road and Merriland River supplies. These supplies are typically operated at high flow capacities to meet summer peak demand but have limited yields on an annual basis.

The groundwater sources are used extensively during July and August. The wells are also used periodically throughout the year in order to reduce treatment chemical usage and to maintain distribution system water quality. The District estimates that the combined yield of all groundwater sources is 3 million gallons per day (MGD) for a period not exceeding one month, or 2 MGD for a period not exceeding four months or 1 MGD on a year-round basis.

The Plant Wells consist of two 8-inch wells each equipped with a 700 gallon per minute (GPM) (1 MGD) submersible pump. The wells are typically operated in parallel. The capacity of this supply is limited to a total of approximately 20 MG's on an annual basis.

The Harriseckett Road supply consists of a 6-inch and 8-inch well equipped with submersible pumps having a pumping capacity of 175 GPM (0.25 MGD) and 300 GPM (0.43 MGD), respectively. Similar to the Branch Brook wells, the Haraseeket Road wells are operated in parallel. The Harriseckett Road supply has a safe pumping capacity of approximately 200 GPM over a maximum of four months. When pumped at a sustained rate of 400-500 GPM, the supply can be pumped for a maximum of approximately one month.

The Merriland River supply consists of a single 12-inch well equipped with a pump having a capacity of 1,100 GPM (1.57 MGD). The safe yield of the well has been estimated at 800 GPM over a prolonged pumping period but can sustain withdrawals upwards of 1,800 GPM for a maximum of 3-4 weeks during summer months. The District anticipates completion of an additional 18-inch well on the Merriland site in 2008 that will be equipped with a pump having a capacity of 1,400 GPM (2.00 MGD). The system will be designed such that only one pump can be operated at a time. A summary of the groundwater supplies is presented in Table 2-2.

TABLE 2-2
SUMMARY OF GROUNDWATER SUPPLIES IN THE KKW SYSTEM

Aquifer	Wells	Pump Capacity (gpm)	Safe Yield	Safe Yield Duration
Harriseckett Road	6-inch 8-inch	125 300	200 gpm	120 days
Plant Wells	(2) 8-inch	700 each	115 gpm	120 days
Merriland River	12-inch 18-inch	1,100 1,500	1,200 gpm	120 days

2.3.2.2 Treatment and Finished Water Quality

The raw water from Branch Brook is treated through a conventional process of coagulation, flocculation, clarification, primary disinfection with chlorine gas, filtration, fluoridation, corrosion control and secondary disinfection with chloramination before being pumped to the distribution system. The filtration system consists of 4 rapid sand filter units each capable of producing 1 - 1.5 MGD each and a single automatic backwash filter (ABW) filter unit having a capacity of approximately 3 MGD. Chemicals used in the treatment process include aluminum sulfate, sodium aluminate, sodium silicate, chlorine gas, sodium carbonate, anionic polymer, anhydrous ammonia and occasionally potassium permanganate.

Finished water is pumped to the distribution system by three high service pumps. Two of the pumps are rated for 2,800 GPM (4.0 MGD) while the third pump is rated for 1,800 GPM (2.57 MGD). The pumps can be operated in any combination to achieve flow rates up to 7 MGD.

Discharge from the groundwater supplies is directed to the Districts Pumping, Treatment and Recycling (PTR) facility where it is treated for corrosion control, fluoridation and disinfection before being pumped into the distribution system.

The finished water delivered to the distribution system can be surface water, groundwater or a combination of both. Using both supplies simultaneously, or hybridizing, was a practice first utilized beginning in May 2007, resulting in an exceptionally fine product that met or exceeded all Federal and State drinking water requirements. In addition to the enhanced aesthetic qualities, hybridizing significantly limits production of disinfection by-products.

The finished and distribution water consistently meets or exceeds all drinking water standards. Total trihalomethane (THHM) and haloacetic acid (HAA5) formation concentrations are generally within the range of 8 - 18 parts per million (ppm), meeting the requirements of the Stage 2 Disinfectants/Disinfection By-Products Rule (D/DBPR). Other finished water quality goals are presented in Table 2-3.

TABLE 2-3
FINISHED WATER QUALITY TARGETS FOR THE KKW

Parameter	Target
pH	8.2 units
Alkalinity	20-80 mg/L
Turbidity	0.10 NTU
Color	0-3 units
Iron	0.03 mg/L
Total Organic Carbon	1 mg/L

2.3.2.3 Storage

The District's total storage capacity is 7.7 million gallons (MG) consisting of five steel standpipes and two elevated steel storage tanks, ranging in size from 0.28 MG to 3 MG. The tanks are located strategically throughout the distribution system. The oldest standpipe was constructed in 1895 while the oldest elevated tank was erected in 1927 and has been a local landmark for many years. Both of these facilities are still in use today.

2.3.2.4 Water Distribution System

The District's transmission and distribution system includes over 207 miles of pipe, ranging in size from 3/4 to 20 inches in diameter. Approximately 85% of the distribution system piping is larger than 4 inches. The system supports 665 public and 222 private fire hydrants. There are seven (7) booster pump stations located throughout the system. The booster stations are used to increase service pressures in the higher elevations of the system. The main service zone operates at a hydraulic gradeline of El 190.00 to El 200.00 feet (USGS). The boosted pressure zones operate at a hydraulic gradeline of approximately El 260.00 to El 270.00 feet (USGS).

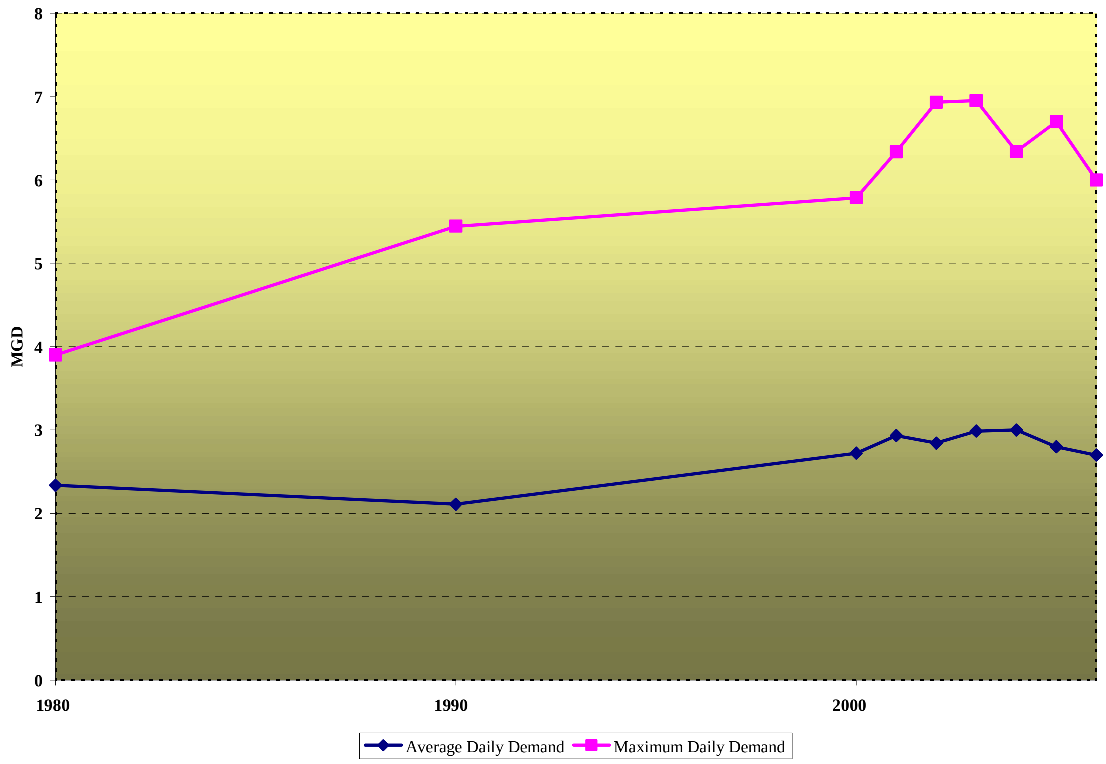
2.3.2.5 Demand Trends

The District current maintains over 12,000 service connections for a population that varies seasonally from about 28,000 to 100,000 during summer periods. Data collected from the 2004 - 2006 Public Utilities Commission Annual Reports indicates an average-day demand (ADD) of 2.83 MGD and a maximum-day demand (MDD) of 6.35 MGD. Historical demand data from 1980 - 2006 is presented on Figure 2-3.

2.3.3 Existing Interconnections and Inter-Municipal Cooperation

As a protective measure, the District has entered into an interconnection agreement with the BSWC and a mutual aid supply agreement with the YWD to meet short-term supply deficits and for emergency purposes. Water purchased from the BSWC is pumped through the Arundel Booster Pump Station by either a 1,200 gpm (1.7 MGD) or 1,800 gpm (2.6 MGD) pump which can be operated in parallel; flow through the station can only pass from the BSWC system to the KKW system. KKW cannot pump water to the BSWC. KKW reported water purchases from the BSWC of approximately 7 MG's in 2004, 14 MG's in 2005 and 18 MG's in 2006.

FIGURE 2-3
DEMAND HISTORY FOR THE KKW



The interconnection with the YWD consists of a 16-inch main and booster pump station located along US Route 1 in Ogunquit. The station is equipped with two 700 gpm (1.0 MGD) pumps which can be run in parallel in anticipation of future improvements. Sales to the YWD were reported to be approximately 0.58 MG's in 2005 and 0.78 MG's in 2006.

2.3.4 Prior Studies and Reports

The last significant published report was a 1982 Comprehensive Water System Study prepared by the E.C. Jordan Company. The study included an evaluation of the water system and identified improvements needed to meet projected water demands of 8.0 MGD in 2020. Recommendations included source augmentation, improvement to distribution piping in the southern areas of the system and storage improvements. Since then, most of the engineering and studies have been performed "in-house" by KKW engineering staff. The District is currently developing an updated comprehensive water master plan.

2.4 KITTERY WATER DISTRICT

2.4.1 Legislative Rights, Chartered Service Territory and Existing Service Area

The history of the Kittery Water District (KWD) system dates back to 1901. The original waterworks facilities were constructed by the Agamenticus Water Company to supply water to the Portsmouth Navel Shipyard (PNS). The Kittery Water District (KWD) was formed and incorporated in 1907 assuming ownership and operation of the facilities of the Agamenticus Water Company. The KWD is chartered by the State of Maine to serve the Towns of Kittery and Eliot and portions of the Town of York.

The portion of the KWD service territory in York generally bounds Welch Road and Beech Hill Road as well as a small portion of the Route 91 corridor in the vicinity of the Districts water treatment facility. This small service area contains the primary transmission mains that feed the core of the Kittery distribution system.

The KWD and YWD are participating in on-going informal discussions on trading service territory in York to better serve the public along the US Route 91 corridor. To date, nothing has been agreed upon.

2.4.2 Existing Infrastructure

2.4.2.1 Supply

The KWD supply is derived from four large surface supplies which are located in the Town of York. These include Middle Pond, Folly Pond, Boulter Pond and Bell Marsh Reservoirs. The total combined safe yield of the reservoir system is estimated to be 5.6 million gallons per day (MGD). Relevant data for each source is presented on Table 2-4.

TABLE 2-4
KITTERY WATER DISTRICT SUPPLIES

Description	Middle Pond Reservoir	Folly Pond Reservoir	Boulter Pond Reservoir	Bell Marsh Reservoir
Available Storage Capacity (MG)	321	273	400	1,100
Reported Safe Yield (MGD)	1.20		1.90	2.5
Drainage Area (Sq. Miles)	1.33		2.4	2.8
Surface Area (Sq. Miles)	77		102	280

Middle Pond Dam was constructed in 1901 by the Agamenticus Water Company to form the Middle Pond Reservoir. The dam impounds Cider Hill Creek downstream from Folly Pond. The impoundment contains approximately 321 million gallons (MG's) of available volume which is controlled by the crest of the spillway. Water flows from Middle Pond to the Francis B. Hatch water treatment facility located below Boulter Pond through 14-inch or 12-inch raw water mains.

The Folly Pond Dam was constructed in 1942, approximately 500 feet upstream of an older dam at the site. Folly Pond Dam also impounds Cider Hill Creek upstream of Middle Pond Dam. The impoundment stores approximately 273 MG's of usable volume. Controlled releases from the impoundment are made by operating a valve on a water main. The water main discharges into a natural drainage swale where it flows a short distance overland before discharging into Middle Pond.

Middle and Folly Ponds provide a total safe yield of 1.2 MGD, having a combined drainage area of 1.33 square miles, and a surface area of 77 acres.

The Boulter Pond Dam and reservoir were constructed by the District in 1951. The Boulter Pond reservoir contains approximately 400 MG's of usable volume. Water is released from the pond through two, 12-inch intake pipes extending through the dam from an intake tower. Boulter

Pond has a surface area of about 102 acres and a drainage area of 2.4 square miles and has a safe yield of approximately 1.9 MGD.

The Bell Marsh Dam was constructed by the KWD in 1987 to form the Bell Marsh Reservoir. The dam impounds Smelt Brook and stores approximately 1,200 MG of usable storage. Normal releases from Bell Marsh are discharged through a 16-inch pipeline rather than directly to the pond, to a concrete headwall near Boulter Pond. Bell Marsh Reservoir has surface area of about 280 acres and a drainage area of 2.8 square miles. The reservoir has a safe yield of 2.5 MGD not including the minimum flow release to Smelt Brook.

2.4.2.2 Treatment

The Francis B. Hatch Water Treatment Plant was designed and constructed between 1959 and 1962. The facility is equipped to treat water from either the Boulter Pond/Bell Marsh Reservoir system or from the Middle Pond/Folly Pond branch of the reservoir system. The facility incorporates conventional treatment using rapid mix, flocculation, sedimentation, and filtration with automatic backwash (ABW) filters. The filter system consists of two parallel 4,800 GPM automatic backwash filters.

The water from the supplies flows by gravity to the water treatment facility from the selected reservoir system for treatment. Finished water is pumped from the treatment facility to the distribution system by the Boulter Pond Pumping Station. The capacity of the treatment plant is 3,500 GPM (5.0 MGD).

The finished and distribution water consistently meets or exceeds all drinking water standards. Total trihalomethane (THHM) and haloacetic acid (HAA5) formation concentrations are generally within the range of 10 - 60 parts per million (ppm), meeting the requirements of the Stage 2 Disinfectants/Disinfection By-Products Rule (D/DBPR). Other finished water quality goals are presented in Table 2-5.

TABLE 2-5
FINISHED WATER QUALITY TARGETS FOR THE KWD

Parameter	Target
pH	7.3 units
Alkalinity	25 mg/L
Turbidity	0.03 NTU
Color	8.0 units
Iron	0.03 mg/L
Total Organic Carbon	1.7 mg/L

2.4.2.3 Pumping

The Boulter Pond Pump Station was constructed in 1951. The station pumps treated water from the treatment facility to the distribution system. The pump station has been renovated over the years with new electrical systems and variable frequency drive equipment.

The facility contains three primary horizontal, centrifugal pumps which draw suction directly from the treatment facility clearwell. The station has a maximum capacity of 3,500 GPM (5.0 MGD).

2.4.2.4 Distribution Storage

The KWD distribution system consists of a single pressure zone operating at a hydraulic gradeline of El 183.0 feet (USGS). Storage within the distribution system consists of two facilities having a total volume of 4.9 million gallons.

The Rogers Road Standpipe was constructed in 1959 of welded steel and has a total volume of 3.0 MG's. The Eliot tank was constructed in 1997 and is constructed of pre-cast, pre-stressed concrete type with a total storage volume of 1.9 MG's.

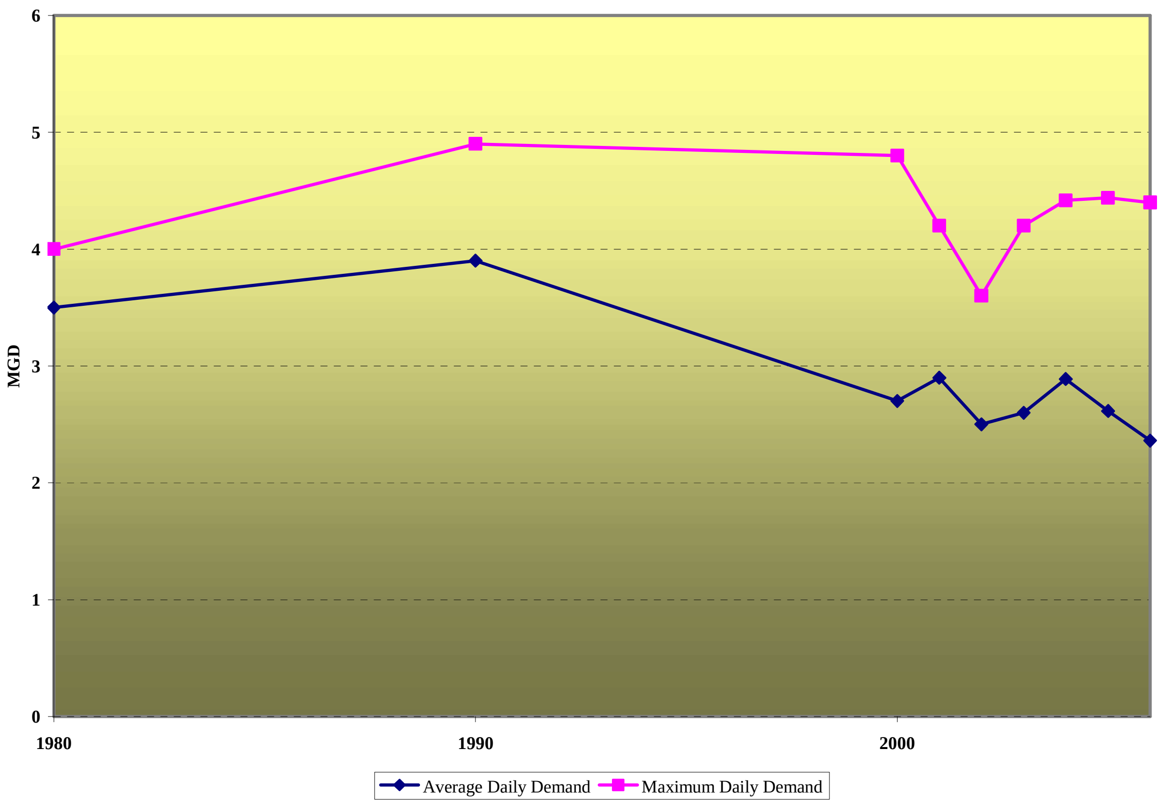
2.4.2.5 Water Distribution System

The KWD operates approximately 93 miles of mains, ranging in size from 2 -20 inches in diameter. The transmission piping (pipes greater than 16 inches) forms a redundant route from the Boulter Pond Pumping Station to the Portsmouth Naval Shipyard and Kittery Village areas.

2.4.2.6 Demand Trends

The District currently maintains over 5,000 accounts which serve a population of nearly 12,000 persons, over 70% of the total service area population. Data collected from the 2004 - 2006 Public Utilities Commission Annual Reports indicates an average-day demand (ADD) of 2.62 MGD and a maximum-day demand (MDD) of 4.42 MGD. Historical demand data from 1980 - 2006 is presented on Figure 2-3.

FIGURE 2-4
DEMAND HISTORY FOR THE KWD



2.4.3 Existing Interconnections and Inter-Municipal Cooperation

In 2006, the Kittery and York Water District's entered into an agreement for mutual aid/emergency purposes. The physical interconnection between the two systems is located along US Route 1. Neither District has reported a need to utilize the interconnection to date. The agreement contains several key provisions:

- Water can be exchanged from either system to the other at a value of $300/million gallons or the annual unit cost (also referred to as the Marginal Cost of Treatment for chemicals and power), which ever value is higher.
- Each water system was required to replace or extend water mains in each of the systems to improve hydraulics. These installations were completed by both utilities in 2007.
- The KWD and YWD would jointly own a booster pumping station.
- Each District could purchase up to 2.0 MGD in an emergency situation.

2.4.4 Prior Studies and Reports

The KWD has studied interconnection opportunities with both the City of Portsmouth, New Hampshire and the York Water District. A conceptual design of a water main crossing of the Piscataqua River to Portsmouth across the Interstate 95 Bridge as well as a sub-aqueous crossing of the river were previously explored by the District. The concepts were never pursued as the City of Portsmouth elected to develop its own supply and treatment facility.

In 2000, the KWD completed a Comprehensive Water System Facilities Plan which was prepared by Earth Tech, Inc. The study included an evaluation of the water system to identify service needs through the year 2010. Improvement recommendations included treatment upgrades, operational enhancements to reduce disinfection bi-product formation in the distribution system, pump station modifications and distribution piping improvements.

In 2004, the Kittery and York Water Districts jointly funded a study for an interconnection between the two systems. This study is discussed in detail under the York Water District.

2.5 PORTLAND WATER DISTRICT

2.5.1 Legislative Rights, Chartered Service Territory and Existing Service Area

The Portland water system began providing water to the citizens of the city in 1869. In 1908, the Maine State Legislature established the Portland Water District (PWD) as a public quasi-municipal water utility. The District has the largest service population in the State of Maine and has been chartered to serve the communities of Cape Elizabeth, Cumberland, Falmouth, Gorham, Portland, Raymond, Scarborough, South Portland, Standish, Westbrook, and Windham.

Expansion of the District included the consolidation and/or merger with the Presumpscot Water & Power Company, the Standish Water & Construction Company, Gorham Water Company, Foreside Water Company, Proute Neck Water Company, Scarborough Water Company, Casco Bay Water Company, Steep Falls Water Company, and the Cumberland Water Company.

The current service area generally includes the downtown and primary business centers within Cape Elizabeth, Cumberland, Falmouth, Gorham, Portland, Scarborough, South Portland and Westbrook. Limited service is provided to the Steep Falls and Sebago Lake Villages in Standish and small areas of Raymond and Windham.

2.5.2 Existing Infrastructure

2.5.2.1 Source

The District's primary source of supply is Sebago Lake. The lake is bordered by the towns of Casco, Naples, Raymond, Sebago, Standish and Windham. Sebago Lake has a surface area of approximately 45 square miles and a drainage basin of approximately 360 square miles. The lake contains approximately 995 billion gallons of water. The District indicated that there has never been a true safe yield study performed for the lake but estimates its safe yield to be approximately 50 million gallons per day (MGD). Using a traditional engineering safe yield estimate of 600,000 gallons per day per square mile of drainage area, we estimate the safe yield to be upwards of approximately 200 MGD, assuming optimum storage usage. There is a significant quantity available from Sebago Lake to meet the Districts needs far into the future. Because of the District's watershed protection programs and the near pristine water quality, PWD secured a filtration wavier/exemption from the USEPA. In effect, the wavier reduced the complexity of treatment required, saving its customers millions of dollars in capital and operating costs. The District is presently studying alternatives to upgrade its Sebago Lake Water Treatment Facility (SLWTF) to meet the requirements of the Long-Term 2 Enhanced Surface Water Treatment Rule.

The District also maintains a small groundwater supply system for the Steep Falls Village area in Standish. The system and supply are completely separate from the primary system which serves the Greater Portland area.

The Sebago Lake system supplies water to six pressure zones to accommodate topography ranging from sea level to EL 470 feet (USGS). Three of the pressure zones are supplied from the SLWTF (two are pumped) and the other three are supplied from the main pressure zone by three booster pump stations located in the distribution system.

2.5.2.2 Treatment

Raw water from Sebago Lake is processed at the District's SLWTF located on the shore of Sebago Lake in Standish. The facility was constructed in 1994 in response to the 1986 Safe Drinking Water Act (SDWA) requirements and has a peak hydraulic capacity of 52 MGD. The process consists of raw water pumping, and ozonation for the inactivation of bacteria, viruses and *Giardia*. Chemical addition includes sodium hydroxide for pH adjustment, zinc orthophosphate for corrosion control, fluoride for public health and chloramines (sodium hypochlorite and ammonia) for distribution disinfection. Finished water is delivered to the system by gravity and high lift pumping. The plant includes full redundancy to provide maximum-day demands in the event any major process component was taken off-line.

The finished and distribution water consistently meets or exceeds all drinking water standards. Total trihalomethane (THHM) and haloacetic acid (HAA5) formation concentrations are generally within the range of 1 - 3 parts per million (ppm), meeting the requirements of the Stage 2 Disinfectants/Disinfection By-Products Rule (D/DBPR). Other finished water quality goals are presented in Table 2-6.

TABLE 2-6
FINISHED WATER QUALITY TARGETS FOR THE PWD

Parameter	Target
pH	8.2 units
Alkalinity	5.0 mg/L
Turbidity	0.20 NTU
Color	0 - 5 platinum-cobalt unit
Iron	0.20 mg/L
Total Organic Carbon	2.5 mg/L

2.5.2.3 Storage

Eleven storage tanks are dispersed throughout the system to provide buffering during peak demands, as well as for fire fighting and emergency purposes. The total stored volume is more than 30 million gallons (MG's) with an active storage volume of approximately 13 MG's. Storage improvements were recommended in the 2003 Comprehensive Water System Strategic Plan in several service zones to address projected deficiencies.

2.5.2.4 Water Distribution System

The District's transmission and distribution system includes over 900 miles of mains which range in size from 2 - 60 inches. The system is segregated into six (6) separate pressure zones designated by their hydraulic gradeline. Several of the pressure zones are served by individual booster stations. Zone 267 is the largest of the six zones serving the customer base in Cape

Elizabeth, Cumberland, Falmouth, Portland, Scarborough and South Portland. This Zone would be the logical point of interconnection between the PWD and the water systems to the south.

The primary transmission mains from the SLWTF to the distribution system have an approximately hydraulic capacity of 44 MGD which should be adequate to meet projected demand for the next 15 years. However, both of the primary transmission mains must be in service to deliver the peak flows; loss of either transmission main would significantly reduce the available flows to meet peak demands. This issue could influence the ability of Portland to serve other systems in the southern Maine region. The 2003 study suggested that improvements to this primary transmission system may be warranted. The District is currently considering alternatives to improve the reliability and increase the capacity of this transmission system.

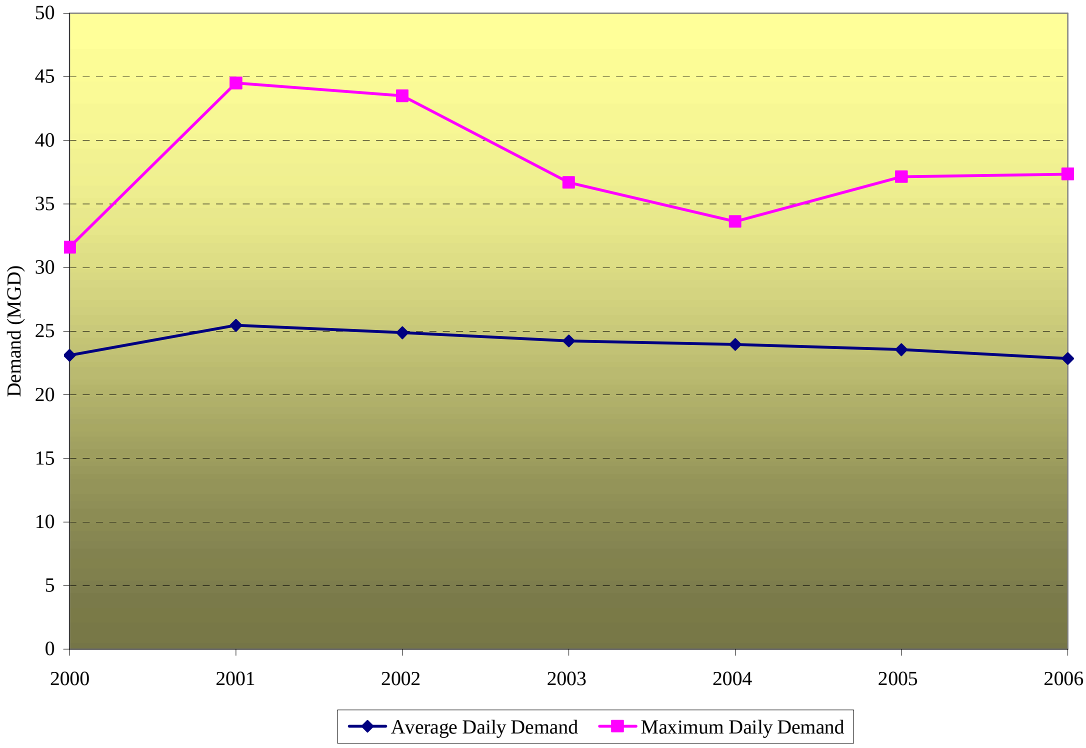
2.5.2.5 Demand Trends

The District current maintains nearly 50,000 service connections; over 90% of which are residential. Data collected from the 2004 - 2006 Public Utilities Commission Annual Reports indicates an average-day demand (ADD) of 23.45 MGD and a maximum-day demand (MDD) of 36.04 MGD. Historical demand data from 1980 - 2006 is presented on Figure 2-5.

2.5.3 Prior Studies and Reports

In 2003, the District completed a major comprehensive plan entitled "2003 Comprehensive Water System Strategic Plan (CWSSP)" which included an evaluation of every facet of their system. The plan and study was prepared by Camp, Dresser and McKee (CDM). The analysis included projections of future demand, developed service plans for each community in the service territory and concluded with a Capital Improvement Plan focused on correcting deficiencies throughout the water system. These improvements should be considered in any future interconnection concepts to assure that adequate capacity and reliability can be provided from the Portland Water Districts system.

FIGURE 2-5
DEMAND HISTORY FOR THE PWD



2.6 SANFORD WATER DISTRICT

2.6.1 Legislative Rights, Chartered Service Territory and Existing Service Area

The Sanford Water District (SWD) was formed in 1929 by consolidating the assets of the Sanford Water Company and the Springvale Aqueduct Company. The new District was chartered by the Maine State Legislature under the Private and Special Laws, Chapter 50, as a public quasi-municipal water utility, giving it the rights to serve the residents of Sanford and Springvale. The two original water systems began operating as one system in 1931 by removing the check valves between the systems.

The current service area generally includes the downtown and primary business centers within Sanford and Springvale, serving approximately 14,000 - 17,000 residents. The village of Springvale is part of the Town of Sanford.

2.6.2 Existing Infrastructure

2.6.2.1 Source

The District's source of supply is groundwater consisting of seven gravel packed wells and a wellfield. The total safe yield of the supplies has been estimated to be approximately 4.42 million gallons per day (MGD). The well supplies include:

- Main Station
- Country Club Road #2
- Cobb I
- Cobb II
- Eagle Drive I
- Eagle Drive II
- New Dam
- Old Mill Station

A brief discussion of each supply follows.

The Main Pump Station was constructed in the late 1800's. It originally consisted of three well fields. The wellfields have been abandoned in stages since promulgation of the USEPA's Safe Drinking Water Act enacted in 1986. The well fields were taken off-line in 2006 and replaced with three new naturally developed wells located adjacent to the Main Station. The Main Station was upgraded in 2008.

The Country Club Road #2 is a gravel-packed well located near the Great Works River. This site is capable of producing approximately 575 gallons per minute (GPM) (0.8 MGD) (controlled by a variable frequency drive to provide a flow range from 325 - 575 GPM) and provides approximately 20% of the total production to the system.

Cobb I & II are gravel packed wells and are located near the Sanford High School. Cobb I was constructed in 1967 and is capable of producing at a flow rate up to 350 GPM (0.5 MGD) (normally run at 280 GPM). Cobb I has historically provided from 5 to 10% of the system's total production. The Cobb II Well was constructed in 1971 and has historically provided from 5 to 10% of the District's yearly production at a rate of approximately 285 GPM (0.41 MGD).

Eagle Drive I and II are gravel packed type wells located in south Sanford. Eagle Drive I was originally constructed in 1965 and has historically provided about 5% of the District's yearly production, yielding a flow rate of approximately 230 GPM (0.33 MGD). Eagle Drive II was originally constructed in 1983 and has a rated capacity of 700 GPM (1.0 MGD). It has historically produces 25 - 30% of the District's yearly production. The Eagle Drive wells have elevated manganese levels and Eagle Drive I is used less frequently than in the past.

The New Dam well was constructed in 1967 and is located on New Dam Road. The well is of the gravel-packed type and provides approximately 20% of the system's yearly production, yielding approximately 400 GPM (0.57 MGD). Similar to the Eagle Drive wells, the new Dam well has experienced elevated levels of manganese in recent years. A study considering treatment of the existing supply or construction of a replacement well in the vicinity of the existing New Dam well is currently in progress.

The Old Mill Station is a gravel packed well constructed in 1992. The facility is designed for a flow rate of 350 GPM (0.5 MGD). The flow rate is limited to a maximum annual average flow of 238 GPM (0.34 MGD) to control influence from nearby residential subsurface disposal fields. This source generally contributes 10% of the District's yearly production.

2.6.2.2 Treatment

The water from the sources is treated for lead and copper corrosion control purposes using sodium hydroxide to elevate pH. The District also adds sodium hypochlorite for disinfection at the Main Station wellfield and at the Old Mill Road well. Fluoride, used for dental hygiene is added at all the sources. Phosphate used as to sequester iron and manganese is added as needed at some facilities.

2.6.2.3 Storage

The District's maintains three water storage tanks throughout the system having a total capacity of 3.64 million gallons (MG's). A description of each follows:

The Grammar Road Standpipe is a steel standpipe which contains approximately 1.865 MG'ss. The standpipe is 96 feet high having an overflow elevation of approximately EL 516 feet (USGS).

The Littlefield Tank is located on Littlefield Road on the Springvale side of the system. The tank is constructed of steel, is 31 feet high and stores approximately 1.024 MG's with overflow elevation at EL 518.15 feet (USGS).

The Hanson Ridge Tank, the oldest tank in the system, is a buried rectangular concrete tank that was constructed in 1905. The facility is located on Hanson Ridge Road and contains approximately 0.75 MG's. The tank has a depth of 12.5 feet and an overflow level of EL 516.15 feet (USGS). The water level in this tank typically controls the operation of the various well pumping stations.

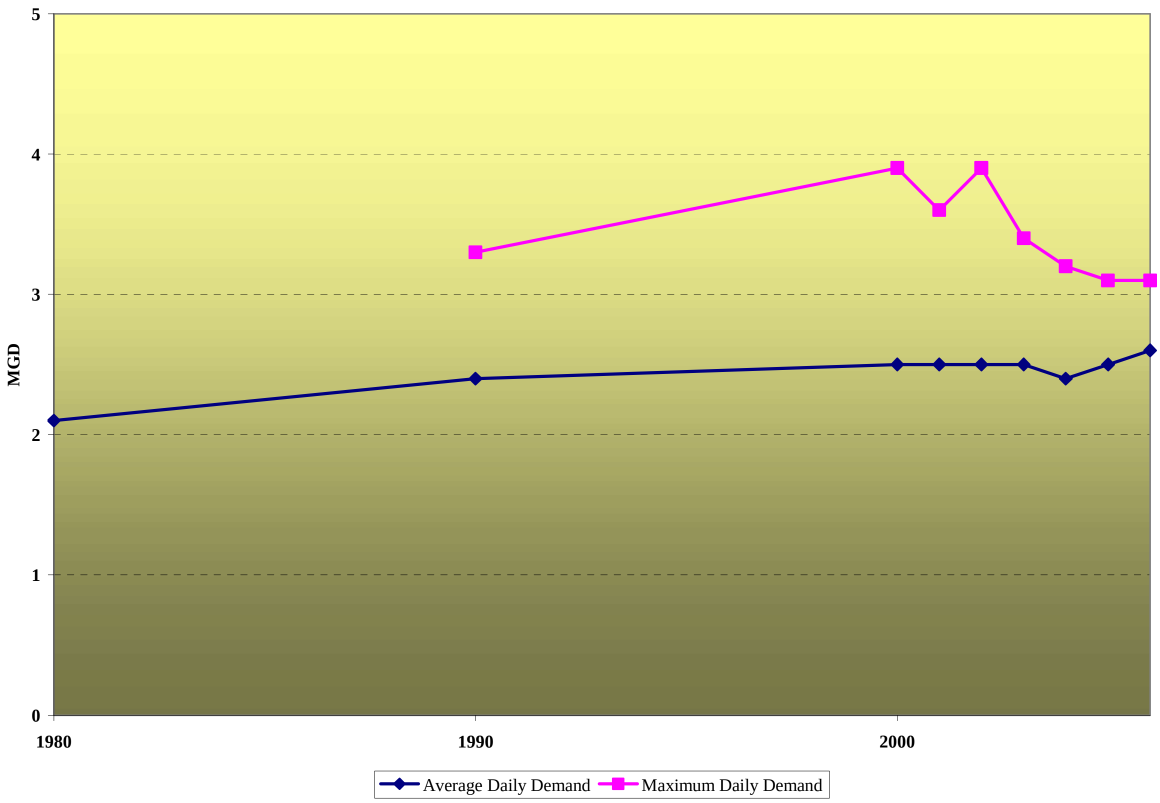
2.6.2.4 Water Distribution System

The District's transmission and distribution system includes over 95 miles of pipe ranging in size from 1.5 inch to 16-inch. The mains primarily consist of cast iron and ductile iron piping, with limited amounts of copper and galvanized piping. A very small amount of asbestos cement main was inherited with the Airport grid. There are also approximately 600 fire hydrants located throughout the system.

2.6.2.5 Demand Trends

The District currently maintains over 5,500 services over 97% which are of the residential type. Data collected from the 2004 - 2006 Public Utilities Commission Annual Reports indicates an average-day demand (ADD) of 2.50 MGD and a maximum-day demand (MDD) of 3.13 MGD. Historical demand data from 1980 - 2006 is presented on Figure 2-6.

FIGURE 2-6
DEMAND HISTORY FOR THE SWD



2.6.3 Existing Interconnections and Inter-Municipal Cooperation

The SWD is not interconnected with any other public water system. This is due in large part because the District maintains multiple well sources, geographically dispersed throughout the service area, and therefore the District has little need to be connected to another water system. A small water system located in Alfred is the nearest public water supply to the District.

2.7 SOUTH BERWICK WATER DISTRICT

2.7.1 Legislative Rights, Chartered Service Territory and Existing Service Area

The South Berwick Water District (SBWD) provides drinking water to the community of South Berwick and a small portion of Berwick in York County, Maine. The South Berwick Water District was incorporated in 1959 under the Private and Special Law Provisions by the State of Maine Legislature (1959 and 1961, Chapter 61 and 1981 Amendments to Chapter UP 148-LD). The SBWD currently serves approximately 1,400 customers.

The primary service area includes South Berwick Village and the Hooper Sands area as well as a small area in Berwick in the vicinity of the Blackmore well field. The original charter has been amended and modified several times since its inception in 1959. The last charter amendment made in 2006 added the US Route 4 corridor in the Town of Berwick to the service territory of the SBWD.

2.7.2 Existing Infrastructure

2.7.2.1 Supply

The SBWD uses groundwater for its potable water needs. The supplies consist of a combination of well points, and gravel-packed and bedrock wells located in four separate well fields. The total combined capacity of the District's sources has been estimated to be 695 gallons per minute (GPM) (1.0 million gallons per day (MGD)). Each source is described as follows.

Agamenticus - The Agamenticus supply is located on a 6-acre site south of Agamenticus Road in South Berwick. This supply is the SBWD's oldest source, constructed in 1937. A major upgrade of the facility was completed in 1983. The Agamenticus supply consists of a gravel-packed well, a drilled bedrock well and a well point system. Each source of supply is pumped to a 13,000 gallon concrete cistern housed within the Agamenticus Pumping Station. Water is pumped from the cistern to the distribution system with one of two 20 Hp centrifugal high lift pumps.

The well point supply consists of seven 2½-inch diameter shallow, drilled well points. The well points are pumped by two 2 Hp centrifugal vacuum pumps located in the Agamenticus Pumping Station. The well point screens are cleaned routinely every 3-5 years when the flow capacity begins to decrease. The flow capacity of the well point system averages 30 GPM.

The gravel-packed well was constructed in the 1940's and is equipped with a submersible pump. The well produces about 35 GPM on a sustained pumping basis.

The third source of supply at the Agamenticus site is a 6-inch drilled bedrock well which produces about 50 GPM on a sustained basis. The bedrock well is only used during high demand periods or during fire conditions because of poor water quality. Iron and manganese treatment is needed to fully utilize this source on a regular basis.

Blackmore - The Blackmore well supply consists of three drilled bedrock wells located in Berwick near the Berwick-South Berwick townline. The Blackmore site was originally developed in 1961 with the construction of two gravel-packed wells. These two original wells have since been abandoned because of poor water quality. The rated capacity of the three wells is 115 GPM (0.17 MGD). The Blackmore wells are pumped to a common point in the pumping station where sodium hypochlorite is injected for disinfection.

Willow Drive - The Willow Drive wells consist of two drilled, bedrock wells which were constructed in 1986 and upgraded in 2003. The 2003 upgrade included addition of high rate filtration to treat high concentrations of iron and manganese.

Each well is equipped with a submersible pump. Willow Drive Well #1 has a rated capacity of 150 GPM (0.21 MGD). Willow Drive Well #2 originally had a 225 GPM (0.32 MGD) yield. In June of 2002, this well was reamed and enlarged to a 12-inch well and deepened, increasing the well's yield to 500 GPM (0.72 MGD); 300 GPM (0.43 MGD) under normal operating conditions.

Junction Road - The Junction Road well was constructed in 1994 to as a supplemental supply. The Junction well produces a sustained flow of 150 GPM (0.21 MGD).

The flow capacities and other relevant data for each well facility are summarized on Table 2-7.

TABLE 2-7
SUPPLY CAPACITY OF THE SOUTH BERWICK WATER DISTRICT SOURCES

Source	Pumping Capacity (GPM)
Agamenticus	115
Blackmore	130
Willow Drive	300
Junction Road	150
Total	695

2.7.2.2 Treatment

The SBWD supplies require minimal treatment. Sodium hypochlorite (NaOCl) is added at each of the sources for disinfection purposes while the Willow Drive supply is filtered for iron, manganese and arsenic removal. Water quality data for each of the supplies taken from the 2001 Comprehensive Water System Facilities Plan is presented in Table 2-8.

2.7.2.3 Distribution Storage

The Powder House Hill Reservoir is a 1.0 million gallon (MG) reservoir located on Powder House Hill in South Berwick. The reservoir is constructed with two buried, concrete chambers each 70 feet wide by 70 feet long by 14 feet high. Each chamber has a total volume of 500,000 gallons. The tank has a base elevation of EL 283 feet (USGS) and an overflow elevation of EL 297.67 (USGS).

TABLE 2-8
GENERAL WATER QUALITY DATA FOR THE
SOUTH BERWICK WATER DISTRICT

Water Quality Parameter	MCL/ SMCL*	Blackmore	Agamenticus	Willow Drive
Total Hardness (as $CaCO_3$) (mg/L)	500	59	25	30
Total Chloride (mg/L)	250	35	12	12
Turbidity (NTU)	1.0	0.80	0.25	0.2
Nitrate Nitrogen (mg/L)	1.0	<0.01	<0.01	<0.01
Nitrite Nitrogen (mg/L)	10	<0.20	0.28	<0.20
Iron (mg/L)	0.30	0.54	<0.30	<0.02
Manganese (mg/L)	0.05	0.15	0.38	<0.05
pH	8.5	7.8	6.5	8.3
Copper (mg/L)	1.3	<0.010	0.02	<0.01
Fluoride (mg/L)	4.0	0.38	<0.20	0.25
Arsenic (ppb)	10	7	5	<4
Sodium (mg/L)	100	66.2	8.4	58
Zinc (mg/L)	5.0	0.006	0.034	0.008
Radon (pCi/L)	300/4,000	2,050 - 2,200	650 - 810	2,570 - 2,610

* MCL - maximum contaminant level; SMCL - secondary maximum contaminant level

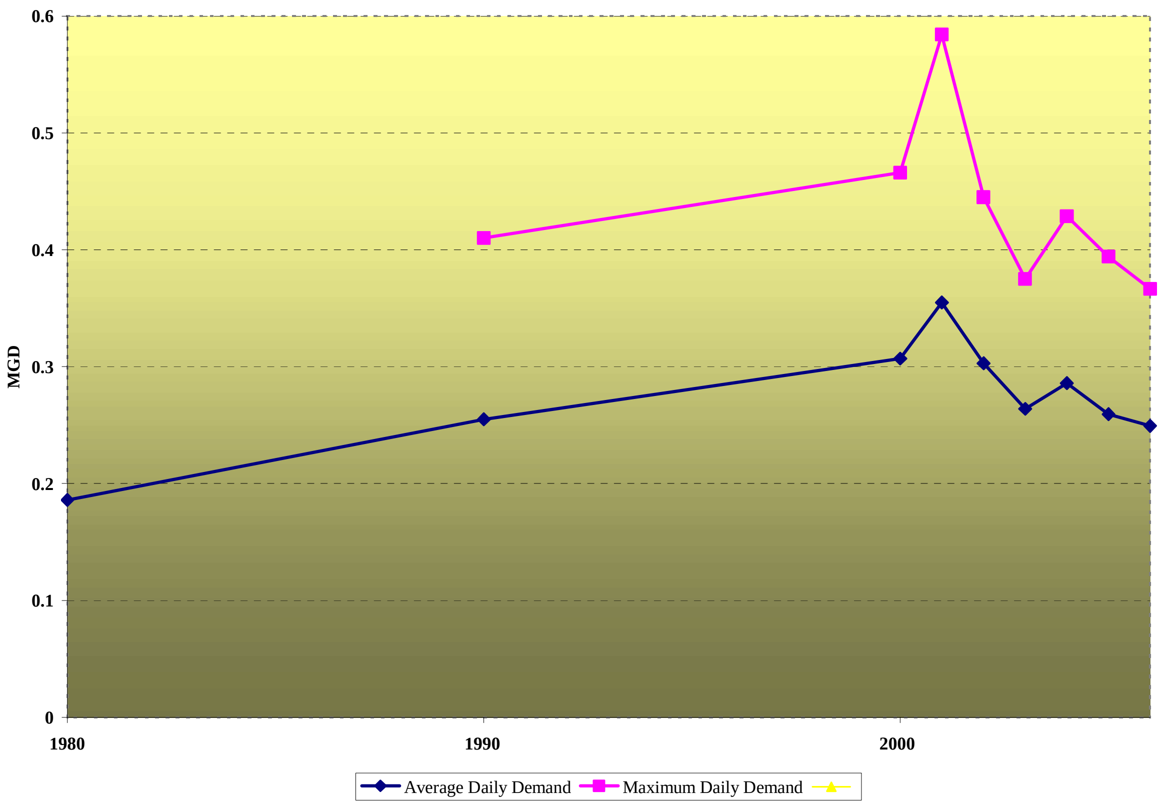
2.7.2.4 Water Distribution System

The SBWD water distribution system is comprised of water mains ranging in size from 1 ½-inch up to 12-inches in diameter. The system contains approximately 195,000 feet (36.9 miles) of water mains. The larger diameter mains are primarily cement-lined cast iron, cement-lined ductile iron and asbestos cement. Various piping materials are present for smaller diameter piping, 3-inches and smaller.

2.7.2.5 Demand Trends

The District currently maintains approximately 1,400 services over 90% which are of the residential type. Data collected from the 2004 - 2006 Public Utilities Commission Annual Reports indicates an average-day demand (ADD) of 0.26 MGD and a maximum-day demand (MDD) of 0.40 MGD. Historical demand data from 1980 - 2006 is presented on Figure 2-7.

FIGURE 2-7
DEMAND HISTORY FOR THE SBWD



2.7.3 Existing Interconnections and Inter-Municipal Cooperation

Similar to the Sanford Water District, because the SBWD maintains multiple sources spread throughout the service territory, they have not been concerned with interconnecting to neighboring systems for mutual aid purposes. However, they are now considering an interconnection with the North Berwick Water District near the intersection of Knights Pond

Road and US Route 4 near the South Berwick-North Berwick Town line. The interconnection will be used for emergency and mutual aid purposes only and is proposed to consist of a single, closed line valve.

2.7.4 Prior Studies and Reports

A Comprehensive Water System Facilities Plan was prepared in 2001 by Earth Tech, Inc. The study included an evaluation of the water system to identify service needs through the year 2020. Recommendations included supply augmentation (since completed), treatment of some of the groundwater supplies for iron and manganese control, source protection and distribution piping improvements.

The study also included an evaluation of potential interconnections with surrounding communities as an alternative to further groundwater development. Specific infrastructure improvements were identified for each of the interconnection concepts. A brief description of each interconnection opportunity follows.

2.7.4.1 Town of Rollinsford, New Hampshire

A preliminary design report was developed in year 2000 for an interconnection between the SBWD and the Town of Rollinsford, NH over the Salmon Falls River Bridge. The primary purpose of the interconnection was for South Berwick to augment flows to Rollinsford. The Town of Rollinsford subsequently constructed a new water filtration facility and the interconnection project was never developed. The South Berwick hydraulic gradeline is located at El 297 feet (USGS), approximately 73 feet higher than the gradeline in Rollinsford, El 224 feet (USGS). The study concluded that an interconnection opportunity with Rollinsford would be easy to accomplish at a reasonable cost because of the close proximity of the two respective distribution systems.

2.7.4.2 City of Somersworth, New Hampshire

The City of Somersworth is located northwest of South Berwick along the Salmon Falls River. The Somersworth and South Berwick water distribution systems are separated from each other by approximately 8,000 linear feet. An interconnection between the systems would require 8,000 feet of 12-inch diameter water main extending down Route 236 from the Buffumsville Road Bridge over the Salmon Falls River Bridge near the terminus of the Somersworth distribution system to South Berwick. Because the hydraulic gradeline of the Somersworth system is lower than the SBWD's system, a booster station would be required to transmit flows from Somersworth to South Berwick.

2.7.4.3 City of Dover, New Hampshire

The City of Dover, New Hampshire's water system is located approximately 15,000 linear feet southwest from the SBWD distribution system. An interconnection between the two systems would require the extension of water main along Portland Avenue through Rollinsford, New Hampshire to Main Street in South Berwick.

2.7.4.4 Kittery Water District, Kittery-Eliot, Maine

The terminus of the Kittery Water District distribution system is located approximately 9 miles from the South Berwick distribution system. At this location, Kittery has a large storage reservoir, the Eliot Tank.

In concept, an interconnection between the two systems would require a booster pumping station with 20 Hp pumps and approximately 38,000 linear feet of 12-inch water main along Route 236 from the end of the Kittery water system at the intersection of Route 236 and Beech Hill Road to the South Berwick system near the Great Works River.

2.7.4.5 Town of Berwick, Maine

The Town of Berwick is located on the Salmon Falls River, directly across the river from Somersworth, NH. Berwick's system is operated under a municipal department of town government. The Town of Berwick uses the Salmon Falls River as a source of supply. The Berwick water system operates on a hydraulic gradeline of El 475 feet (USGS).

The SBWD system terminates near a golf course on Route 4, and is separated by a distance of approximately 10,000 linear feet from the Berwick distribution system. In 2006, the Town of Berwick ceded water service of the Route 4 corridor within Berwick to the SBWD because of the close proximity of the SBWD to this commercially zoned area.

A hydraulic study was conducted by Wright-Pierce in 2006 to develop a service plan for this corridor north of the Berwick-South Berwick Town line and the Knights Pond Road area located in South Berwick. The study recommended a 12-inch main and storage tank to supply flows and fire protection to the Knights Pond Road area. This study should be re-visited if any planning efforts for regionalization along Route 4 are proposed north of this area to the North Berwick or Sanford Water District systems.

2.7.4.6 North Berwick Water District, North Berwick, Maine

The North Berwick Water District (NBWD) and SBWD systems are proposing an interconnection near Knights Pond Road. The NBWD is not participating in this study, but has critical piping infrastructure that may be important if regionalization in western York County is considered.

The hydraulic gradeline of the North Berwick system is approximately El 240 feet (USGS) (the exact elevation is not known and was estimated by the NDWD from known hydrant pressures).

2.7.4.7 Summary of Prior Regionalization Planning in the South Berwick Area

Potential interconnections between adjacent water systems are summarized in Table 2-9. The relevance of these local efforts in the context of the larger scope of this Report will be discussed where warranted later in this study.

TABLE 2-9
INTERCONNECTION REQUIREMENTS TO THE
SOUTH BERWICK WATER DISTRICT
FOR SURROUNDING MAINE AND NEW HAMPSHIRE COMMUNITIES*

Community	Water Main Required for Interconnection	Diameter of Water Main	Pumping Required
Rollinsford, New Hampshire	200 feet	8-inch	Yes
Somersworth, New Hampshire	8,000 feet	12-inch	No
Dover, New Hampshire	15,000 feet	12-inch	No
Kittery, Maine	38,000 feet	12-inch	Yes
Berwick, Maine	13,000 feet	12-inch	No
North Berwick, Maine	500 feet	12-inch	Yes

* Excerpted from 2001 SBWD Master Plan Report.

2.8 YORK WATER DISTRICT

2.8.1 Legislative Rights, Chartered Service Territory and Existing Service Area

The Town of York was originally supplied its drinking water beginning in 1896 from the York Shore Water Company. The York Water District was organized under Chapter 8 of the Private and Special Laws of 1929 by the State of Maine and was chartered to serve the Town of York. The charter was amended in 1967 to expand the territory of the District and modernize its charter. The expansion essentially granted the right of the Kittery Water District and Kennebunk, Kennebunkport & Wells Water District to serve small portions within York. It was amended again in 1981 to replace the former Chapter 8 with Chapter 14.

The existing service area generally encompasses the area east of US Route 1 to the ocean, the US Route 1 corridor, and a portion of the Route 91 corridor between US Route 1 and Interstate 95.

2.8.2 Existing Infrastructure

2.8.2.1 Supply

The primary source of water supply for the YWD is the Chase's Pond Reservoir. The pond receives flow from Welch's Pond and numerous small streams in the head waters of a branch of the Cape Neddick River. The drainage area encompasses approximately 2,090 acres, nearly 90% of which is owned by the District. The water surface area of Chase's Pond and Welch's Pond comprise 0.23 square miles of the total watershed. In a 2003 study, the safe yield of Chase's Pond was determined to be approximately 2.05 million gallons per day (MGD).

The Chase's Pond Dam was constructed in 1906. In 1950, the volume of the pond was increased by raising the height of the dam and extending embankments on either side of the dam. In 1986, major portions of the dam were rehabilitated.

In 1994, Anderson-Livingston Engineers (ALE) conducted a bathymetric survey and topographic survey of the shoreline of Chase's Pond. The bathymetric survey determined that the impoundment contains approximately 474.5 million gallons (MG) of active storage volume with the flashboard in-place. ALE also concluded that the active storage volume of the Pond could be increased to approximately 584 MG by raising the dam several feet. This change would also increase the safe yield of the Chase's Pond from approximately 2.05 MGD to 2.8 MGD.

2.8.2.2 Treatment

Raw water flows by gravity from through a 30-inch transmission main to the Josiah B. Chase Water Treatment Facility (WTF) located at Chases Pond. The facility was constructed in 1990 and has a maximum design capacity of 2,800 gallons per minute (GPM) (4.0 MGD).

The treatment process consists of a direct filtration technology system manufactured by CPC Engineering, Microfloc Products and includes chemical addition, clarification, filtration, disinfection, and corrosion control. Ammonia is added at the end of the clearwell to form chloramines in the treated water as a secondary disinfectant. High lift variable speed pumps deliver water to the system through a 16-inch transmission main via Old Post Road and Ridge Road.

The District's targeted finished water quality goals are presented in Table 2-7.

TABLE 2-10
FINISHED WATER QUALITY TARGETS FOR THE YWD

Parameter	Target
pH	8.8 units
Alkalinity	12 mg/L
Turbidity	<0.10 NTU
Color	<5 CVU
Iron	<0.05 mg/L
Total Organic Carbon	<2.0 mg/L

2.8.2.3 Distribution Storage

Distribution storage is provided by two storage facilities; the York Heights tank located in York Village and the Simpson Hill tank located near York Beach. The York Heights tank contains 2.0 MG's while the Simpson's Hill tank contains 3.0 MG's. The tanks operate at an overflow elevation of EL 189 feet (USGS). Either tank can be selected to control the operation of the pumps at the treatment facility.

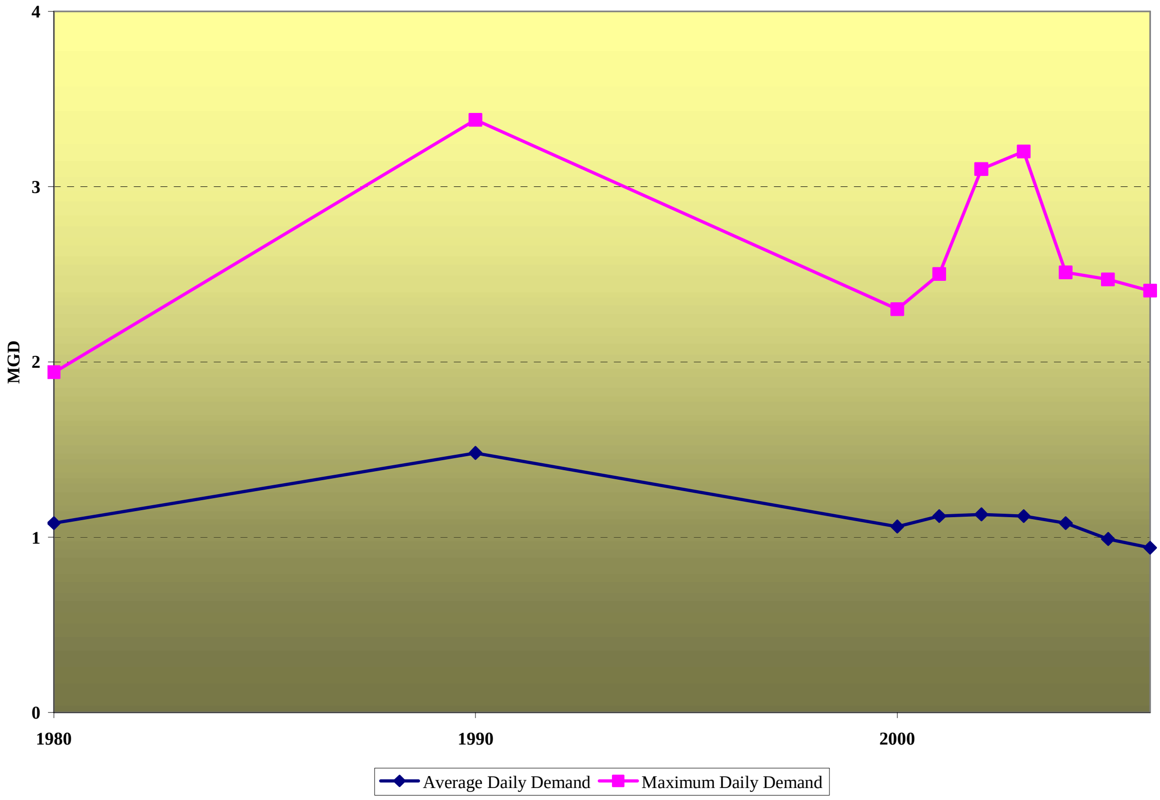
2.8.2.4 Water Distribution System

The primary distribution system piping includes approximately 82 miles of 6, 8, 10, 12, and 16-inch pipe. The system also includes a network of summer seasonal surface polyethylene lines which are generally 4-inch diameter and less, amounting to approximately 57,000 feet of pipe. The seasonal mains are drained in the fall and reconnected in the spring.

2.8.2.5 Demand Trends

The District currently maintains approximately 5,000 services. Over 90% of the existing service connections are residential. Data collected from the 2004 - 2006 Public Utilities Commission Annual Reports indicates an average-day demand (ADD) of 1.00 MGD and a maximum-day demand (MDD) of 2.46 MGD. Historical demand data from 1980 - 2006 is presented on Figure 2-8.

FIGURE 2-8
DEMAND HISTORY FOR THE YWD



2.8.3 Existing Interconnections and Inter-Municipal Cooperation

In 2003, York entered into an agreement with the Kennebunk, Kennebunkport & Wells Water District to share water under declared supply emergencies. The agreement fixed the cost of water to either system at $300/million gallons exchanged or the higher of the two Districts average annual unit cost, plus ten percent.

This interconnection required the design and construction of 16-inch transmission main between the two systems along US Route 1. The interconnection was designed to transmit up to 2.5 MGD by pumping from the KKW system to York and up to 1 MGD of water from York to the KKW system. KKW reports that approximately 0.50 MGD was transferred under the Mutual Aid/Emergency Agreement to York in 2005 and approximately 0.75 MGD in 2006.

However, in order for the YWD to transfer flow to KKW which operates at a higher gradeline, the District must pump flows through a booster pumping station. The station contains four pumps; two of which are rated for 1.0 MGD (700 gpm) and two smaller service pumps produce about 140 GPM (0.20 MGD) each. The York distribution system operates at a hydraulic gradeline of between El 185 feet (USGS) and El 190 feet (USGS) while the hydraulic gradeline in the KKW system is approximately El 210 feet (USGS).

A second interconnection was also constructed between York and the Kittery Water District. This interconnection consists of booster pumping which is designed to transmit 2 MGD from York to Kittery and 2.5 MGD from Kittery to York. The study which identified the hydraulic requirements of this interconnection is described below.

2.8.4 Prior Studies and Reports

2.8.4.1 Residential Service Study

In 2006, Wright-Pierce was commissioned by the District to conduct a study to provide new water service to a proposed residential development located along Route 91 in York. The analysis considered service from the YWD through an interconnection with the KWD. The study concluded with recommendation for the construction of a booster pump station to provide needed service pressures and fire flow capacity.

2.8.4.2 Emergency/Mutual Aid Interconnection

In 2004, Wright-Pierce conducted a study to identify the hydraulic requirements for an interconnection between the YWD and the KWD. The purpose of the study was to identify the proper location for a booster pumping station, to determine the hydraulic capacity of flowing water in either direction and identify improvements needed in either system to accommodate the increase in flows. The study was jointly funded between both Districts.

The study identified a location adjacent to the York River as the preferred location for a booster pumping station sized to provide a capacity of 1,400 GPM (2 MGD) from York to Kittery and 1,750 GPM (2.5 MGD) from Kittery to York. Identification of hydraulic constraints under various flow regimes, and piping upgrades and improvements were determined n the study. Piping for this interconnection has been installed and tested. The booster pumping station is scheduled for construction in 2008. In the interim, flows can be pumped across hydrants in an emergency until the pumping station is constructed.

2.8.4.3 Bell Marsh Reservoir and Chase's Pond Interconnection Study

In 2002, a study was conducted to interconnect Kittery's Bell Marsh Reservoir with York Water Districts' Chases Pond. The conceptual design consisted of a 2,100 GPM (3.0 MGD) pumping station and 18,000 linear feet of 16-inch high-density polyethylene transmission main between Bell Marsh and Chases Pond. The project, as conceived at the time, proposed installing the pipeline directly on the ground for summer transfers only and locating the pumping station below Bell Marsh Reservoir along Smelt Brook. The project was not pursued because the two participating District’s could not reach agreement on the value of water to be sold. The proposed cross country corridor is fully owned by both Districts so the project could be pursued in the future without the need for land access or easements.

2.8.4.4 Master Plan Study

In 2004, Wright-Pierce prepared a Master Plan for the entire water system to identify improvements needed to meet projected demands through 2025. The study concluded that both average and maximum daily demands are expected to double through the planning period. Recommendations included the development of additional supplies, upgrade of the water treatment facility to increase its capacity, distribution piping and storage improvements and reliability and vulnerability protection by interconnecting to the KKW system along US Route 1.

SECTION 3

EXISTING REGIONAL COOPERATION EFFORTS

WORKING TOGETHER TO IMPROVE THE LEVEL OF SERVICE

3.1 INTRODUCTION

The primary motivation for forming the Southern Maine Regional Water Council (SMRWC) was to collectively seek ways to address common issues facing water suppliers in southern Maine and to improve customer service. Since its inception, the SMRWC has explored many opportunities and synergies between members. Clearly, in its short tenure, the SMRWC has been able to demonstrate many significant benefits as a result of informal cooperation.

The purpose of this section is to briefly detail the on-going initiatives which the SMRWC currently engaged and is considering. It also identifies other areas of opportunity that the SMRWC hopes to explore in the future.

> *To collectively seek solutions to common water utility issues which result in measurable improvement in the quality of service provided to the customers served by SMRWC utilities.*

3.1.1 Existing Initiatives

3.1.1.1 Cooperative Purchasing Program - Chemicals

The SMRWC cooperative purchasing program was developed to increase the buying power of members for common purchases such as chemicals. The program has been facilitated by staff at the York and Portland Water Districts. In addition to the seven SMRWC members, the program has been expanded to "non-SMRWC members" and totals 21 participants, including some water utilities in New Hampshire. Through the program, members are able to purchase over 25 common chemicals used in water and wastewater treatment operations through volume discounts. The program has resulted in savings to customers ranging from 5 to 24 percent of yearly chemical expenditures.

3.1.1.2 Sharing of Staff and Personnel

One of the biggest challenges facing utilities in Maine and around the region is finding qualified operators and staff. The profession is challenged by an aging workforce and lack of qualified operators. The members have recognized this short-coming and have considered ways to share human resources. This has included recognition of each systems areas of expertise and identification of opportunities to share administrative, managerial and technical resources. The SMRWC believes that staff sharing will become more and more utilized overtime. To date, several of the systems have shared resources for minor engineering tasks and studies, training exercises and some construction related assistance.

Recent examples of cooperation were sharing of staff between the KKW and the YWD to install new chemical feed equipment at the York Water Treatment Facility and design and construction of the interconnection booster pump stations between York and the KKW system and between York and the KWD's system. These efforts provided a needed service and better value to the YWD than a private contractor.

3.1.1.3 Tank Maintenance

Member utilities have identified tank maintenance as one of the biggest annual expenses that each system faces on a yearly basis. Extensive resources are allocated for a variety of maintenance related tasks each year, including mechanical equipment upkeep, water main flushing and replacement, hydrant and valve repair, and water storage tank repair and preservation.

Routine rehabilitation and repair of steel water storage tanks is critical and costly maintenance function for utilities. Recognizing the potential for significant savings, members have created a program to consolidate tank coating and rehabilitation projects by bidding multiple tank rehabilitation projects as a single project with the intent of receiving more favorable pricing from coating specialists. The group has developed a standard technical specification template and common contractual language to streamline the process and identify materials and procedures for recoating steel tanks.

The process has already resulted in the consolidation of engineering and administrative tasks between systems and provided engineering resources at a good value to the smaller member utilities. A contract for recoating two steel tanks was recently advertised for bids in 2008; one for the Portland Water District and one for the York Water District. Once this contract has been completed, the group will revaluate its success and seek similar opportunities in the future.

3.1.1.4 Mutual Aid Agreements and Emergency Interconnections

One of the key elements which can be leveraged by combining the resources of multiple systems is the ability to supply/support one another with supplemental water service in times of need or emergencies. Several of the systems have already taken advantage of this opportunity and have engineered and invested in infrastructure required to physically connect to neighboring systems.

To date, agreements have been established between the Kittery and York Water Districts, the York and Kennebunk, Kennebunkport & Wells Water Districts and the Kennebunk, Kennebunkport & Wells Water District and the Biddeford & Saco Water Company. Each of these agreements contains certain and specific provisions for the transfer of water including; protocols for use of the interconnection, quantity and cost of exchanged water.

In addition, all seven water systems have entered into a Mutual Aid Agreement, the first of its kind in Maine. The Agreement provides for a legal, financial and communication framework for member utilities to assist each other in times of emergency. As a result of the experience gained from the development of the agreement, SMRWC members are now helping to expedite the rapid development of the recent Maine WARN initiative, currently underway at the Federal level.

3.1.1.5 Water and Wastewater Agency Response Network (WARN) Initiative

WARN is a system currently under development that is intended to eventually become a nation-wide emergency response program for water and wastewater systems. The program is designed to "provide a method whereby water/wastewater utilities that have sustained or anticipate damages from natural or human-caused incidents can provide and receive emergency aid and assistance in the form of personnel, equipment, materials, and other associated services as necessary from other water/wastewater utilities".

The program works by providing "rapid, short-term deployment of emergency services to restore the critical operations of the affected water/wastewater utility. The backbone of the WARN concept is the Mutual Aid and Assistance Agreement. It is in the Mutual Aid and Assistance Agreement where provisions for network activation, reimbursement, liability and other issues are mutually agreed upon by participating utilities".

SMRWC members may consider future participation in the program once it has been implemented.

3.1.1.6 Regional Meter Study

A subgroup of the SMRWC - KEYS - consisting of the Kittery, York, and South Berwick Water Districts obtained a $50,000 grant from the Maine Municipal Bond Bank to study possible consolidation of planning, purchasing and standardization of hardware, software, and technology related to water meters, water meter purchasing, water meter data collection, processing & billing software and related technology. The group strongly believes that implementing a sound comprehensive Plan will result in purchasing and operations efficiencies that will almost certainly provide some measure of cost savings.

The study concluded that each of the systems would benefit from collaboration by selecting the same meter equipment for all of the utilities. As a result, the Districts are again leveraging their collective size to procure similar equipment through a future purchase of new metering equipment. In addition, operations staff familiar with the new equipment can be shared to assist adjacent systems if needed.

3.1.1.7 Safety Training

Each member utility maintains an extensive safety program, designed for the welfare of their employees and to meet local, state and federal worker welfare laws and practices. Water systems operators and staff are in some cases mandated to participate in safety training in order to maintain licensing eligibility or as required by certain codes and standards. Several of the systems have combined forces and have conducted joint safety training exercises as well as classroom exercises.

3.1.1.8 Worker Uniform Purchase

In another effort to exploit their combined purchasing power, several of the systems have explored opportunities to standardize uniforms and work apparel. These efforts uncovered some commonalities between systems but generally concluded that standardization of uniforms and work apparel is often one of personal choice in addition to the many specific needs of each utility. They concluded that the procurement of uniforms and work apparel is best left to the individual utility. Their exploratory efforts did result in benefits to at least one of the members. The Kittery Water District reported that as a result of the study, they identified a new uniform company who is able to provide similar product at a lower cost.

3.1.1.9 Periodic & Annual SMRWC Meetings

The bylaws of the SMRWC require members participate in periodic business meetings. The by-laws also provide for an annual business meeting and preparation of an annual report to Trustees and other stakeholders, on the group's progress of the prior year's activities. The meetings promote communication where members engage in regular dialog of on-going initiatives and results in greater accountability between the systems. This forum has established formal communications between systems and identification of potential issues and ideas for enhanced mutual cooperation.

leverage this report to secure other grant and funding opportunities which could benefit the systems and customers.

3.1.1.13 Lobbying

The formation of the SMRWC has resulted in a much larger voice for the member utilities and customers served by the member systems. The SMRWC has been able to leverage its combined size to increase its influence over policy making and other issues which affect the water industry. The members all agree that this has been one of the most beneficial aspects of the SMRWC.

3.1.1.14 Public and Private Cooperation

In what may be an unprecedented relationship, the SMRWC includes primarily public water systems (Districts) as well a member from the private water supply arena - the Biddeford & Saco Water Company. On the surface, public verse private water suppliers would appear to have dramatically divergent agendas and purpose. Yet other than one utility serving the consumer "for-profit", there are far more similarities between the organizations than differences. All of the systems, whether public or private, are governed by the State of Maine Drinking Water Program (DWP), the State of Maine Public Utilities Commission (PUC) and the United States Environmental Protection Agency (EPA). Each organizations primary purpose is to provide reliable service and produce the highest quality water at the lowest cost. Over the long-term, the SMRWC hopes that the benefit of this relationship between public and private water providers will bring rise to a higher level of service to the customers served by these organizations.

3.1.2 Future Opportunities

In addition to the on-going initiatives and programs outlined above, the SMRWC has discussed other *potential* future opportunities which could be explored as interest and resources are made available. These include the following.

3.1.2.1 Shared Dedicated Staff

The success of the initiatives and programs identified and developed by the SMRWC are largely dependent upon champions within the organization who can devote the time and talent to the task at hand. In recognition, the members may consider hiring of a position to oversee and drive existing and potential initiatives.

3.1.2.2 Materials Purchasing

Similar to the chemical purchasing and tank maintenance programs, the members hope to expend their combined purchase power into material purchases such as pipe, valves, hydrants and other water service related products.

3.1.2.3 SCADA/GIS

Many of the members systems utilize computerized Supervisory Control and Data Acquisition Systems (SCADA) as well as Geographical Information Systems (GIS). The organization may consider potential opportunities to share ideas, experiences, procedures and processes used in the development, use and maintenance of SCADA and GIS systems.

3.1.2.4 Equipment Purchasing

The combined systems own a large array of equipment and machinery used for the service, maintenance and installation of various water system components. In the future, the group may explore possibilities of sharing or renting equipment, such as construction machinery, portable generators, analytical equipment, etc.

3.1.2.5 Consolidation of Administrative and Billing Tasks

One area which the SMRWC members have considered for future discussion is the merit for the creation of a centralized call or administration center to handle billing, service connections and callouts and other water administrative functions common to each system.

SECTION 4

HISTORICAL & PROJECTED POPULATION AND DEMAND TRENDS

WHAT DOES THE FUTURE HOLD?

4.1 INTRODUCTION

Over the past several decades, many of the communities in the southern Maine region have seen significant growth unlike any other time in their history. This growth has placed pressure on community services and public utilities including water suppliers. In response and as a way of managing the pressure placed on the infrastructure, many communities have developed and implemented growth ordinances, established new zoning ordinances, and instituted impact fees/charges. Three of the SMRWC member utilities (Kennebunk, Kennebunkport & Wells Water District, South Berwick Water District and York Water District) have instituted system development charge fees (Impact Fees) as a tool to fund future infrastructure needs caused by growth. As reported by the State of Maine Planning Office (SPO), York County had the highest growth rate of any county in the State of Maine for the period of 1990 - 2004. SPO population projections suggest that this trend in population growth will continue through the year 2020. Population data for Cumberland and York Counties is presented in Table 4-1.

TABLE 4-1
POPULATION TRENDS AND FORECASTS FOR YORK AND CUMBERLAND COUNTIES*

County	1970	1980	1990	2000	2020
Cumberland	192,528	215,789	243,135	265,612	300,000
York	111,576	139,666	164,587	186,742	241,300

* Population trend data obtained from the US Census Bureau. Projections for the year 2020 provided by the Maine SPO.

Adequate potable water supply in most of southern Maine is recognized as a limited resource primarily characterized by smaller groundwater aquifers, saline bays and estuaries, and small river basins. The two largest available supplies in the region are the Saco River and Sebago Lake. Both of these supplies are located in the northern extremity of the SMRWC service area currently being utilized as supplies for the Biddeford & Saco Water Company and the Portland Water District. Transmission of water from these sources to southern areas of the SMRWC may be a costly. The challenge faced by member water utilities has and will continue to be how best to serve the public with the highest quality and quantity of water at the lowest cost.

The purpose of the section of the report is to develop an understanding of the existing supply limitations within the southern Maine region. This will require review of historical water usage and population trends as well as the development of future population and water demand projections within each member service area. Section 6 will assess the current supply availability and the limitations of infrastructure to deliver the level of service expected by customers. In some cases where individual community master plans exist, this information was consolidated and is repeated in this document for consistency purposes.

Projections of water use are typically based on population forecasts and knowledge of growth patterns in a community. Hence, projections of future water use typically consider population trends and projections, historical customer growth trends within the service area, current and proposed zoning and land use ordinances, municipal comprehensive plans and studies, developable land data, and projections of future growth and its location within a community.

While a detailed and exhaustive population and demand analysis was not included in the scope of this study, a basic understanding of population trends and projections is valuable to plan for future water supply and infrastructure needs. An important aspect of the planning process is to plan for upgrades and/or additional water works facilities in advance of realizing the future demand. A 20-year planning period is usually chosen to project the future demand. Some infrastructure, such as water pipes, storage tanks, or a reservoir, have a long service life and thus require long planning periods of 50 or more years; however, other infrastructure such as pumps and treatment typically have a shorter service life and planning for only 20 years is necessary. A 20-year planning period is usually chosen for comprehensive facility plans because of the higher degree of confidence in planning projections. In the case of this study, a regional water system and regional water supply plan that seeks to protect and manage water supplies is likely to be a long-term proposition at best, yet long-term projections can provide tremendous value and guidance on where to focus future resources. Therefore, this study will consider projections extending out to year 2050.

Numerous factors can impact population and water use projections, including economic conditions, new development (residential, industrial and commercial), changes in land-use patterns or zoning, conservation efforts, and regulatory limitations. For instance, many of the southern Maine coastal communities serve a significant seasonal population and tourism-based businesses, therefore, economic conditions are likely to be the most significant factor that can effect projections for these areas. Declines in the economy, similar to the recession that occurred in late 2001, can tend to reduce visitation and hence water-use by seasonal populations.

Conversely, economic development can be accompanied by increases in resident population. An example of a specific development that would have regional water supply implications would be the Portsmouth Naval Shipyard in Kittery. This major regional employer has been identified for military realignment and may not continue as a sustainable employer for the region. Similarly, the closing of the Pease Air Force Base in Portsmouth, New Hampshire created economic disruption due to population loss throughout York County Maine in the 1990's. Generally, residential growth is the primary driver of increased water-use in the region.

4.2 PROJECTION METHODOLOGY

Projections of population and demand can be challenging and only as good as the validity of the available data and the ability of the planner to see far and accurately into the future. The reality is that precise projections are not possible for a planning period extending out much greater than 10 years for infrastructure planning. However, good approximations can be made which are adequate for long range supply planning purposes for periods of 50 years or more.

Understanding the potential future growth of demands in a water system is one of the most important aspects to understanding future water needs. In general, a community's population can be related to the total water demand of a community. Residential water demand is directly related to population in a community. Commercial, municipal and industrial water demands also tend to vary proportionally to a community's population growth.

Three projection methodologies were considered for calculating population and demand projections for this study. The three scenarios considered were:

- Option 1 - A "Regulated" scenario under the current Maine Public Utilities Guidelines for water system expansion.
- Option 2 - A "Deregulated" scenario for water system expansion.
- Option 3 - A combination of Option 1 and Option 2.

Each offers distinct advantages and disadvantages as detailed below.

- **Option 1 - The "Regulated" Scenario**

  Option 1 considers projections based on the current regulatory climate where extension of water service to new customers is governed by the Maine Public Utilities Commission (MPUC) under Chapter 65 of the Rules and Provisions.

  This policy requires the customer, developer or end water user to fund extensions of distribution infrastructure provided that the utility has adequate capacity to do so. All of the SMRWC utilities are either private water companies or quasi-municipal utilities which are regulated by the PUC rules. These utilities are not affiliated with local or regional planning agencies and can not extend service to meet a planning objective; however, regulation does allow extension of service if requested. The MPUC policy can, but does not necessarily, curtail expansion of service. Out-migration from urban centers can result in lower water-use for the utility. In addition, there is no obligation of a utility to serve rural and suburban areas because of the prohibitive cost to extend service which must be borne by the immediate user. As a consequence of this policy, much of the population growth in the region may not be served by public water supplies.

Option 1 assumes that the ratio of the existing served residential population to the total population within the service area will remain constant into the future. It also assumes that projected commercial, industrial and governmental customer demands will remain proportional to the existing residential demand.

As an example, if community "A" has a current total population of 2,000 persons yet the water system only serves 1,000 persons; the percentage of population served in that community is 50%. This projection model would assume that 50% of all new residents would be served by public water from the existing system or by extensions of service.

This approach produces the lowest projection of growth, projected demands and infrastructure upgrades required to accommodate increases in demand. This method also tends to mirror current planning initiatives which suggest flat to moderate growth throughout the planning period. However, it is the least conservative projection method, and excludes potential growth outside the present service territory boundaries.

- **Option 2 - The "Deregulated" Scenario**
  Option 2 assumes that water utilities in the State of Maine will eventually be deregulated allowing utilities to extend water infrastructure beyond present service boundaries. Under this scenario, the utilities are projected to serve a larger percentage of the projected population growth because utilities will be free to extend water to serve new development. The existing customer base or implementation of an impact fee system or system development type of rate structure would fund improvements in an unregulated environment. This policy would tend to promote growth and development. Presently, there is no political support for deregulation of the waterworks industry in the State of Maine.

The approach assumes that all residential population growth and currently un-served customers within each utilities service territory will be served. Similar to Option 1, the demands for commercial, industrial and governmental customer classes will be extrapolated based on current ratio of consumption to residential demand.

This approach produces the most conservative (highest) water use projections of the three Options under consideration. This would tend to lead to over sizing of infrastructure investment for growth which may or may not be realized or require public water in the future. However, from a strictly resource perspective, water supply planning and protection of supply resources are long-term decisions. As an example, consider the current situation regarding water supply for the greater Boston, Massachusetts metropolitan area. The original planners of the Massachusetts Water Resources Authority (MWRA) Quabbin Reservoir and aqueduct system had the vision to design and construct large facilities suitable for a 100 year or more planning period. Under today's economic conditions, land valuations alone would make large scale expansion of the MWRA reservoir system for increased yield cost prohibitive.

- **Option 3 - The "Regulated/Deregulated" Scenario**

  This Option considers a potential scenario where the industry remains regulated for the next 20-years after which the industry becomes deregulated. Under this scenario, demand growth is projected to remain flat to moderate during the regulated period, and then increase substantially as the industry becomes deregulated. The State of Maine has the most highly regulated water industry of any New England state.

  The quasi-municipal water district predominates in the state because of the more rural character and tendency for the sources of supply to be located outside the population centers and municipal boundaries of most communities. In other New England states, the water utilities tend to be municipal water departments which develop and expand in accordance with common municipal zoning and planning guidelines. This could be reflective of a future deregulated industry in the State of Maine and therefore worthy of consideration for projections of future water use.

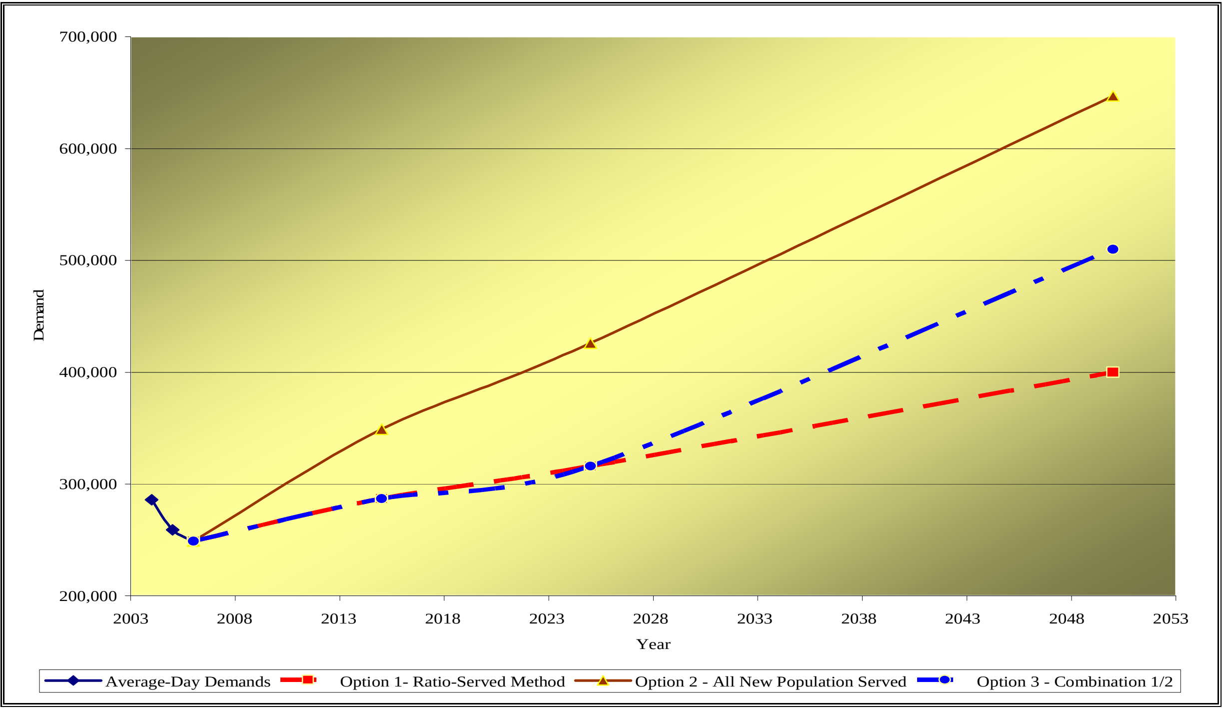
This methodology assumes that the ratio of the existing served residential population to the total population within the service area will remain constant for the next 20-year period. Beyond 20-years, this model assumes that all residential population growth and currently un-served customers within each member utility's service territory will eventually be served by public water. Similar to Options 1 and 2, projected commercial, industrial and governmental customer demands will remain proportional to existing residential demand.

This approach represents a compromise on the extent of population growth in the region that will require public water service. It also offers predictable growth during the early years when reasonable data is available and prepares utility members for a possible worst case high growth scenario far into the future. The downside to this approach is that deregulation may not occur in later years leading to overly conservative projections.

As an example, the South Berwick Water District was selected to illustrate and compare the three projection approaches. Figure 4-1 presents the data graphically where the years 2004, 2005 and 2006 were used as the historical "starting point". Projections beyond 2006 were developed from projections of population and extrapolation of existing demand trends.

Following a series of workshops with the utility members and presentations of each projection approach, SMRWC members selected Option 1 as the most reasonable approach and because it is consistent with current utility law and policy. The analysis contained in this report will be based on water-use projections using Option 1.

FIGURE 4-1
DEMAND PROJECTIONS FOR THE SOUTH BERWICK WATER DISTRICT



4.3 POPULATION TRENDS AND PROJECTIONS

To better understand the population demographics in each member community and the southern Maine region, historical population data was collected from a variety of sources listed below. These sources generally rely on the U.S. Census Bureau for historical data. Historical and projected population trends and estimates for each utility are presented in Table 4-2.

- Greater Portland Council of Governments (GPCOG)
- Southern Maine Regional Planning Commission (SMRPC)
- Maine State Planning Office (SPO)
- US Census Bureau
- Municipal Comprehensive Plans and Land-use Zoning Documents
- Independent Studies completed by SMRWC Member Systems

In general, projections prepared by local planning agencies (GPCOG and SMRPC) were used over projections by state and federal planning agencies.

TABLE 4-2
POPULATION TRENDS & PROJECTIONS OF SMRWC SERVED COMMUNITIES

Water System	Town/City	1990[1]	2000[1]	2006 Projection[2]	2025 Projection[3]	2050 Projection[2]
BSWC	Biddeford	20,710	20,942	21,318	22,507	24,072
	Old Orchard Beach	7,789	8,856	9,353	10,927	12,998
	Saco	15,181	16,822	17,686	20,423	24,024
	Subtotal	**43,680**	**46,620**	**48,357**	**53,857**	**61,094**
KK&W	Arundel	2,669	3,571	3,857	4,762	5,953
	Kennebunk	8,004	10,476	11,195	13,472	16,468
	Kennebunkport	3,356	3,720	3,951	4,683	5,646
	Ogunquit	974	1,226	1,277	1,440	1,654
	Wells	7,778	9,400	10,073	12,205	15,010
	Subtotal	**22,781**	**28,393**	**30,354**	**36,562**	**44,731**
KWD	Kittery	9,372	9,543	9,783	10,541	11,539
	Elliot	5,329	5,954	6,202	6,986	8,018
	Subtotal	**14,701**	**15,497**	**15,984**	**17,527**	**19,557**
PWD	Cape Elizabeth	8,854	9,068	9,279	9,947	10,826
	Cumberland	5,836	7,159	7,619	9,077	10,995
	Falmouth	7,610	10,310	10,943	12,947	15,584
	Gorham	11,856	14,141	15,104	18,155	22,169
	Portland	64,157	64,249	65,180	68,130	72,011
	Scarborough	12,518	16,970	18,357	22,750	28,530
	South Portland	23,163	23,324	23,882	25,647	27,970
	Standish	7,678	9,285	9,892	11,816	14,347
	Westbrook	16,121	16,142	16,553	17,856	19,570
	Windham	13,020	14,904	15,824	18,737	22,570
	Subtotal	**170,813**	**185,552**	**192,634**	**215,062**	**244,572**
SWD	Sanford	**20,463**	**20,806**	**21,424**	**23,383**	**25,960**
SBWD	South Berwick	**5,877**	**6,671**	**7,096**	**8,443**	**10,215**
YWD	York	**9,818**	**12,854**	**13,574**	**15,854**	**18,854**
	TOTAL	**288,133**	**316,393**	**329,424**	**370,688**	**424,983**

[1]From US Census [2]Projected By W-P [3]Projected By GPCOG

4.4 DEMAND TRENDS AND PROJECTIONS

4.4.1 Historical Demand Trends

Historical water production data was collected from each utility between 1980 and 2006. Detailed revenue or metered water-use data was collected from the annual Maine Public Utilities Reports for each utility for the years 2004-2006 (revenue data prior to this period was not available). The historical water-use data will be used as the framework for developing demand projections. A summary of water production, revenue (metered) and non-revenue water use for each system is presented in Tables 4-3, 4-4, 4-5, 4-6, 4-7 and 4-8.

The tables include historical average- and maximum-day demands as well as the ratio of maximum-day demands to average-day demands (MDD/ADD) for the three year period. Average-day demand is defined as the total water production in a year divided by 365 days. The maximum-day demand is defined as the maximum day of water production that occurs during a given year. The MDD/ADD ratio indicates the magnitude in demand fluctuation between average and maximum demands and is useful for the calculation of projected demands. For the southern Maine member systems, the maximum-day demand occurs during the summer months as a result of expanded service connections for summer residents, summer water use by the tourist industry and from increased use of irrigation and lawn watering. The maximum-day demand period can be sustained for a 3-5 month period requiring more robust supply planning than demand patterns that occur in non-tourist areas.

The tables also include the peak-hour demand which is the highest hourly flow during the year. The peak hourly flow is usually estimated from tank level trending data. Hourly water-use follows a diurnal water-use curve with higher water use during morning and evening hours. During a maximum-day condition, supply pumps should produce the daily needs by pumping the required daily flow at a steady, even rate over a 24-hour pumping period. When hourly usage exceeds this average pumping rate, storage tanks drain into the distribution system to make up the difference that the pumping systems do not provide. When hourly usage is less than the pumping rate such as at nighttime or during the mid-day period, storage tanks compensate by filling. Understanding hourly water-use is important for sizing storage tanks and for studying distribution systems but is not necessary for supply planning purposes.

TABLE 4-3
BSWC PRODUCTION AND SALES HISTORY IN GALLONS PER DAY

Category	2004	2005	2006	Average
Un-metered Sales to Gen. Customers	40,885	40,825	37,208	39,639
Un-metered Sales to Commercial	13,975	14,337	13,099	13,804
Residential Sales	3,168,000	3,254,293	3,120,690	3,180,995
Commercial Sales	1,277,255	1,326,677	1,247,521	1,283,817
Industrial Sales	202,148	190,074	165,753	185,992
Public Authorities	77,693	81,293	74,477	77,821
Non-Revenue	1,355,641	723,052	716,660	931,784
Production (Average Daily Demand)	6,135,597	5,630,551	5,375,408	5,713,852
Maximum Daily Demand	11,140,000	10,970,000	9,430,000	10,510,000
Peak-Hour Demand	14,040,00	13,820,000	11,888,00	13,250,000
MDD/ADD	1.81	1.95	1.75	1.84

TABLE 4-4
KKW PRODUCTION AND SALES HISTORY IN GALLONS PER DAY

Category	2004	2005	2006	Average
Residential Sales	1,371,723	1,404,523	1,345,923	1,374,057
Commercial Sales	811,159	796,271	799,337	802,256
Industrial Sales	51,896	49,079	50,551	50,509
Public Authorities	0	0	0	0
Non-Revenue	595,897	545,223	515,290	552,137
Production (Average Daily Demand)	2,830,675	2,795,097	2,711,101	2,778,958
Maximum Daily Demand	6,340,000	6,700,000	6,000,000	6,350,000
Peak-Hour Demand	10,500,000	11,000,000	7,500,000	9,670,000
MDD/ADD	2.11	2.39	2.22	2.24

TABLE 4-5
KWD PRODUCTION AND SALES HISTORY IN GALLONS PER DAY

Category	2004	2005	2006	Average
Residential Sales	676,742	685,063	655,805	672,537
Commercial Sales	127,836	123,879	116,025	122,580
Industrial Sales	108,367	108,164	104,986	107,173
Public Authorities	1,574,921	1,371,701	1,299,329	1,415,317
Non-Revenue	402,027	323,792	184,830	303,550
Production (Average Daily Demand)	2,889,893	2,612,600	2,360,975	2,621,156
Maximum Daily Demand	4,416,000	4,439,000	4,399,000	4,420,000
MDD/ADD	1.53	1.70	1.86	1.70

TABLE 4-6
PWD PRODUCTION AND SALES HISTORY IN GALLONS PER DAY

Category	2004	2005	2006	Average
Residential Sales	9,249,940	9,190,792	9,137,638	9,192,790
Commercial Sales	4,109,992	4,133,647	3,969,137	4,070,925
Industrial Sales	4,226,244	4,078,036	4,009,164	4,104,481
Public Authorities	962,299	981,244	942,055	961,866
Non-Revenue	5,327,299	5,020,532	4,337,219	4.895.016
Production (Average Daily Demand)	23,875,773	23,404,249	22,395,214	23,225,079
Maximum Daily Demand	33,620,000	37,153,000	37,357,000	36,040,000
Peak Hour Demand	36,000,000	36,000,000	38,000,000	36,667,000
MDD/ADD	1.40	1.58	1.63	1.54

TABLE 4-7
SWD PRODUCTION AND SALES HISTORY IN GALLONS PER DAY

Category	2004	2005	2006	Average
Residential Sales	1,066,737	1,095,334	992,858	1,051,643
Commercial/Industrial Sales	726,340	721,315	716,151	721,268
Public Authorities	0	0	0	0
Non-Revenue	602,356	641,433	872,186	705,325
Production (Average Daily Demand)	2,395,433	2,458,082	2,581,195	2,478,237
Maximum Daily Demand	3,200,000	3,100,000	3,100,000	3,130,000
Peak Hour Demand	3,600,000	3,600,000	4,500,000	3,900,000
MDD/ADD	1.33	1.24	1.19	1.26

TABLE 4-8
SBWD PRODUCTION AND SALES HISTORY IN GALLONS PER DAY

Category	2004	2005	2006	Average
Residential Sales	199,855	199,567	189,817	196,413
Commercial Sales	27,752	27,558	26,089	27,133
Industrial Sales	0	0	0	0
Public Authorities	7,486	7,445	8,765	7,899
Non-Revenue	51,601	24,788	24,558	33,649
Production (Average Daily Demand)	286,694	259,358	249,229	265,094
Maximum Daily Demand	429,000	394,000	367,000	396,000
Peak Hour Demand	-	-	-	-
MDD/ADD	1.50	1.52	1.47	1.50

TABLE 4-9
YWD PRODUCTION AND SALES HISTORY IN GALLONS PER DAY

Category	2004	2005	2006	Average
Residential Sales	573,160	559,000	521,141	551,100
Commercial/Industrial Sales	201,500	204,000	219,000	208,167
Public Authorities	16,600	26,699	40,500	27,933
Non-Revenue	294,847	197,444	157,833	216,708
Production (Average Daily Demand)	1,086,107	988,142	938,474	1,004,241
Maximum Daily Demand	2,510,000	2,470,000	2,405,000	2,460,000
Peak Hour Demand	3,610,000	3,070,000	4,720,000	3,800,000
MDD/ADD	2.32	2.49	2.56	2.46

The data indicates that water production from each member utility has remained relatively stable over the period of 2004-2006. For some utilities however, water production or demands has declined. Nearly all member utilities reported that the decrease in production was likely the result of cooler and wetter conditions during the summer months of 2005 and 2006. It is important to note that master planning studies for specific utilities should be based on studying historical water usage over a longer period of time to better understand usage trends. Demands and water usage over a shorter period of time can be influenced by weather conditions, fire flows, flushing, leaks, lost or unaccounted-for water, meter calibration, changes in water rates and other factors that affect water demands on a year to year basis.

For the purposes of a broad, regional study, a smaller 3-year subset of this historical data has been selected to understand per capita water use for projecting demands forward to year 2050 for the region.

4.4.2 Historical Service Trends by User Class

The number of service connections by user or customer class will be used to project the portion of the residential population within the service territory of each utility and to estimate the current portion of the population served by public water. Data from the Maine PUC 2006 annual report will be used for this calculation. Table 4-10 summarizes the total number of services reported in 2006 for each water system.

TABLE 4-10
SERVICE CONNECTIONS BY USER CLASS

Category	BSWC	KKW	KWD	PWD	SWD	SBWD	YWD
Residential	13,587	11,124	4,803	45,487	5,476	1,300	4,666
Commercial	1,238	1,210	287	3,536	131*	77	327
Industrial	43	17	3	95	-	0	0
Public Authorities	99	0	243	456	0	16	47
TOTAL	14,967	12,351	5,337	49,574	5,607	1,393	5,040

*SWD reports commercial and industrial users as a single customer class.

4.4.3 Historical Demand by User Class

As discussed earlier, the projection methodology selected for this study will assume that the ratio of water-use by non-residential customers to residential customers will remain the same in the future as the ratio observed in 2006. This is a reasonable assumption based on historical trends and is a practical way to model commercial water-use which typically mirrors growth in residential water-use. Industrial water-use is much more difficult to predict in the future so an assumption that industrial water-use will also follow a similar trend seems reasonable.

Table 4-11 presents a summary of the water-use by customer class as well as a ratio of that water-use to the residential-use using 2006 data. The data illustrates two points; (1) that most of the current use in each system is residential suggesting that population growth and related residential water-use is the best predictor of future demands and, (2) the smaller percentage of commercial and industrial use will be projected to remain in a similar ratio into the future and is less important as a predictor of future demands.

TABLE 4-11
2006 RATIO OF USE BY CUSTOMER CLASS TO RESIDENTIAL USE IN PERCENT

System	% of….	Residential	Commercial	Industrial	Public Authorities	Non-Revenue
BSWC	Total Production	58.5	23.4	3.1	1.5	13.5
	Residential	-	40.3	6.4	2.5	23.0
KKW	Total Production	49.6	29.5	1.9	0	19.0
	Residential	-	59.4	3.8	0	38.3
KWD	Total Production	27.8	4.9	4.5	55.0	7.8
	Residential	-	17.7	1.6	198.1	28.2
PWD	Total Production	40.5	17.8	18.0	4.2	19.5
	Residential	-	43.4	43.9	10.3	47.5
SWD	Total Production	38.5	27.7	*	0	33.8
	Residential	-	72.1	*	0	87.9
SBWD	Total Production	76.1	10.5	0	3.5	9.9
	Residential	-	13.7	0	4.6	-
YWD	Total Production	55.5	23.3*	-	4.3	16.8
	Residential	-	42.0	-	7.8	30.3

*SWD and YWD reports Commercial and Industrial use as a single customer class.
** - YWD reports all customer use in one user category.

4.4.4 Historical Per Capita Use

Per capita water usage is amount of water metered and consumed by each member of a household. For example, an average household size of three family members that consumers 300 gallons of water per day (gpd) has a per capita water consumption of 100 gpd/capita. Per capita consumption is regulated in many states as a means of promoting water conservation and demand management. Per capita consumption is also important in understanding the trends of residential users in the system and is often used as a basis for making projections of future water needs. In the State of Maine, two demographic conditions are leading to less water use per service connection: (1) our aging population and (2) trends towards smaller family size within urban centers and compact areas and within the State of Maine and the nation as a whole. On this basis, per capita water-use is the best method to predict future residential demand, not water-use per service connection. Our analysis assumes that future per capita water-use will not be regulated and that present voluntary water conservation and demand management practices will remain under local control.

Residential per capita figures were calculated by dividing the average of the 2004-2006 residential revenue water sales volume by the product of the number of residential services multiplied by the average housing density of the service area.

$$\text{Revenue Sales} \div (\text{Services x Housing Density}) = \text{Per Capita Water Use}$$

The average housing density for each system was collected and consolidated from the Southern Maine Regional Planning Commission, municipal planning agencies, existing individual utility master planning reports, and the US Census Bureau for each community in the study region. For the water systems that provide service to multiple communities, the household size data was averaged from the service communities. This data is presented in Table 4-12.

TABLE 4-12
AVERAGE HOUSING DENSITY WITHIN SERVICE AREA

Member System	Persons/Household
BSWC	2.24
KKW	2.25
KWD	2.41
PWD	2.52
SWD	2.46
SBWD	2.75
YWD	2.40

A summary of the average residential per capita water use for 2004 - 2006 by system is presented in Table 4-13. Typically, per capita water-use varies markedly by community and water system and can be affected by affluence, housing density; demographics and water rate incentives. The data reflects some of this variance in the region and by utility.

TABLE 4-13
RESIDENTIAL PER CAPITA WATER-USE BY UTILITY

Utility	Per Capita Water Use (gallons per day)
BSWC	105
KKW	55
KWD	58
PWD	80
SWD	78
SBWD	55
YWD	56

4.4.5 Estimates of the Historical Served Residential Population

The projection methodology selected for this study assumes that the ratio of the *year-round* residential population presently served by the utility (base year 2006) will remain the same throughout the planning period; this calculation excludes the summertime increase in service, most of which is presumed to be included in the total service connection figure. This will tend to overestimate the percentage of actual served population in some cases with a high influx of tourism but is appropriate from a long-term planning perspective. A summary of the estimated served residential population by utility is presented in Table 4-14. The 2006 served population was calculated by multiplying the number of residential services by the average housing density within the utility.

TABLE 4-14
ESTIMATE OF THE 2006 SERVED POPULATION BY SYSTEM

Member System	Estimated 2006 Population	Estimated 2006 Persons Served	% Population Served
BSWC	48,357	30,390	63
KKW	30,354	24,985	82
KWD	15,984	11,551	72
PWD	192,634	152,582	79
SWD	21,424	13,471	63
SBWD	7,096	4,258	60
YWD	13,574	11,198	82

4.4.6 Water Demand Projections

Water demand projections are determined by making estimates of future population and applying historical demand data. A detailed water audit/analysis was not part of the scope of this study. As presented at the beginning of this Section, the method chosen for making the demand projections assume the following:

- Water demand projections assume that the ratio of the percentage of residential customers served to the total service population from 2006 would remain the same throughout the planning period for each water system.
- The estimated served population multiplied by per capita water-use results in the projection of residential demand projection.
- Commercial, industrial, governmental and unaccounted-for water-use projections remain proportional to the residential use in 2006.
- The level of detail is sufficient for the needs of a regional study.

Projected maximum-day demand (MDD) projections were calculated by multiplying the historical MDD/ADD ratio presented previously for each utility to the projected average-day demands. In some cases, minor adjustments were made to coincide with prior master planning estimates which may have been based on older data or are more refined because of the larger historical data set used to establish the local utility projections. In the case of the Portland Water District, estimates were used from the 2003 Comprehensive Water System Service Plan (CWSSP). In the case of the York Water District, projections were made assuming that all of the historical demand consisted of residential growth.

Table 4-15 presents the results of the projection analysis for 2025 and 2050 for each utility. The demand projections should be re-visited periodically throughout the planning period and revised if necessary. The demand projections should be kept in proper context for this study and the local ramifications of the analysis within each water system.

Trends and projections of average and maximum-day water demands for each utility are presented graphically on Figures 4-2, 4-3, 4-4, 4-5, 4-6, 4-7 and 4-8.

TABLE 4-15
AVERAGE (ADD) AND MAXIMUM DAY DEMAND (MDD) PROJECTIONS BY SYSTEM IN MGD

Member Utility	Historical MDD/ADD Ratio	Demand	2006	2025	2050
BSWC	1.84	ADD	5.72	6.13	6.95
		MDD	10.51	11.27	12.78
KKW	2.24	ADD	2.83	3.27	4.00
		MDD	6.35	7.32	8.95
KWD	1.70	ADD	2.62	2.84	3.16
		MDD	4.42	4.78	5.34
PWD	1.54	ADD	23.45	32.73	42.00
		MDD	36.04	47.78	60.90
SWD	1.26	ADD	2.50	2.49	2.80
		MDD	3.13	3.11	3.46
SBWD	1.50	ADD	0.26	0.32	0.39
		MDD	0.40	0.49	0.60
YWD	2.46	ADD	1.00	1.12	1.33
		MDD	2.46	2.75	3.27
Southern Region	-	ADD	38.38	48.90	60.63
		MDD	63.31	77.50	95.30

FIGURE 4-2
BSWC AVERAGE AND MAXIMUM-DAY DEMAND PROJECTIONS IN MGD

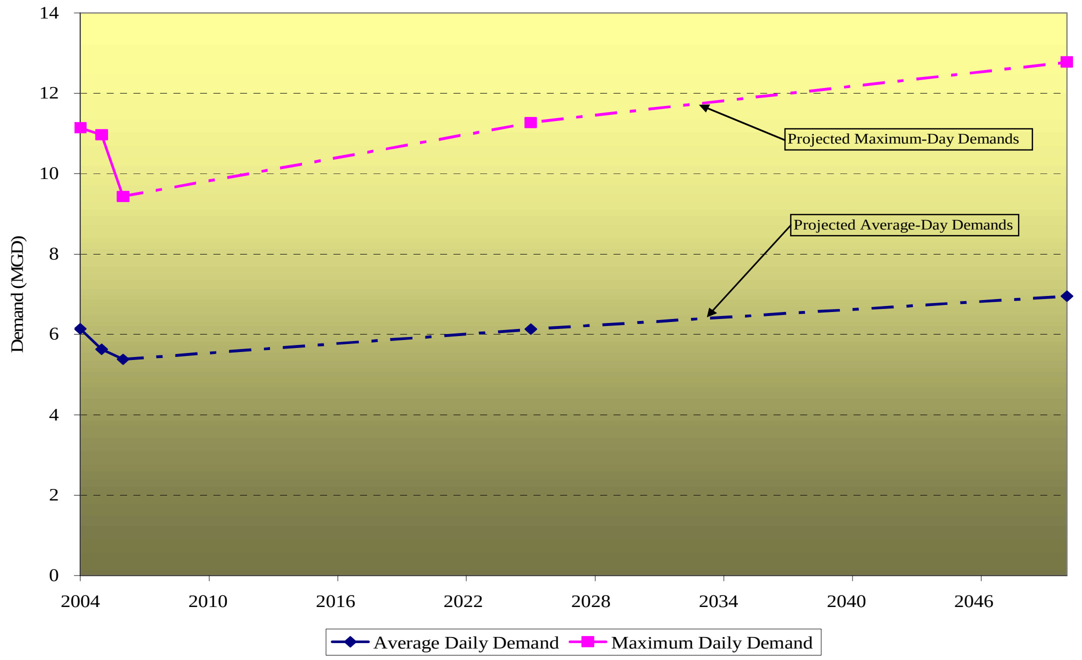


FIGURE 4-3
KKW AVERAGE AND MAXIMUM-DAY DEMAND PROJECTIONS IN MGD

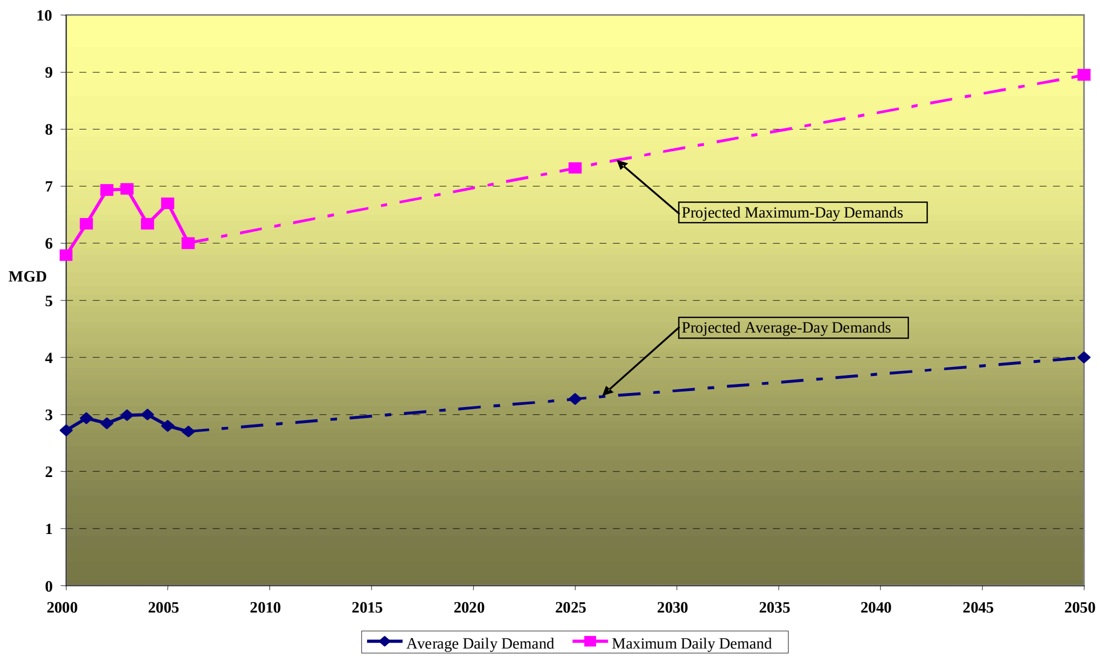


FIGURE 4-4
KWD AVERAGE AND MAXIMUM-DAY DEMAND PROJECTIONS IN MGD

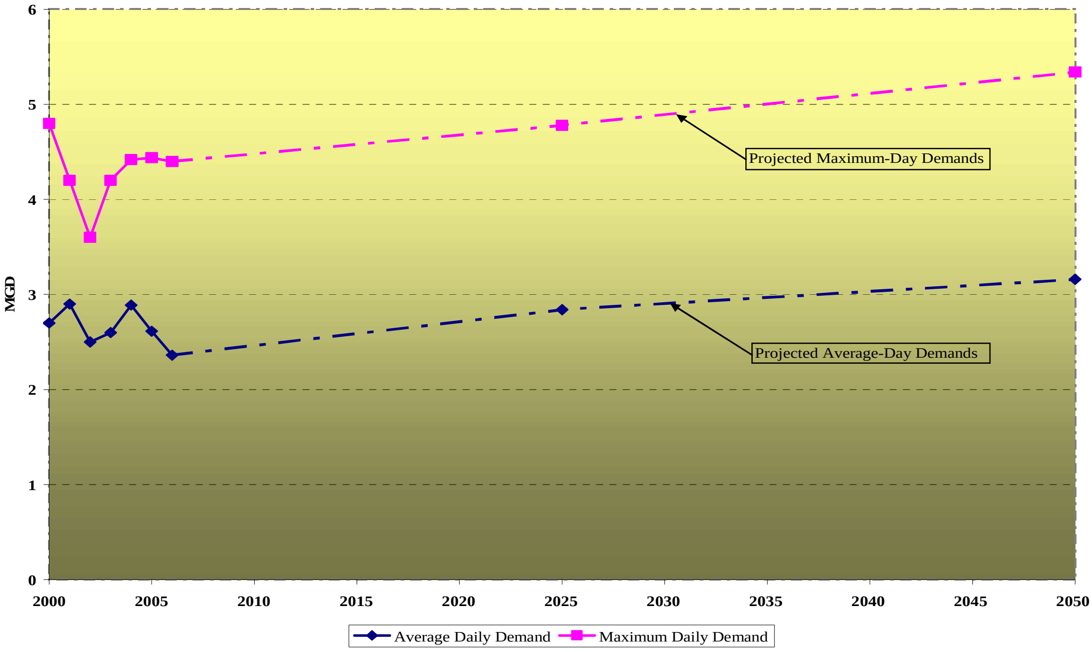


FIGURE 4-5
PWD AVERAGE AND MAXIMUM-DAY DEMAND PROJECTIONS IN MGD

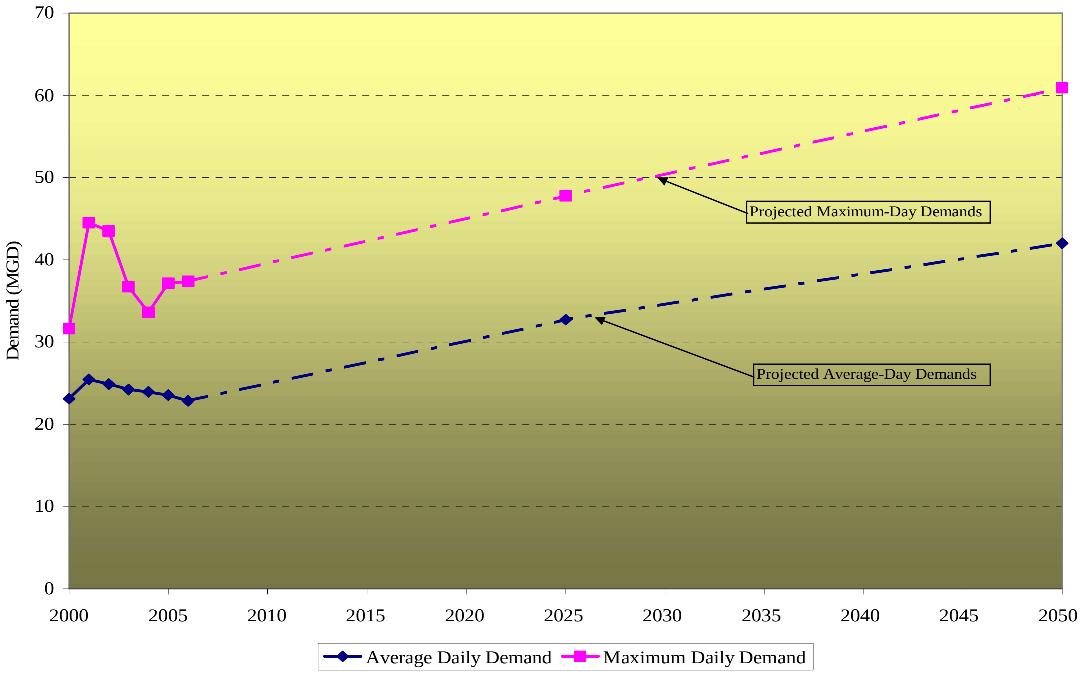


FIGURE 4-6
SWD AVERAGE AND MAXIMUM-DAY DEMAND PROJECTIONS IN MGD

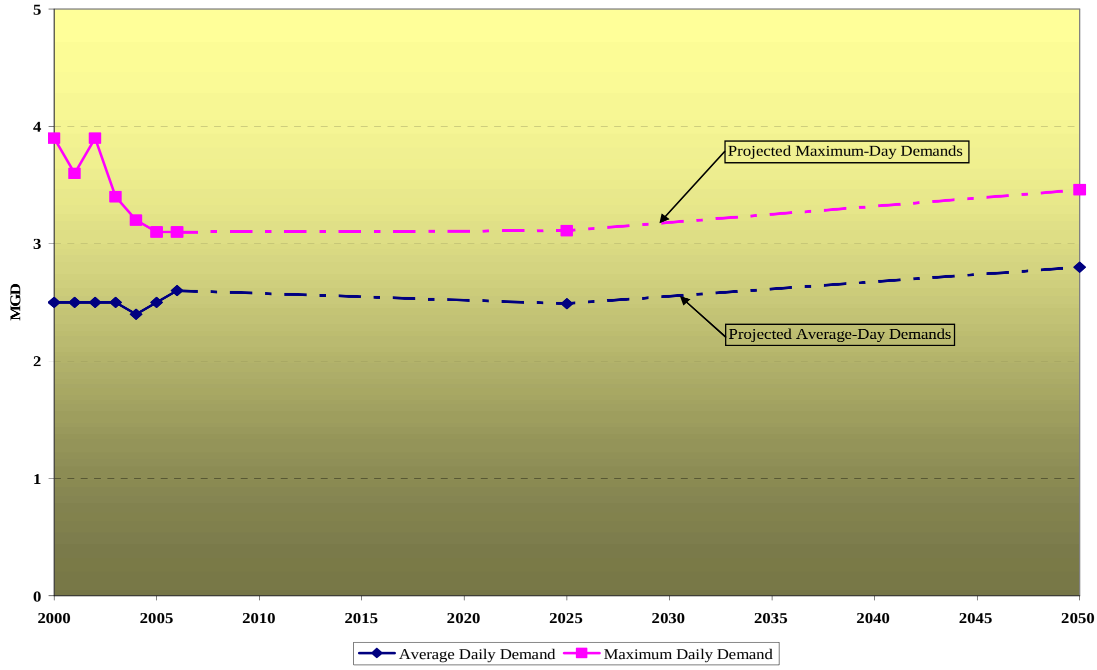


FIGURE 4-7
SBWD AVERAGE AND MAXIMUM-DAY DEMAND PROJECTIONS IN MGD

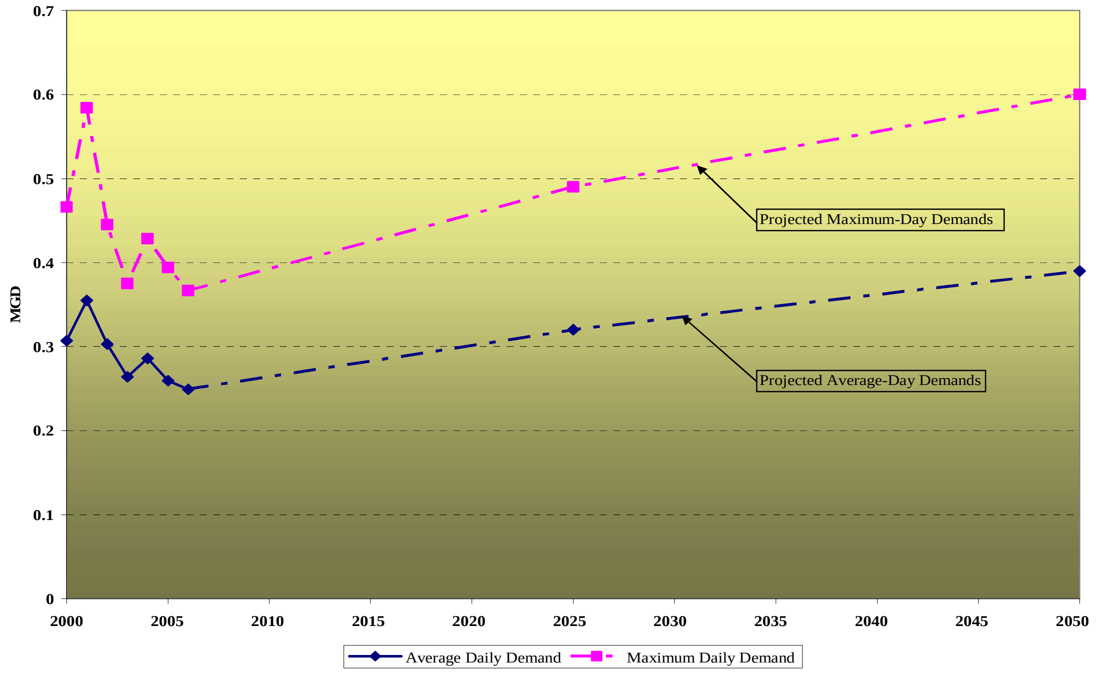
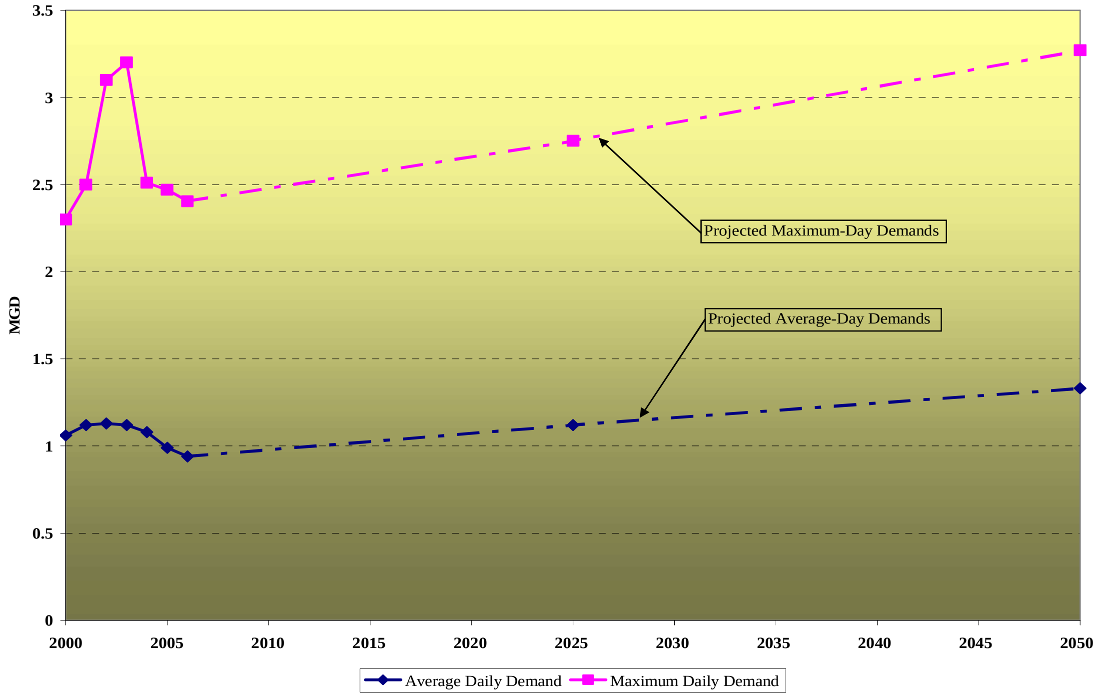


FIGURE 4-8
YWD AVERAGE, MAXIMUM AND PEAK-HOUR DEMAND HISTORY IN MGD



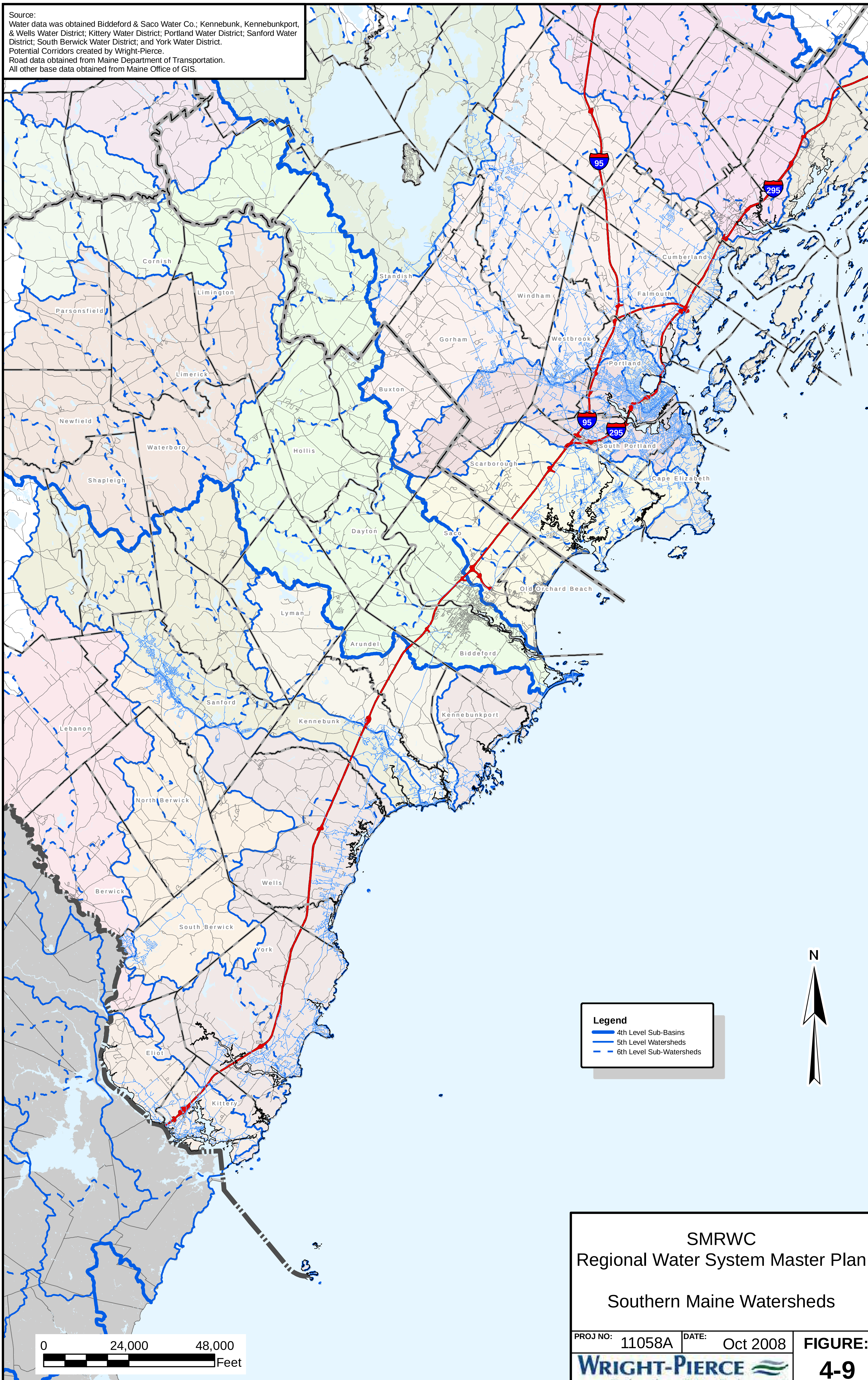
4.4.7 Concluding Statements

Projections made for each system within the study are reflective of basic planning methodologies and assumptions for the purposes of understanding the relative "order of magnitude" of water needs on a broad regional basis. The projections did not detail specific operating variations within each system and therefore should be used with caution. We recommend that each utility revisit the estimates on a case-by-case basis for their own individual needs.

The projections were developed based on historical data and are reflective of current and known regulatory conditions. There are a number of regulatory issues which are currently being considered and/or developed which could affect the projections and water-use management within each system. These include the following:

- **Deregulation** - Maine water utilities are regulated by the Maine Public utilities Commission (MPUC). The MPUC regulates extension of water service, water pricing and rate control, and other aspects of management of water utilities. The rules and regulations are specific and different for public or quasi-public utilities and private water companies. Deregulation and local control could change how water supplied and water-use is managed in the future. Utility managers should track and participate in any developments towards deregulation in the State of Maine.
- **Future Water Conservation and Demand Management** - Many states have/are instituting demand management as a tool for water conservation. Although not required presently in Maine statutes, this could be an area for future regulation of water utilities. In other New England states, water conservation and demand management includes the following:
    - Limitations on summer water-use and lawn irrigation
    - Defined thresholds/requirements on per capita water-use linked to approval of the expansion of supply with hard-trigger environmental goals and objectives
    - Water-withdrawals based on environmental stress levels in watersheds
    - Increasing block water rate structures as an incentive to conserve
- **Water Withdrawal Regulations** - Chapter 587 of the Maine Department of Environmental Protection (MEDEP) rules will be implemented in 2008 for surface water users. The rules will establish baseline water withdrawals and guidelines for future expansion of supply. The new rules are expected to make expansion of supply capacity increasingly difficult for most supplies other than for large river and reservoir systems.
- **Interbasin Transfer of Surface Water Supplies** - The State of Maine presently does not regulate the transfer of flows between water bodies from one drainage basin to another. Regulation of these so-called interbasin transfers could be an area of regulation which could impact projections of demand. In some states, transfer of flows from a surface water source into a distribution pipe that results in a sewer discharge in another drainage basin is regulated as an interbasin transfer. Interbasin transfer rule-making should be monitored as a potential area for future regulation. Figure 4-9 presents watershed basins in Southern Maine.

Source:
Water data was obtained Biddeford & Saco Water Co.; Kennebunk, Kennebunkport, & Wells Water District; Kittery Water District; Portland Water District; Sanford Water District; South Berwick Water District; and York Water District.
Potential Corridors created by Wright-Pierce.
Road data obtained from Maine Department of Transportation.
All other base data obtained from Maine Office of GIS.



SMRWC
Regional Water System Master Plan

Southern Maine Watersheds

PROJ NO: 11058A | DATE: Oct 2008 | FIGURE: 4-9

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SECTION 5
COMMUNITY PLANNING
IDENTIFYING SYNERGIES WITHIN THE COMMUNITY

5.1 INTRODUCTION

The viability of forming a regional water system or enhancing regional cooperation amongst SMRWC membership is likely to be influenced by local planning ordinances and objectives, economic development, and growth initiatives of local, regional and State of Maine entities. To better understand how the SMWRC service territory might expand, interconnect, or improve supply cooperation, knowledge of locations where communities are guiding and encouraging growth and development is needed. To gain this understanding, the following tasks have been completed:

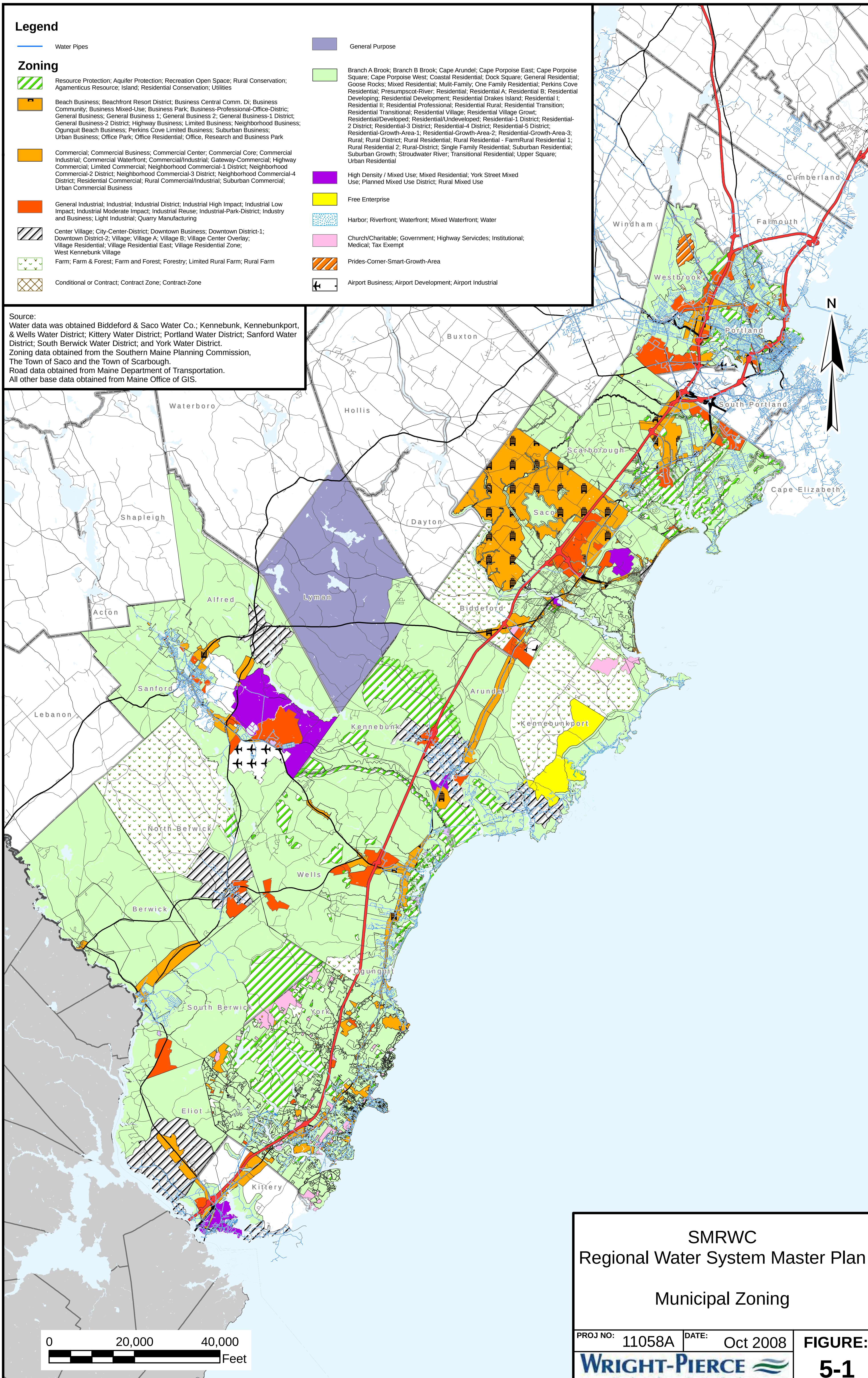
- Identification of Specific Local or Regional Growth Initiatives - Specific projects or regional growth initiatives have been identified through contact with local, state and regional planning agencies.
- Collection of Local Zoning Maps and Ordinances - Zoning maps and ordinances have been collected from service communities in the SMRWC territory to understand where growth and development is being encouraged at the local level.
- Consolidation of Mapping - Existing local planning maps have been consolidated into a regional planning map to identify where regional water objectives may dovetail and overlap with local planning goals and objectives.
- Interviews with Local Planning Departments - Interviews have been conducted with local planning officials in service communities to clarify mapping and to understand specific growth planning in each community.
- Identification of Growth Corridors - Major arteries and growth corridors have been identified between distribution systems of SMRWC member utilities to prepare a plan for exchanging water should more formal cooperation or interconnections occur in the future.

Under current Maine PUC regulations, water utilities are not obligated or permitted to extend or fund public water service to serve new development unless the improvement benefits the customer base as a whole or the improvement is funded by the applicant requesting the extension. Public-private or utility-municipality partnerships are a frequent approach to extending water supply that is a variant to the Maine PUC main extension rules. However, it is prudent for water systems to plan for the extension of the public water system to serve development in areas identified for future growth. By understanding both local development zoning and by having an understanding of likely primary highway corridors for growth, a hydraulic analysis can be conducted to see if interconnections in these same locations makes the most logical and economic sense.

This Section summarizes the planning, economic development and growth initiatives of the communities served by the SMRWC utility members which could impact and/or influence regional cooperation. Municipalities contacted during the study included Alfred, Arundel, Berwick, Biddeford, Dayton, Eliot, Falmouth, Gorham, Kennebunk, Kennebunkport, Kittery, Lyman, North Berwick, Ogunquit, Old Orchard Beach, Saco, Sanford, Scarborough, South Berwick, South Portland, Standish, Wells, Westbrook, Windham and York. Figure 5-1 illustrates land-use zoning within southern Maine communities. Figure 5-2 presents as composite of projected growth areas in each community in the Southern Maine Region.

In addition, the Greater Portland Council of Governments (GPCOG), Southern Maine Regional Planning Commission (SMRPC), and the State of Maine Planning Office (SPO), all of which coordinate regional planning goals in the service area, were also contacted.

The purpose and goal of engaging municipal planners and independent planning agencies was to obtain a general understanding of local and regional planning efforts and issues facing southern Maine communities. This exercise was not intended to be comprehensive but general enough to understand areas where development is being encouraged. The effort in obtaining feedback was commensurate with the allocated budget. We would encourage further dialogue with local



SMRWC
Regional Water System Master Plan

Municipal Zoning

PROJ NO: 11058A	DATE: Oct 2008	FIGURE: 5-1

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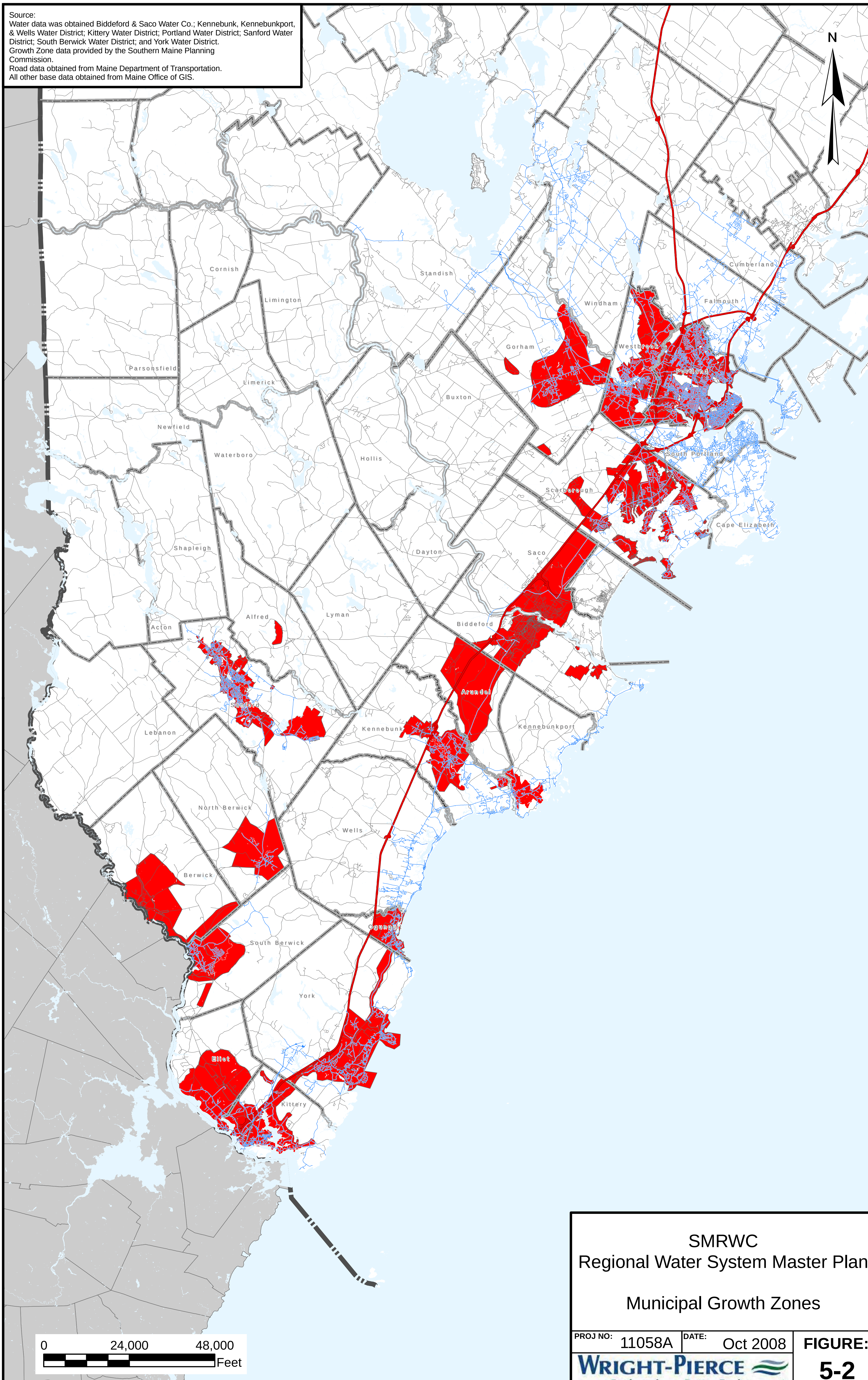

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planning agencies after the study is concluded and as new initiatives within communities are considered in the future.

5.2 MUNICIPAL GROWTH AND PLANNING

5.2.1 Biddeford & Saco Water Company Service Communities

The Biddeford & Saco Water Company is chartered to provide water service to the communities of Biddeford, Old Orchard Beach, Saco, Dayton and Lyman. For the BSWC, planning information was collected from City of Biddeford and Town of Old Orchard Beach and Saco planning department representatives.

Zoning within the current service area (primarily the area east of Interstate 95 in Biddeford, Saco and Old Orchard Beach) consists of a mix of residential, rural, commercial, and business/industrial designations. The City of Biddeford and the Town of Saco urban centers, located on each side of the Saco River, serve as the primary core of the water system. None of the respondents within the communities served by the BSWC projected any significant changes to zoning or planning policy over the study period which would affect water use in a notable way. In fact, all respondents indicated that there are limited growth opportunities for larger water users such as commercial, industrial and business entities. The City of Biddeford is demographically similar to many other urban centers in the State of Maine experiencing out-migration to rural areas and an aging population. Recent water system planning studies completed by Wright-Pierce have reported a similar trend in the Town of Skowhegan and the Cities of Augusta, Waterville and Gardiner. All of these communities have experienced declining industrial bases in there core city centers.

Specific developments in the greater Biddeford area, such as the Saco Island development project, are primarily residential developments and are not expected to change general water-use patterns in any appreciable amount. The BSWC has identified important residential growth in the Jenkins Road area of Saco and the Andrews Road area of Biddeford. Major housing developments in the planning stages in the Cascade Road area of Saco have also been identified.

These specific developments are well within normal water supply planning and resource capacity for the BSWC.

The primary areas identified for growth in the Biddeford-Saco area are located within the urban centers of Biddeford and Saco and within a corridor between Interstate 95 and US Route 1. The US Route 1 growth corridor extends from the Scarborough town line to the north and is contiguous with a similar growth area in the Town of Arundel to the south. Most of the existing growth area is currently served by public water. Several small, noncontiguous growth areas were also identified in the Biddeford Pool area.

5.2.2 Kennebunk, Kennebunkport & Wells Water District Service Communities

The Kennebunk, Kennebunkport & Wells Water District (KKW) is chartered to provide water service to the communities of Kennebunk, Kennebunkport, Wells, Arundel and Ogunquit as well as portions of York and Biddeford. Information regarding planning and growth was collected from the communities of Kennebunk, Kennebunkport and Wells.

Zoning within the current service area consists overwhelmingly of residential and rural-type of uses. Areas within the service territory designated for commercial, industrial and business purposes are already heavily developed. Small remaining land areas are available for in-fill developments. These zoned areas include:

- The business center of Kennebunk extending outward from the town center along US Route 1 and 99.
- The business center of the Kennebunkport Harbor area.
- The Cape Neddick area in Ogunquit abutting the Town of York.
- The Route 1 corridor in Arundel between US Route 1 and Interstate 95.

Outside of the areas identified above, the Town of Kennebunk indicated that there is little property left available for substantial land development. Anticipated development in the Town will be as a result of infill within existing developed areas. Similarly, growth within the Town of Kennebunkport is expected to be primarily residential, meeting the Town's goal to steer new development towards areas where existing infrastructure already exists. The Town of Wells reported that zoning throughout the community also consists of primarily of the residential and mixed-use zoning.

The Town of Arundel expects and is encouraging any future growth to be concentrated along the US Route 1 corridor. This area includes focusing commercial development along the southern end of US Route 1 and industrial and business uses towards the northern end of US Route 1. The Town also intends to protect the US Route 111 corridor as a scenic and rural transportation corridor and hope to minimize any new access to Interstate 95.

5.2.3 Kittery Water District Service Communities

The Kittery Water District is chartered to provide water service to the communities of Kittery, Eliot and a small portion of York along the transmission main corridor between Boulter Pond and the Kittery distribution system. The Kittery Water District and the York Water District have also exchanged service territory and have installed an emergency interconnection and pump station along the US Route 1 in York to aid each other in times of emergency. The pipeline interconnection was installed jointly by both District's in 2006.

The towns of Eliot and Kittery have several large areas within the current service area that are targeted for commercial growth. These areas are largely located within the present service area of the District and include:

- The US Route 1 commercial corridor between the Piscataqua River and the New Hampshire state line and the Town of York.
- The US Route 236 corridor in Eliot and Kittery.
- The business and commercial center in downtown Kittery.
- The Portsmouth Naval Shipyard area.

Large inland areas of the service territory have primarily residential and rural land-use designations. Each community also contains isolated areas designated for commercial and business/industrial purposes, most of which reside near or adjacent to major highway arteries. None of the municipal planning department respondents indicated any significant changes to current zoning or planning policy which could affect water-use during the planning period. Any anticipated development in Kittery would not require major infrastructure investment or benefit from extension of service or cooperation with adjacent water utilities.

5.2.4 Portland Water District Service Communities

The Portland Water District (PWD) is chartered to provide water service to the communities of Cape Elizabeth, Cumberland, Falmouth, Gorham, Portland, Raymond, Scarborough, South Portland, Standish, Westbrook, and Windham. None of the communities within the Portland Water District's service area provided direct input to the study.

However, specific community service plans were developed as part of the District's 2003 Comprehensive Water System Strategic Plan. These plans were reviewed and consulted as part of this study. Data in the community service plans included a detailed analysis of existing and projected residential and non-residential growth specific to each member community and the potential impact of projected growth to the PWD water system.

In a broad sense, zoning within PWD's current service area is very diverse. Areas within Portland, South Portland, Westbrook and Windham include large zoning tracts for commercial, industrial, and business, while the outlying communities Cumberland, Cape Elizabeth, Falmouth, Gorham and Standish generally consist of large expanses of residential and rural designations.

In brief, anticipated growth patterns within each community and the perceived impact on PWD's ability to provide expanded water service are detailed as follows.

- Cape Elizabeth - All future residential growth is expected to occur within the existing PWD service area. In this sense, the infrastructure is already in-place and appears adequate for the future conditions. Non-residential and employment growth is currently concentrated in and around the town center. Similarly, the Town predicts limited development in the non-residential sector all of which is located within PWD's current served area. Potential exists for some non-residential development on the extremities of US Route 77, but only when and if sewer is extended. None of the potential future growth is expected to require expansion of the existing service area.
- Cumberland - The Town's 1998 Comprehensive Plan indicates a strong desire to maintain residential growth throughout the community while preserving the rural areas of the town by discouraging residential development in areas not currently served by public utilities (sewer and water). Consistent with a desire to promote residential growth, non-residential and employment growth is expected to be minimal and limited to the current commercial and industrial zoned areas in the village center and on the outlying area of the Town along US Route 100. Public water and sewer infrastructure is not expected to be extended to this area of the community. None of the potential future growth is expected to require expansion of the existing service area.
- Falmouth - The Town's current zoning and ordinance plan directs future residential growth towards existing developed neighborhoods and residential areas. The large outlying areas of undeveloped land will be kept in check because of the lack of public services. Therefore, residential growth is not expected to have any impact on the PWD's operations. Non-residential and employment growth exists primarily along the US Route 1 corridor and Interstate 295, Exit 10 area. The Town's future land-use designations retain these areas as the focus of any future development. Therefore, all areas designated for commercial and industrial use are currently served by PWD's system.
- Gorham - The Town's 1993 Comprehensive Plan identified a number of residential growth areas within the community; many of these areas are located outside of the existing PWD service area. Existing non-residential and employment area generally exist within the Village Center, the Towns Industrial zoned area and in a few outlying neighborhood areas. Future land-use zoning and ordinances continue to concentrate non-

residential use within existing zoned areas. A significant portion of the areas designated for residential and non-residential growth in and around the Village Center are currently served by PWD. Outlying residential and non-residential growth areas will require significant investment in extensions of service. It is impossible to predict with any certainty as to if or when public utilities will be extended to outlying areas of the community.

- Scarborough - The Town of Scarborough projects strong growth in the residential and non-residential customer base over the next 15-20 year period. Most of the growth is being forecast within the existing areas zoned for these specific uses. The majority of existing areas and areas of projected growth are currently served by the PWD. One exception is a residential area located in the southern portion of the Town west of Interstate 95. The largest impact to PWD is likely to stem from the commercial and business development expected along the Payne Road and Haigis Parkway near the former Exit 6.
- Standish - The PWD provides water service from the primary distribution system to a limited area of Standish generally covering the Sebago and Standish Village areas. The Town's 1992 Comprehensive Plan focuses future residential and non-residential development primarily within these village settings. However, it was pointed out that the Town's current density and frontage requirements within the service area limit significant development and the possibility of serving future residential development.
- Windham - Similar to the other communities served by the PWD, Windham has seen significant residential and non-residential growth over the past 10-20 years. The Town's 1993 Comprehensive Plan established small areas of light and medium density residential growth area while the remainder of the community is zoned rural. The residential areas are generally concentrated in North Windham along the primary transportation corridors of Route 302 and Route 115. Small isolated areas are located along the southern Route 302 corridor and in south Windham along the Gorham town line. The 1993 plan intended that the light and medium residential areas would be served with public utilities while all other areas generally would not. Non-residential use and projected growth also generally is located along the Route 302 corridor. Other non-residential zoning designated areas

are located in the South Windham commercial and industrial area and in the Enterprise District located off of Route 302 in North Windham. Residential and non-residential growths areas are currently served by the PWD water system. Future development within these areas is not expected to result in significant water demands. However, development within the Enterprise District could result in large increases in water demand; the extent of however is not known.

5.2.5 Sanford Water District Service Communities

The Sanford Water District is chartered to provide water service to the communities of Sanford and Springvale. Information included herein was provided by the Town of Sanford Planning Department.

Zoning within Sanford consists primarily of various residential and rural designations except for the primary commercial corridor along US Route 109 through downtown Sanford. Commercial, industrial, research and business designations are located throughout the downtown service center and to the outlying areas east of the Town center. This primary target area for development overlaps the Sanford Water Districts service territory, which was likely the focus of the zoning strategy. Outside of this development zone, rural and residential land-use zoning predominates. Existing water supply to serve this development appears adequate and will not likely necessitate regional cooperation as development occurs outside this focus area.

Recent growth trends for commercial and business has been south of the downtown center along Route 109, near the Sanford municipal airport. Growth is expected to trend away from the downtown compact area and follow that of similar industrial based communities in Maine as previously described. In addition, the lack of a water system for fire suppression needs outside of the current water service area will limit development opportunities.

The Town of Sanford is situated on a large gravel aquifer (glacial outwash plain) with opportunity to expand groundwater development for well supplies. It is expected that local development and growth along major highway corridors can be supplied water from local groundwater sources for the foreseeable future. Any anticipated development in Sanford would not require major infrastructure investment or benefit from extension of service or cooperation with adjacent water utilities.

5.2.6 South Berwick Water District Service Communities

The South Berwick Water District is chartered to provide water service to the communities of South Berwick and a very small isolated area of Berwick along US Route 4 which was added by a charter amendment in 2006.

Land-use zoning within South Berwick consists almost exclusively of the residential type with a small mix of business and industrial zoning in and around the downtown area. The small downtown area has been identified as a potential growth area. The Towns Comprehensive Plan is designed to concentrate future residential growth near to existing public water and sewer service similar to other communities within the region.

In addition, the US Route 4 area extending north from South Berwick has also been targeted as a residential and light commercial growth corridor. This territory was ceded to the South Berwick Water District from the Town of Berwick because of its close proximity to South Berwick's public water system and the Towns desire to encourage light development along the highway corridor. Extension of water mains north of South Berwick began in 2006 in response to new development.

5.2.7 York Water District Service Communities

The York Water District is chartered to provide water service to the community of York and small areas of Kittery along US Route 1. The York Water District has ceded a small area in Cape Neddick to the KKW Water District over the past several years.

The Town of York has very restrictive requirements that discourage development including a water System Development Charge (SDC), and sewer and municipal impact fees. The Town of York has also conducted growth saturation studies which have identified very limited opportunity for further development within Town boundaries. Approximately, 70% of the developed land within York is of the residential type.

The Town of York's Comprehensive Plan includes a statement that water service for new development is limited by the York Water Districts' existing hydraulic gradeline. The two primary areas in York where some limited development is encouraged or anticipated is along US Route 1 north of York Village, the York Village area and the York Beach area between the York River and Cape Neddick. Most of this area is presently served by public water. Any anticipated development in York would not require major infrastructure investment or benefit from extension of service or cooperation with adjacent water utilities.

The type of development expected in the Town of York is in the health care, dining and lodging sectors and that the rate of growth from this development will approximate the projected employment growth rate for York County.

5.3 REGIONAL GROWTH, PLANNING AND ECONOMIC DEVELOPMENT INITIATIVES

Representatives from the Greater Portland Council of Governments (GPCOG) and the Southern Maine Regional Planning Commission (SMRPC) were engaged early in the study to provide information on growth planning in the PWD service area. Each of these agencies has been active in the development of various growth, planning, and economic development issues in southern Maine for decades. The primary mission of these agencies is:

- To coordinate and consolidate local planning efforts on a regional basis
- To evaluate regional transportation needs
- To provide resources and data to municipal planning departments

- To represent the State of Maine and execute planning objectives for the southern Maine region

A number of studies and planning reports were provided by these agencies which contained information relative to future development and water-use. While many of the studies were focused primarily on transportation needs and planning, they provide a unique perspective and insight into projected population growth and land-use patterns throughout southern Maine. Development of a regional water system or more formal regional cooperation will require interaction with many stakeholders. It is often misunderstood by the public, that water utilities in the State of Maine can not encourage or fund expansion of a water system for development initiatives. However, there remains a perception, that the presence of public water will create development opportunities.

In our present regulatory environment, the SMRWC member utilities can only respond to responsible development requests. The purpose of having a regional cooperation plan such as this is to assure (1) The public water system grows and extends service beyond the current service territories in a planned and organized manner and, (2) That the utility understands the implications of sizing and locating infrastructure mindful of the potential for a future regional water system.

The following discussion summarizes several regional planning efforts which were identified in southern Maine. These projects and initiatives may guide how and where infrastructure might be located in the future to meet both planning and growth goals as well as water supply needs on a regional basis.

5.3.1 Southern Maine Regional Planning Commission

The Southern Maine Regional Planning Commission (SMRPC) is a regional planning organization under the jurisdiction of the State of Maine Planning Office (SPO). The SPO is located within the executive branch of state government directly responsible to the Governor's

Office. The SMRPC serves thirty-nine member municipalities in York, Oxford and Cumberland Counties. The SMRPC was founded for the purpose of a coordinated effort for economic development and resource management in southern Maine. One of the SMRPC's leading programs has been the facilitation of a number of corridor planning initiatives for major arteries within and between their member communities. Following is a brief overview of corridor planning and other regional efforts which could support regional cooperation amongst SMRWC member utilities.

5.3.1.1 US Route 1 Corridor Study

SMRPC formed the US Route 1 Corridor Coalition in 2006. The Coalition includes public and private sector groups with a stake in the future of US Route 1 from Kittery to Biddeford. The charge of the coalition is to develop a corridor plan that sustains and enhances the corridor's transportation, land use and economic development needs. It is likely that future expansion of the Route 1 corridor will offer opportunity to both local utilities and the SMRWC membership for potential water system extensions.

5.3.1.2 US Route 109 Corridor Study

The US Route 109 Corridor Coalition was formed to study and implement planning strategies to assure a high degree of transportation mobility between Sanford and Wells. The coalition is tasked with developing action plans that sustain a high level of service based on future economic and residential activity. It is also tasked with projecting future land-use within and around the corridor. The preliminary study indicated that the Towns of Sanford and Wells have been discussing the potential establishment of a Pine Tree and/or Free Trade Zone(s) along US Route 109, which would require changing current land-use designations for property adjacent to the roadway. The study identified Sanford as a designated Service Center community, which may lead to increased residential and commercial growth. These efforts could spurn economic development and the need for increased water service along this corridor.

This highway could also be an important link between the Sanford Water District and the KKW Water District. Both water distribution systems terminate on US Route 109 in their respective service areas. An interconnection between the two water systems, which leads to development and growth, would meet and support the development objectives as well for this highway artery.

5.3.1.3 US Route 111 Corridor Study

The US Route 111 Corridor Committee was formed in response to the publics concern regarding land-use development, mobility and safety along this roadway. This stakeholder group has focused primarily on transportation planning along the US Route 111 corridor. US Route 111 has been identified by all of the communities bounding this corridor as a suitable area to encourage commercial and/or high density residential growth in the future.

The committee has produced a study which highlights on-going traffic congestion along this corridor with projections for further traffic increases in the future. In recent years, large retail establishments have developed in Biddeford around the Interstate 95 interchange. Future transportation upgrades to this development zone could provide opportunity for expansion of water service.

This highway could potentially serve as a link between the Sanford Water District and the BSWC for regional interchange of water. Both water distribution systems terminate on US Route 111 in their respective service areas.

However, none of the communities along US Route 111 identified any future growth initiatives along this corridor. Other likely interconnection routes to interconnect the Sanford Water District with the coastal communities include US Route 99 or US Route 109, both of which are nearly ½ as long as the US Route 111 corridor. An interconnection along US Route 111 would be lengthy and costly but could be supported by the public at large to meet overlaying development objectives.

5.3.1.4 US Route 236 Corridor Study

The US Route 236 Corridor Implementation Committee was formed as stakeholder group in an effort to effectuate current development efforts and planning along the US Route 236 corridor. Similar to the other committees, transportation and traffic were the drivers for forming this study group. The committee reported that traffic counts along this segment of roadway have doubled over the past 20-years. With a continued forecast for traffic growth in the southern Maine region, improvements to the US Route 236 corridor will be eventually needed and warranted. The committee has developed a proposed Action Plan aimed to address growing transportation concerns. Of importance to this study are action plans which seek to better define and coordinate land use and economic development needs along the corridor and to seek efficient means to link other major roadways in the area. All of these efforts will again lead to potential opportunities for the expansion of regional cooperation.

This highway could also be an important link between the South Berwick Water District and the Kittery Water District for regional interchange of water. Both water distribution systems terminate on US Route 236 in their respective service areas. An interconnection between the two water systems would be lengthy and costly but could be supported by the public at large to meet overlaying development objectives.

The South Berwick Water District has studied several sites in South Berwick along US Route 236 for potential development of new groundwater supplies.

5.3.2 "Connecting Communities: Planning in Southern Maine"

In 2004, the SMRPC secured funding to conduct a regional visioning study entitled "Connecting Communities: Planning in Southern Maine", in response to the defeat of a statewide referendum to construct a casino resort in the greater Sanford area. Similarly, other large scale development projects have been defeated by voters in the region including the expansion of retail outlets in Kittery, a liquefied natural gas facility in Wells, a Great American Neighborhood development project in Scarborough and a racino at Scarborough Downs Harness Racetrack in Scarborough.

The aim of the study was to solicit input from each of the southern Maine communities in regards to the direction for economic expansion in the region. The resulting responses would form the basis of an action plan/visioning statement to help guide participants in a common direction.

Little was concluded from this study regarding development of regional transportation needs or development planning on a regional basis. Specific development projects will continue to be proposed on a case by case basis. SMRWC utility members should become engaged with this group to identify major potential developments outside present service territory boundaries that may require cooperation or extension of public water. These projects may be drivers for regional cooperation, trading of service territory or reconsideration of service planning.

5.3.3 Southern Maine Corridors Committee - Regional Transportation Assessment

In 2004, the Southern Maine Corridors Committee was formed representing Town administrators, planners, environmentalists, business and commerce groups, and transportation professionals. The purpose of the committee is to assess regional transportation, land use, economic development needs along major transportation corridors within the Southern Maine Economic Development District (SMEDD).

The committee identified the six most important corridors within the region. Of relevance to this study, the corridors of interest include:

- The Southern Coast Corridor which includes US Route 1, Interstate 95, the Eastern Trail and Guilford Rail Line/Amtrak.
- The Southern Maine Central Corridor which includes US Route 4, 5, 11, 35, 202 and 236.
- The York County East-West Corridor which includes US Route 4A, 5, 22, 112, 117 and 202.

The primary objective of the committee is to work with local communities to develop common strategies for transportation infrastructure, comprehensive and economic planning efforts. All of these efforts may lead to future opportunities to partner with communities and transportation agencies to extend water service throughout the region.

5.3.4 Summary of Regional Efforts

The majority of the initiatives presented offer a glimpse into the vision and regional plan for the expansion of transportation and identification of economic and land-use needs for the southern Maine region. Implementation of the plans will require continued study, commitment and capital investment to support the plans goals outlined.

From a regional water supply planning perspective, it is clear that investment in infrastructure is needed throughout the region to support continued growth and economic development. This investment will provide potential opportunities for the expansion of infrastructure or regional cooperation to extend water service. We encourage the SMRWC to monitor the activities of local and regional planning efforts and in certain instances, provide support to these efforts. The SMRWC will need to be engaged on a regional basis for initiatives in southern Maine that may impact utility members from projects or initiatives outside each utilities service territory.

5.4 POTENTIAL INTERCONNECTION CORRIDORS

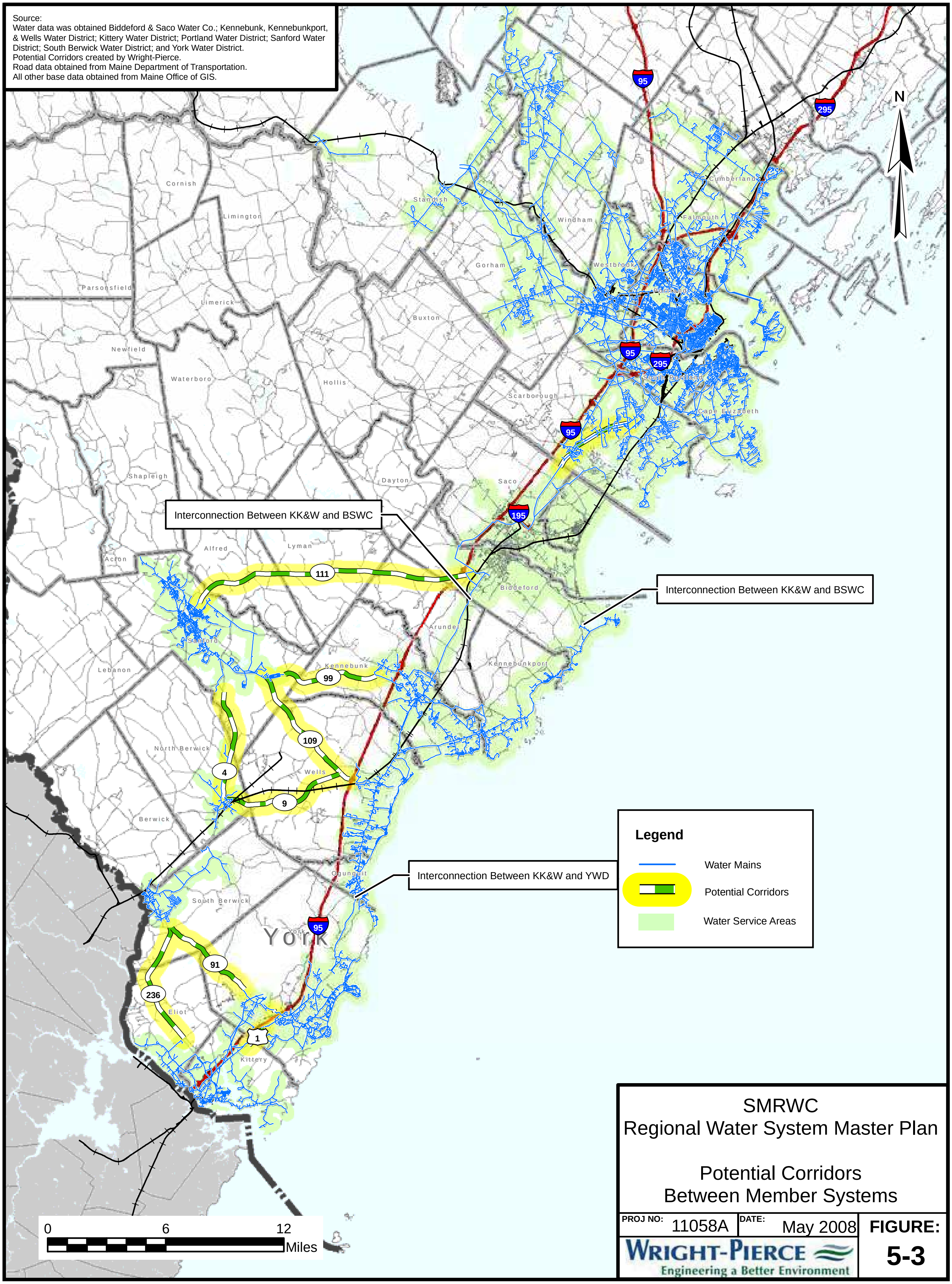
If any conclusion can be drawn from the review of local and regional planning efforts, it is that future growth which would be expected to significantly impact current water demands is likely to occur along existing and future commercial and transportation corridors and within existing service areas. These areas are commonly located in close proximity to major traffic and thorough fares. Consequently, interconnection between adjacent water utilities will be similarly concentrated in these areas of expected growth and development.

Corridors which have been considered for further analysis as potential routes for interconnections between SMRWC member utilities are described below and shown on Figure 5-1. A technical analysis of each opportunity including development of service plans and hydraulic considerations is presented in later Sections of this Report.

- Kittery and South Berwick Water District Systems - *US Route 236 and US Route 91*
- Kittery and York Water District Systems - *US Route 1*
- South Berwick, North Berwick, and Sanford Water District Systems - *US Route 4*
- Kennebunk, Kennebunkport & Wells, South Berwick, and North Berwick Water District Systems - *US Route 9*
- Kennebunk, Kennebunkport & Wells, and Sanford Water District Systems - *US Route 109 and US Route 99*
- Biddeford & Saco Water Company and Portland Water District Systems - *US Route 1* or *Pine Point Road*
- Biddeford & Saco Water Company and the Sanford Water District - *US Route 111*

The US Route 111 corridor between the Biddeford & Saco Water Company and Sanford Water District Systems will not be considered in the hydraulic analysis due to the physical distance between the systems and the lack of growth initiatives by any of the communities located along the corridor. Should significant develop occur in the future, this could become a viable route.

Corridors to be considered for a regional water system will be discussed in subsequent Sections of the Report.



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SECTION 6

LOCAL SUPPLY AND INFRASTRUCTURE ADEQUACY

CAN IT GET THERE FROM HERE?

6.1 INTRODUCTION

Section 6 will provide an overview of the current supply availability throughout the southern Maine region in order to provide perspective on the long-term regional water supply needs over the next 50-100 years. Freshwater surface supplies and groundwater resources are a limited resource and along coastal communities. Surface water supplies pre-dominate the area while utilities located within the interior of York County rely primarily on groundwater sources for their potable needs.

The adequacy of a resource, be it a lake, river, reservoir or groundwater aquifer, must be properly managed and allocated to meet the growing needs of the region. The resource can not be engineered or created. In many regions of the country, the supply of water is the driving factor that will control and manage how and where population growth can occur and how communities develop. Within the southern Maine coastal region, several key conditions can be expected to influence the management of water supplies in the future include:

- Availability of supplies.
- Quality and quantity of supplies.
- Environmental restrictions on withdrawals from surface and groundwater water supplies.
- Development (residential, commercial, industrial) and demand growth.

Section 4 developed estimates of future population and water demand within the region. Section 6 will consider the ability of each system to supply and deliver the projected demands within their chartered service territory. The findings and conclusions from this analysis are expected to help answer the following water management questions:

- Does each member utility have adequate supply to meet the projected needs of the water system over the planning period and if not, when approximately will additional supply capacity be needed?
- Can the existing sources of supply within each utility be expanded to meet the projected future need within the utility?
- If a utility cannot meet its projected needs by expanding its own source of supply, how can cooperation from other member utilities meet any projected supply deficit?
- Does regional cooperation provide a better value for customers than expanding a utilities existing source of supply or developing a new source of supply within its own service territory?

Subsequent to the supply evaluation, Section 7 will explore hydraulic issues and limitations associated with sharing water between systems, whether for regional cooperation or emergency needs, and opportunities where additional supply development can be achieved within projected water management guidelines being implemented in 2008 by the Maine Department of Environmental Protection.

Several conditions of supply and infrastructure adequacy will be examined; (1) the supply capacity or *safe yield* , (2) the ability to deliver/treat the required demands under worst case conditions - also known as the *safe pumping/treatment capacity* and (3) potential legal and environmental restrictions for the development of new or expansion of current sources of supply.

The analysis will conclude with an assessment of the supply balance within the region, strategies for improving the management of the supplies and potential impediments to regional cooperation.

6.1.1 Definitions

Supply adequacy is the measure of a water systems ability to reliably meet the expected range of existing and projected demands, under all daily demand conditions. In the context of this study, the existing supplies of each member system will be assessed on adequacy as a long-term source of supply to understand the relationship between individual member needs and surplus availability. Supply adequacy is defined by the following water works engineering principles:

- Safe Yield - The safe-yield of a supply is defined as the maximum amount of water that can be withdrawn for an extended sustainable period of time under the most severe or critical drought periods without having a detrimental effect on the ecology of the watershed. The available quantity of a *surface* supply should exceed the maximum projected water demand of the service area under drought conditions were practical; however the average daily demand is generally considered the minimum standard for surface supplies. This definition is consistent with proposed future water withdrawal regulation by the Department of Health and Human Services and Department of Environmental Protection which will likely require management of supplies on an annual withdrawal basis (millions gallons/year) or an average-day basis (millions gallons/year/365 days) (both agencies will have jurisdiction in the future over management of surface water from a resource perspective). The safe yield for groundwater supplies should exceed the projected maximum day demand of the system assuming that the largest source is out of service
- Safe Production/Treatment Capacity - The safe production and/or treatment capacity of the system, should be greater than or equal to the projected maximum-day demand with the largest pumping or treatment unit out of service. This presumes that a system has adequate mechanical and/or treatment capacity.

The general demand pattern in southern, coastal Maine has two distinct seasonal periods. The maximum demand is a composite monthly flow for the 5-month high demand period (maximum-day) of May-October. Low flows occur over the remaining 7-month winter demand. When water-usage is averaged over a 12-month period, the average-day demand is somewhere in the middle. Communities which experience dramatic demand variations as a result of unusual conditions such as seasonal tourism or significant industrial needs may consider maintaining supply capacity greater than average-day conditions.

The proceeding safe yield assessment is based on existing data provided by each utility; a safe yield analysis is not included in the scope of the study.

6.2 SAFE YIELD ANALYSIS

Prior safe yield studies for the SMRWC utilities have generally been based on the following:

- Yield available during the drought period of record.
- Consideration of actual impounded storage volume in each reservoir system.
- No mandated minimum flows, lake level restrictions or other regulated environmental limitations on water withdrawal.

To conduct a safe yield analysis for a surface water supply, three pieces of information are needed:

- The cumulative inflow to the reservoir system over the entire period during the drought of record obtained from stream gage data.
- The impounded reservoir volume above the intake system is usually calculated using bathymetric surveys.
- Minimum flows, limitations of leakage and other sources of known outflow other than for drinking water purposes from the reservoir systems.

Generally, water users cannot withdraw more than the estimated safe yield of the source without running out of water during the drought of record. In all other years, sufficient supply should be available to meet the needs of the water system with varying degrees of concern and surplus supply based on the annual rainfall and inflow to the reservoir system. In some states however, users can be mandated to an amount less than the true safe yield of the supply for ecological or other purposes. In these cases the mandated withdrawal rate for the source in question is considered the "safe or available yield". The State of Maine will soon be implementing legislation that may limit withdrawals from some water bodies. The implications of the proposed water withdrawal regulations will be discussed later in the report. It is important to understand that all discussions of yield in this report are based on present regulations, which do not place environmental limitations on the withdrawal of water, except in limited circumstances such as the Bell Marsh Reservoir in Kittery, where both minimum conservation flows and lake level restrictions are in place.

Many systems are forced out of necessity to withdraw flows at rate higher than the safe yield of the source during certain periods of the year in order to meet maximum demand conditions. Maximum demands typically occur during the period of the year when inflow or run-off to rivers, streams, lakes and ponds are at their lowest levels often coinciding with the period of lowest rainfall. A safe yield study considers the optimum size of impounded storage. Storage volume above the so-called "optimum storage volume" has a diminished value since the cost is not commensurate with very small incremental gains in yield. This is why simply making a storage reservoir larger may not produce a higher sustained yield over an entire year. In all cases, reservoirs allow a water user to produce higher sustained flows during the drier summer period than is available as stored water.

In New England, the most severe drought periods have been in 1941, 1963-1967 and 2000-2002. All safe yield analyses conducted prior to 2000 were based on 1960's drought; which was most severe in coastal Maine. Because the coastal plain from Kittery to Saco is characterized by shallow glacial soils with limited soil storage capacity, the region is subject to large variations in stream flows.

Available yield is largely driven by the amount and distribution of precipitation in any given year. Cumulative inflow into a watershed is used to estimate yield of a supply. Where local data does not exist, similar gaged watersheds in the region are typically used. For example, the Oyster River in Durham, New Hampshire was used to develop the safe yield estimates for the York and Kittery systems. These systems have also completed bathymetric studies making their dry-year yield estimates very accurate.

For groundwater supplies, safe yield is predicted using a groundwater model and pumping tests. A pumping test of a well predicts the zone of influence around the well using monitoring wells to measure drawdown and a groundwater model. The pumping test is usually conducted during installation of the well and must be correlated to the dry-year condition by simulating recharge to the well based on a drought period of record.

The SWD and the SBWD use groundwater supplies exclusively. The KKW Water District uses a combination of surface and groundwater supplies to meet their needs relying primarily on the Branch Brook for the majority of demands and the groundwater sources as peaking supplies during the months of July and August when demands are highest. Each well has been rated for yield during a dry period. Similar to surface water supplies, the pumping rate of these sources is generally not limited by environmental restrictions within the recharge zone of the wells except in limited cases. As an example, the pumping rate of the Sanford Water Districts Old Mill Road well supply has a pumping flow rate restriction based on nearby residential subsurface disposal systems. Groundwater withdrawals are highly regulated in other states and are likely a target area for future regulations in the State of Maine. Pending rulemaking is discussed further in the report.

Table 6-1 presents an overview of the safe yield of each member utilities sources of supply. The data includes the estimated safe yield of the sources (from Section 2) as compared to current and projected demand data. Utilities which rely on surface supplies have been evaluated based on the supply meeting the projected average-day demand of the system. These systems include the BSWC, KKW, KWD, PWD and YWD. Systems relying on groundwater sources have been evaluated based on the supplies being able to meet the maximum-day demand of the system with the largest pumping unit out of service. These systems include the SWD and SBWD.

TABLE 6-1
SAFE YIELD OF SUPPLIES IN MGD

Member System	Safe Yield[1] (MGD)	2006	Surplus/ (Deficit)	2025	Surplus/ (Deficit)	2050	Surplus/ (Deficit)
BSWC	1,000	5.72	994	6.13	994	6.95	993
KKW	5.25[2]	2.83	2.42	3.27	1.98	4.00	1.25
KWD	5.60	2.62	2.98	2.84	2.76	3.16	2.44
PWD	100	23.45	76.55	32.73	67.27	42.00	58.00
SWD	4.42/(3.42)	2.50	0.92	2.49	0.93	2.80	0.62
SBWD	1.00/(0.73)	0.26	0.47	0.32	0.41	0.39	0.34
YWD	2.05	1.00	1.05	1.12	0.93	1.33	0.72
Southern Region	1,118	42.8	1,078	53.68	1,068	65.97	1,056

1 From Section 2. Figures shown as "(x)" represent safe yields assuming the largest unit out of service and are used for the analysis.

2 The safe yield of 5.25 MGD represents the available supply during the peak summer months of July and August. It includes yield from the District's primary source (Branch Brook) as well as all available groundwater supplies. As reported by the District, the yield of Branch Brook is more than adequate to meet all demand conditions outside of the peak months of July and August. It should be noted that the Districts ability to meet maximum-day demands during the peak demand seasons should be revisited outside the scope of this study. The District can sustain short multiple days of maximum-day demand; however extended maximum-day demand conditions may challenge the District's ability to reliably serve the system.

Several conclusions can be drawn from the data presented in Table 6-1:

- Individual Utility Supply - Each utility appears to have adequate safe yield to meet their needs far into the future. However, we know that several supplies are already in or are nearing a stressed condition and development and/or protection of new sources will be required. See below for further discussion on recommendations for increased supply capacity for these systems.
- Regional Supply Balance - The existing source of supply's have adequate safe yield to meet the regions projected needs for public water supply. The Saco River and Sebago Lake represent the largest supplies which could serve the entire region.
- Environmental Withdrawal Restrictions - Loss of existing yield due to a reduction in withdrawal volume from lake level restrictions or minimum flow releases could affect some SMRWC utility members' ability to adequately serve the projected customer base.
- Saco River and Sebago Lake Supply's - The Saco River, and to some extent Sebago Lake, provide the bulk of the surplus yield in the region and can be exploited further as a regional water supply if additional capacity is needed.

The demand projections are worst case scenarios and do not include variables such as economic prosperity which results in new residential housing, commercial and industrial development and other large water-users. Based on the projections of growth and development made by local planning entities, significant increases in water demand are not anticipated in the region.

6.2.1.1 Improvements in Safe Yield to Meet Future Conditions at the KKW Water District

The KKW Water District is projected to approach the safe yield of its existing supplies in the near future. These conditions could require further cooperation between KKW and the Biddeford & Saco Water Company in the short-term to sustain reliability during peak demand seasons as KKW develops additional sources of supply. The KKW is currently evaluating multiple potential options to augment supply which include:

- Expanded reliance on the BSWC interconnection during summer months when pumping and need is highest.
- Purchase water from the interconnection with the York Water District to augment supply in the Wells-Ogunquit area of the distribution system.
- Develop additional groundwater resources in the KKW service area (on-going).
- Expand the safe yield of Branch Brook by increasing the storage volume of the existing impoundment.

6.2.1.2 Improvements in Safe Yield to Meet Future Conditions at the Sanford Water District

In the long-term, the projected long-term demands in the SWD are projected to *approach* the safe yield of its existing supplies. Some surplus supply should be available remain. Over the next 20-years, the District should closely monitor growth and demands. Because the District operates multiple groundwater supplies spread throughout the system, the supply vulnerability is low. Should demands begin to trend differently than their master plan suggests or as projected within this study, the District should consider exploration for additional sources of supply.

6.2.1.3 Improvements in Safe Yield to Meet Future Conditions at the South Berwick Water District

The South Berwick Water District is projected to *approach* the safe yield of its existing supplies under average-day demand condition, however, similar to the conditions of the SWD, some surplus supply is anticipated to remain through the planning period. Over the next 20-years, the District should closely monitor growth and demands. Because the District operates multiple groundwater supplies spread throughout the system, supply planning is more flexible. If demands begin to trend differently than projections presented in this report, the District should reconsider or advance supply development projects.

6.2.1.4 Improvements in Safe Yield to Meet Future Conditions at the York Water District

The York Water District is projected to approach the safe yield of its existing supplies under average-day demand conditions. For planning purposes, the YWD has been proactive and has considered several long-term alternatives to improve summer peak demand reliability. These options could be implemented in the future if additional supply is needed:

- Expanded reliance on the KWD interconnection during summer months when pumping and need is highest and the KWD has surplus supply.
- Purchase water through the interconnection with the KKW *if available* (although this portion of the KKW distribution system has insufficient yield during summer months).
- Increase the impounded volume of Chase's Pond by raising the dam (studied in 2002).
- Reconsider the purchase of raw water from Kittery Water District's Bell Marsh Reservoir (studied in 2003).

6.3 SAFE PUMPING/TREATMENT CAPACITY

The safe pumping and/or treatment capacity is a measure of a systems ability to supply treated water to the distribution under all operating conditions. It differs from total pumping/treatment capacity (when all pump and treatment units are in service) because it considers a worst case scenario where the largest production unit is unavailable on a maximum-day due to maintenance or mechanical failure.

In the context of this study, the surplus safe pumping/treatment capacity will be considered to offset needed pumping and/or treatment improvements necessary to meet the criteria of transferring water between systems.

Table 6-2 presents a summary of each water system and its total and safe pumping/treatment capacity as compared to existing and projected demands. The data presented suggests that several systems may require investment in pumping and treatment redundancy in the very near future before considering initiatives to share water with neighboring systems.

TABLE 6-2
SAFE PUMPING/TREATMENT CAPACITY IN MGD

System	Total Pumping/ Treatment Capacity	Limiting Unit	Safe Pumping/ Treatment Capacity	2006 MDD	2006 Surplus/ (Deficit)	2025 MDD	2025 Surplus/ (Deficit)	2050 MDD	2050 Surplus/ (Deficit)
BSWC	14.50	Raw Water Pumps	11.71	10.51	1.20	11.27	0.44	12.78	(1.07)
KKW	9.14	WTP	7.42	6.35	1.07	7.32	0.10	8.95	(1.53)
KWD	5.00	HS Pumps	5.00	4.42	0.58	4.78	0.22	5.34	(0.34)
PWD	52.00	Pumps	52.00	36.04	15.96	47.78	4.22	60.90	(8.90)
SWD	4.42	Eagle Drive	3.42	3.13	0.29	3.11	0.31	3.46	(0.04)
SBWD	1.15	Willow Drive	0.57	0.40	0.17	0.49	0.08	0.60	(0.03)
YWD	4.00	WTF Filter	2.00	2.46	(0.46)	2.75	(0.75)	3.27	(1.27)

6.3.1.1 Improvements in Pumping/Treatment Capacity to Meet Future Conditions at the BSWC

In the long-term (beyond 20-years), the demands in the BSWC system may exceed the safe pumping/treatment capacity of the system. The limiting factor of the system appears to be the raw water pumping system. Loss of either pump would limit the production capacity through the water treatment facility. The next upgrade of the facility should include an analysis of safe pumping and treatment capacity to assure reliable conditions in the event of the largest unit in the system during maximum-day demand conditions.

6.3.1.2 Improvements in Pumping/Treatment Capacity to Meet Future Conditions at the KKW Water District

The long-term safe pumping capacity will approach a deficit in approximately 20-years. In order to maintain reliable and sustained service, improvements may be warranted. The District is currently developing new groundwater supplies throughout the system which will improve the current condition. They are also considering the expansion of in-stream storage capacity of the Branch Brook to increase the availability of supply through the facility. Modifications to the plants pumping and treatment processes may be needed to handle increased flows.

6.3.1.3 Improvements in Pumping/Treatment Capacity to Meet Future Conditions at the Kittery Water District

In the long-term (beyond 20-years), the demands in the KWD system may exceed the safe pumping/treatment capacity of the system. The limiting factor of the system appears to be either the water treatment facility or the high service pumping system. The District has plans for a major treatment upgrade and expansion in the coming years which should address long-term concerns of adequacy.

6.3.1.4 Improvements in Safe Yield to Meet Future Conditions at the Portland Water District

Similar to several other utilities, the District's safe pumping and treatment capacity is anticipated to be exceeded in the long-term. The current system should be more than adequate however for the next 20-30 year planning period. At the time of the next treatment and pumping upgrade, the District should incorporate improvements to allow reliable safe pumping and treatment conditions through the planning period.

6.3.1.5 Improvements in Pumping/Treatment Capacity to Meet Future Conditions at the KKW Water District

The long-term safe pumping capacity be in deficit in approximately 20-30 years. During the interim, the District should evaluate the feasibility of either developing new groundwater supplies or interconnecting with the Kittery Water District to alleviate the projected deficit.

6.3.1.6 Improvements in Pumping/Treatment Capacity to Meet Future Conditions at the York Water District

Based on the above analysis, the District appears to be in a safe pumping and treatment deficit under existing conditions. The limiting process is the water treatment facility which has insufficient capacity assuming one of the filter units was unavailable during a maximum-day demand event. The District currently has back-up capabilities through interconnections with the KWD and KKW Water Districts which should be adequate to meet any short term deficits. However, upgrades are warranted and should include at a minimum, the addition of filter capacity to assure reliable service independent of mutual aid.

6.4 SUMMARY OF SUPPLY ADEQUACY AND BALANCE ON A REGIONAL BASIS

A number of conclusions can be drawn from the data presented in Tables 6-1 and 6-2. This data will serve as the basis for evaluating the hydraulic requirements for interconnecting distribution systems, mutual aid cooperation, or expansion of the water systems in southern Maine. In general, the following broad conclusions can be reached regarding local and regional supply in the region:

- Local supply planning has been effective and most utilities have sufficient supply to meet customer needs locally on a short-term basis. However, current local supplies cannot sustain long-term projections and further development and expansion of supplies will be needed.
- Environmental restrictions from LD 587, Rules and Regulations associated with Water Withdrawal, will present the biggest challenge to meeting supply needs in the region.
- The Kittery-York "sub-region" reservoir system has surplus supply.
- The Saco River has the largest yield and is the best opportunity to expand supply in the region with minimal risk from withdrawal limitations under LD 587.
- Regional supply planning for improved mutual aid is needed in the region.
- Sebago Lake has surplus supply but existing infrastructure may limit opportunities to transmit flows to the south.

Both the Saco River and Sebago Lake have surplus supply capacity that could be used to augment needs in the SMRWC service region. In fact, the Saco River has ample supply capacity to serve the entire southern Maine region and still have a significant supply surplus. A discussion of improved mutual aid, emergency support and regionalization opportunities which originate from either of these sources will be discussed later in this report.

There is very little surplus "safe" pumping/treatment capacity available under existing conditions from any of the member systems. Small exchanges of water could be accommodated by PWD and the BSWC provided that the proper infrastructure was in-place. However, the data presented indicates that most of the system will require some pumping and treatment upgrades just to meet their own current and future projected demand conditions. This is not unexpected considering that infrastructure is designed for a 20-year planning period.

The decision to invest in pumping and transmission improvements between systems must be considered carefully and weighed against the benefits to public service and health. Of primary importance is the need to serve communities who are in obvious supply and pumping deficits under current and projected conditions. Of secondary concern is the need and ability to provide mutual aid among member systems in the event of significant catastrophe. The feasibility of meeting each condition will be dependent upon a variety of variables including economics, political climate and actual demand growth.

6.5 CONCEPTUAL STRATEGIES TO MEET THE SUPPLY IMBALANCE

The previous findings lend credence to the concept of considering some form of water sharing between the member systems. In some regards, this is not surprising as there are already a number of interconnections between systems in the southern and central study area where there is the greatest need. The existing interconnections have resulted in the formation of small sub-systems between:

- The Kittery and York Water Districts
- The York and Kennebunk, Kennebunkport & Wells Water Districts
- The Kennebunk, Kennebunkport & Wells Water District and the Biddeford & Saco Water Company

The Kittery, York, Kennebunk, Kennebunkport & Wells Water Districts and the Biddeford & Saco Water Company exist today as essentially one large sub-system stretching from the Maine/New Hampshire border north into Scarborough.

On a smaller scale, the Sanford and South Berwick Water District systems could someday benefit by co-joining systems, particularly if the North Berwick Water District system were to participate as the link between the three (the North Berwick Water District did not participate in this study). Other future sub-systems could include a link between the Kittery/South Berwick systems and between the Sanford Water District and the Kennebunk, Kennebunkport & Wells Water Districts.

Secondly, the results unequivocally suggest that the members should develop a strategy towards protecting current and potential future water resources. The availability of future supply sources in southern Maine is limited. Every effort should be made on both a local, State and Federal level to insure protection and accessibility to remaining supplies for long-term drinking water purposes.

6.6 IMPACTS AND ISSUES WITH INTER-SYSTEM SUPPLY EXCHANGE

6.6.1 Legal and Charter Limitations/Restrictions

The SMWRC member utilities are chartered by the State of Maine legislature to provide public water supply to a specific geographic areas as described earlier in the report. In general, the SMRWC utility members can participate in inter-system wholesale agreements or emergency interconnections without compromising the intent of the legislative charters.

The existing emergency interconnection agreements between the Kittery, York and KKW distribution systems meet the intent of the legislative charters for these member utilities and continued cooperation under these circumstances should not change the intent of any member utilities legislative charter.

6.6.2 Chapter 587 - In-stream Flows and Lake and Pond Water Levels

In 2007, the State of Maine adopted Chapter 587 - In-stream Flows and Lake and Pond Water Levels (Rule). This regulation will be administered by the State of Maine DEP and will establish guidelines for withdrawal of water from surface water bodies for suppliers of public water. For the SMRWC membership, the Biddeford & Saco Water Company, Kennebunk, Kennebunkport and Wells Water District, York Water District, Kittery Water District and the Portland Water District are likely to be impacted by this regulation.

Groundwater systems are not likely to be impacted by the rule unless they have been determined to be directly "under-the-influence" of adjacent surface waters and they have wells within 25-feet of the normal high water mark of a regulated surface water body. The rule is designed to protect natural aquatic life and other uses by establishing minimum stream flows downstream of dams and water level restrictions of lakes and ponds. The rule requires that petitioners for new or increased withdrawals from surface sources establish in-stream flows or lake and pond levels prior to being issued a permit for the withdrawal; the new rule is not expected to affect current operations of any water utility. Existing public water supplies will follow a separate, but similar approval process.

The rules have the potential to disrupt and limit regional water suppliers in the SMRWC service area. A summary of provisions of the rulemaking follows:

- <u>System Design Capacity</u> - All utilities have established the capacity of existing distribution and treatment infrastructure as of May 2007. A Community Water System Withdrawal Certificate will be issued for a system up to its system design capacity.
- <u>Aquatic Base Flows</u> - Minimum stream flows will be established for streams below dams based on the DEP classification of the stream and reservoir.
- <u>Lake Level Restrictions</u> - Surface water bodies will be required to manage lake level fluctuations for important resources such as macro-invertebrates in the littoral zones of lakes and for nesting waterfowl.
- <u>Drought Management Provisions</u> - The rules provide for relief under drought or water supply emergencies.
- <u>Water Rate Impacts</u> - The regulation stipulates that the rules can not cause hardship to water users from a change in water withdrawal regime.
- <u>Use Attainability Analysis (UAA)</u> - For utilities that can not reach operated conditions through the certificate process with DEP, a more rigorous habitat based UAA process will be required.

Water utilities will have a 5-year period to comply with the new regulations. The specific impacts to each SMRWC utility are unclear at this juncture and will not be known until habitat assessments and site walks are conducted by DEP.

The Maine DEP has identified approximately 10 water utilities in the State of Maine whom are not operating within the lake level and stream flow guidelines established in the rules. These utilities will be required to pursue one of three options; (1) a Community Water System Withdrawal Certificate, (2) accept lake level and flow restrictions in accordance with water quality standards, or (3) pursue operating conditions through the UAA process. The Kennebunk, Kennebunkport & Wells, York and Kittery Water District's all have been identified as utilities that will require a certificate or one of these other processes.

In other New England states, communities are reconsidering large rivers as sources of supply to meet the challenges of water withdrawal regulations on smaller watersheds. Both Concord and Manchester, New Hampshire and Haverhill, Massachusetts are studying the use of the Merrimack River as a potential new source of supply. Withdrawals for public water supplies from large river systems such as the Saco River are very small in comparison to seasonal flow variations in the river. The minimum aquatic base flows needed to maintain a healthy river ecosystem are minimally impacted by withdrawals for public water supplies. It is anticipated that the BSWC and their use of the Saco River is well positioned to comply with the regulations without a UAA or certificate process from DEP.

Similarly for Sebago Lake, water withdrawals from this large public water supply are very small in comparison to the natural inflow to the lake basin. For large lake systems, the withdrawals for public water supplies are unlikely to impact desired lake levels to protect the biology and ecosystem of the lake. Again, from the perspective of water withdrawal regulations, the Portland Water District and Sebago Lake basin are well positioned to comply with the regulations without a certificate or UAA process.

As the regulatory process for water withdrawal unfolds in the State of Maine, the SMWRC membership should continue to monitor the impact on these regulations for each individual utility. Based on the dialog taking place in on-going stakeholder meetings, the current preservation of yield will be maintained for the small water systems in York County with some future restrictions. The following restrictions are anticipated:

- Drought Management Provisions - Lake level restrictions will likely be implemented and tied in some manner to precipitation and drought indices.
- Conservation and Lost Water Management - It is likely that in the future, provisions for managing lost water and demand management will be included in the regulations before minimum water levels and minimum stream flows are allowed to be exceeded.

6.6.3 Interbasin Restrictions

Interbasin transfers of flows from one watershed to another watershed are regulated in most states and likely an area for future regulation in the State of Maine. Some states regulate delivered water to customers within distribution systems as interbasin transfers if water flows across a watershed boundary within a water main. The environmental concern is disruption of the hydrologic balance in watersheds by exporting water as potable water or as wastewater discharges.

The SMRWC should track any new regulation that seeks to regulate interbasin transfers in the State of Maine. This type of regulation could have a big impact on regionalization or exchange or water between distribution systems.

Section 7 will consider the expansion of existing interconnections leading to a regional water system and will address the question of how best to interconnect the systems. The evaluation will be conducted using hydraulic modeling software and using the supply surplus and deficit figures developed within this Section. It will detail the hydraulic analysis of various interconnection and regional water system scenarios and will consider the short and long-term needs of each member system, hydraulic requirements and infrastructure needs.

SECTION 7

LOCAL AND REGIONAL WATER SYSTEM EVALUATION

7.1 INTRODUCTION

Regional cooperation between the SMRWC utilities will be dependent on the proximity and capacity of existing infrastructure to transmit water between water systems. The purpose of Section 7 of this report is to understand the hydraulic and infrastructure limitations of the distribution systems of each utility to improve regional cooperation in the future. More specifically, the evaluation will include:

- Development of Needs Scenarios - Supply surplus and deficits within each water utility have been identified in Section 6 of this report. The technical requirements to share water between systems will be identified and tested.
- Hydraulic Limitations of Distribution Systems - A hydraulic analysis of the distribution and transmission systems of each water utility will be completed to understand the hydraulic limitations and investment required for interchanging water in the future.
- Mutual Aid Opportunities - Mutual aid scenarios will be developed and analyzed. A plan for to cooperate and share water under various emergency scenarios will be developed.
- Development Corridors - Service plans for key development corridors in the region will be prepared and hydraulic limitations identified.

In Section 6, the following conclusions were identified regarding water supply in the region:

- Regional Supply Capacity - The SMRWC service territory maintains a supply surplus on a regional basis.
- SMRWC Utility Member Supply - Many of the utilities maintain adequate supply to meet average-day needs. Several of the systems have stressed supplies which will likely require cooperation from other systems and/or development of new sources.

- Mutual Cooperation - Cooperation and interchange of water will be important in the future for emergency and mutual aid purposes and for sustained maximum-day demand periods for some utilities.

There is no urgency for the development of a regional water system to meet the projected water supply needs of the region. More than likely, regional cooperation will develop gradually over time and will be focused on emergency planning and support. It will ultimately be driven by the divergence of increasing demand, supply limitations and possible system expansion to accommodate growth along primary highway corridors.

The foundation for regional cooperation has already begun to form through existing interconnections for mutual aid and emergency purposes. Other opportunities to expand supply have been conceptualized, studied and in some cases implemented. Not surprisingly, the first interconnections have developed in the southern end of the region where supply capacity is not as strong as areas to the north.

7.2 OVERVIEW OF HYDRAULIC MODELS OF SMRWC MEMBER SYSTEMS

Hydraulic evaluations of water distribution systems are made using a computerized hydraulic model of the water distribution system. The characteristics of the water system such as pipe sizes (diameter, length, C-value, and ground elevation at pipe intersections), hydraulic grade line elevations, pump operation characteristics, and total system demand are the primary inputs to the model (the C-value is an estimate of the pipe roughness which determines headloss in a water main). The model generates pressures, hydraulic grade line elevations and available flows at pipe junctions, pipe velocities and head losses within each pipe.

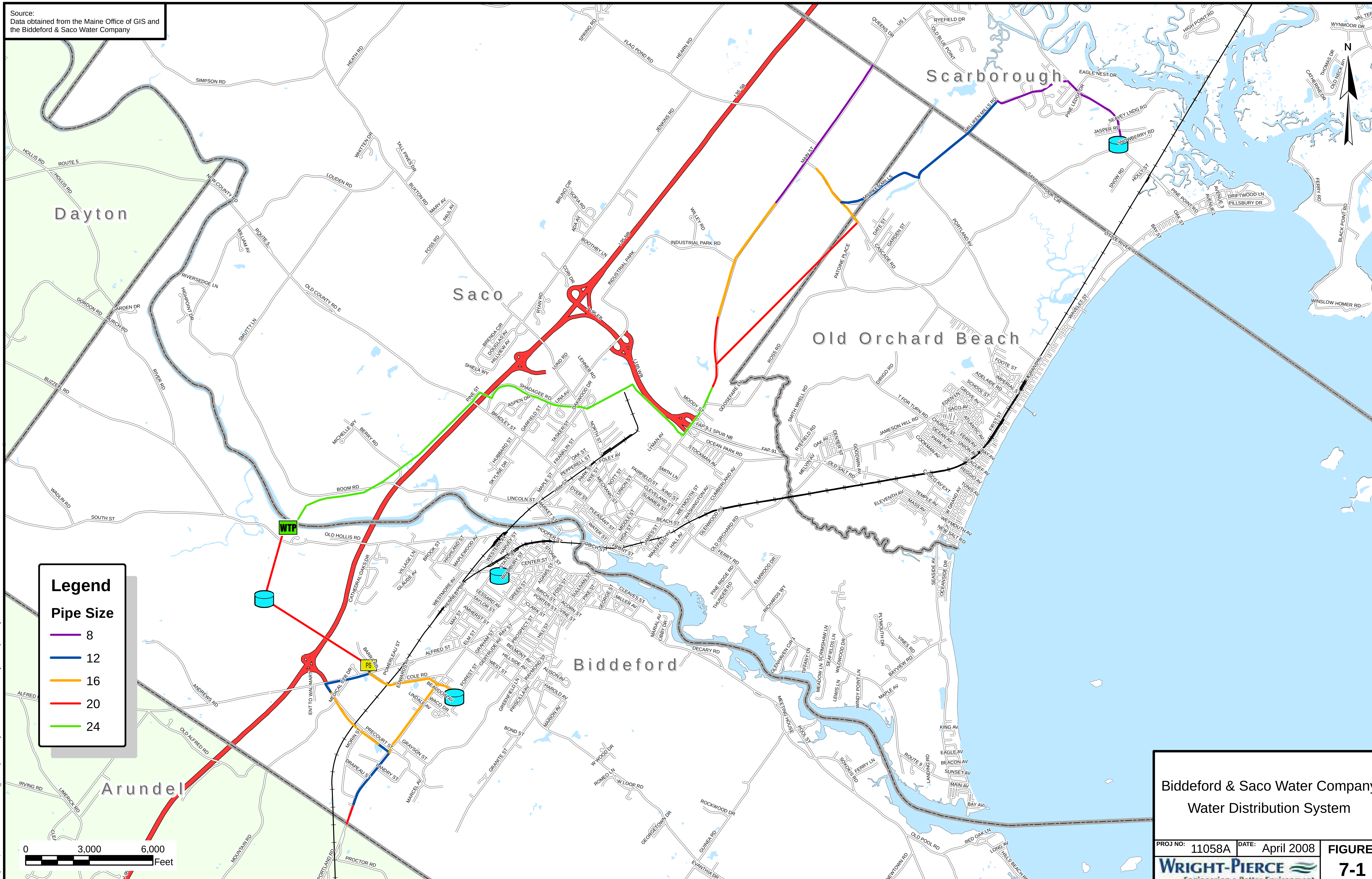
Once developed, a hydraulic model can be used to simulate the impacts to each water system when water is shared between two water systems considering an interconnection. For mutual aid or regionalization studies, the typical challenge is managing hydraulics between the two cooperating water utilities so customers in each system are protected and provided an adequate level of service during occasional use of the interconnection for emergency conditions. As an example, low pressures are typically acceptable during emergencies without need for individual low service agreements for customers if the cooperation is for emergencies. In addition, from a regulatory perspective, EPA does not consider an interconnection that is used for emergency purposes only as a source of supply when considering water-age related water quality problems.

For this study, existing hydraulic models were used for the analysis except for the KKW Water District and the BSWC. For the KKW Water District, a new skeletal model was developed comprised of only large diameter and hydraulically important pipelines. For the BSWC, a very basic and limited skeletal model was developed using some of the major transmission piping. An overview of each of the hydraulic models and general system characteristics of each system follows.

7.2.1 Biddeford & Saco Water Company (BSWC)

BSWC's existing hydraulic model and distribution map was not made available for this study; a skeletonized model of the distribution system was created of the major transmission piping (generally greater than 12") located between I-95 to the west and US Route 1 to the east extending to the northern and southern extremities of the system. It also included the major transmission piping from the water treatment plant to tanks and the high pressure zone located in the southern portion of the system. Less than 10% of the total distribution system (200 miles of water mains) pipe was included in the model. Existing demands were apportioned equally across nodes. The model was developed using WaterCAD hydraulic modeling software. A map of the BSWC distribution system used in this analysis is presented on Figure 7-1.

Pipe age, material and estimated "C-value" (provided by BSWC) were used as pipe inputs. Tank overflow elevations, pump capacity and operating head were used for system parameters. Fire flow field tests were not conducted and therefore the model could not be calibrated due to the lack of data. Any modeling results should be validated through the use of a complete calibrated model of the system.



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Based on discussions with BSWC staff and preliminary model runs, we have made some preliminary observations on conditions in the distribution system that might affect the transfer or receiving of flows to either the KKW system to the south or the Portland Water District distribution system to the north:

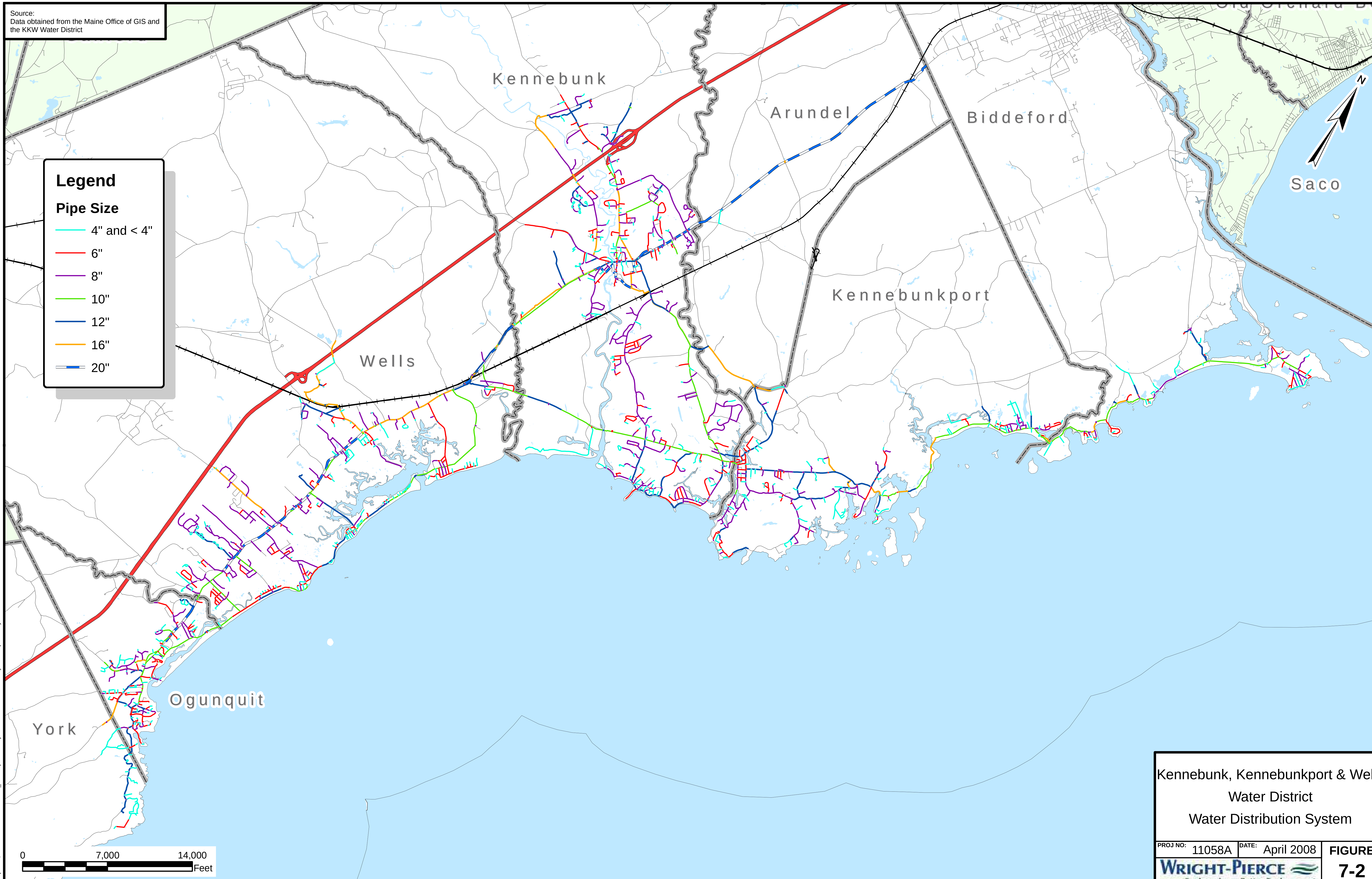
- Characterization of the Northern End of the Distribution System - The northern end of the US Route 1 corridor experiences low to marginal system pressure ranging from 35 to 45 psi. The distribution system in this location terminates includes 8-inch water mains on Route 1 at the Saco town line and on Pine Point Road (Route 9) near Scarborough Marsh. There are also 12 inch water mains in Portland Avenue and Old Blue Pint Road in this area of the system. The relative small size of these mains will tend to limit large transfers of water from BSWC to PWD unless improvements are made within the BSWC distribution system. On the other hand, this area of the system appears adequate to receive large quantities of water from PWD because of the existing low pressure in the area as well as the larger pipe. Our analysis will study this location further as an opportunity for mutual aid.
- Characterization of the High Pressure Zone - Pressures within the high pressure zone range between 35 to 70 psi. Lower pressures are concentrated near the storage tank and south along US Route 1 in this zone. This area is generally served with 10 to 20-inch diameter water mains.

7.2.2 Kennebunk, Kennebunkport & Wells Water District (KKW)

As part of the scope of this study, a skeletonized hydraulic computer model was created of the KKW water system which included approximately 110 of the 200 miles of their piping. This included a majority of pipelines greater than 8-inches in diameter as well as pumping and storage facilities. The skeletal model was created using WaterCAD hydraulic modeling software. All pipelines for critical loops and service mains were modeled. A map of the KKW distribution system used in this analysis is presented on Figure 7-2.

Existing demands were generally allocated equally across the system. Pipe age, material and estimated "C-value" were used as pipe inputs. This data was collected from the recently completed GIS project undertaken by the District Tank overflow elevations and locations, booster pump and finished water pump characteristics at the water treatment facility were also incorporated into the model. The District provided recent fire flow data for hydrants throughout the system which was used to calibrate the model. The model evaluation was primarily focused from north to south along the Route 1 corridor. Existing conditions in the KKW distribution system of importance include:

- Transmission Main to BSWC System - The northern end of the distribution system along US Route 1 between Ross Road and the Biddeford City line is served by a 20-inch diameter water main and a small booster pumping station. Static pressures vary between 20 to 50 psi. Some of the customers along US Route 1 are served with minimum service pressure agreements. Large water withdrawals or transfer of flows northerly to the BSWC system for mutual aid along this pipe segment will require a sizable booster pumping station and/or tank to achieve and maintain adequate service pressure.
- Service Area near York Town Line - Service pressure in the southern area of the system is established by the Ogunquit storage tanks. These tanks can be filled directly from the plant under low demand conditions. During seasonal demand increases, the Moody Booster station is needed to fill the tanks. Transmission pipe along the southern Route 1 corridor consists primarily of 12 to 16-inch diameter mains. KKW's system appears adequate to serve the YWD with approximately 1-2 MGD at the existing emergency interconnection with the existing pumping station. For flows above 2 MGD, significant upgrades to the US Route 1 water mains locally are needed.



Kennebunk, Kennebunkport & Wells Water District

Water Distribution System

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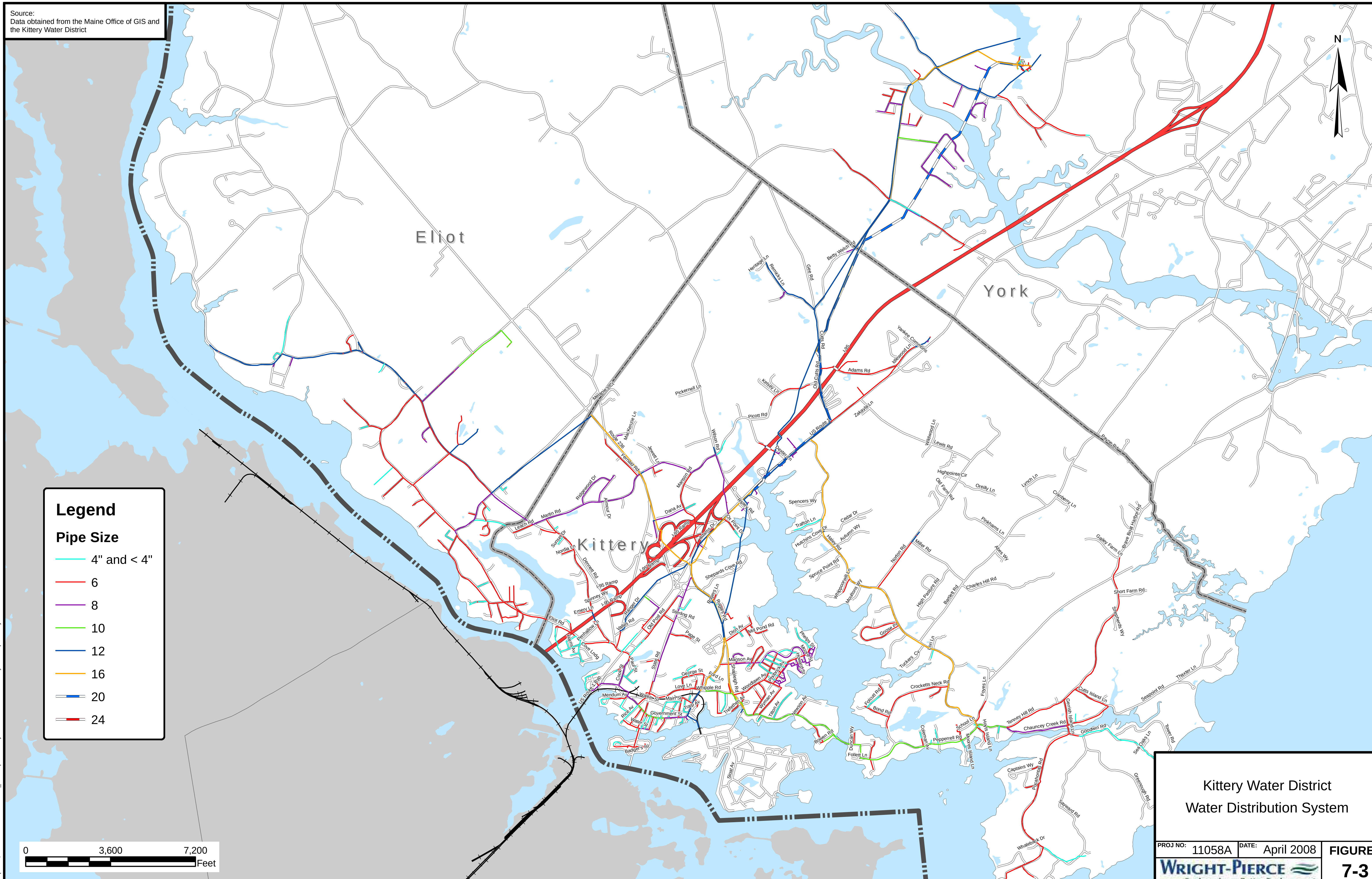
7.2.3 Kittery Water District (KWD)

The hydraulic model of the Kittery distribution system was developed for the District as part of its 2000 Comprehensive Water System Master Plan. The model was originally used to evaluate fire flow requirements within the Kittery distribution system and to study improvements needed to provide reliable service to the Portsmouth Naval Shipyard in the future. The model was used in this study to evaluate the impacts of transferring water between the Kittery and York Water Districts and the Kittery and South Berwick Water District's. It includes all of the District's approximately 105 miles of piping ranging in size from 2 - 20 inches in diameter and was updated as part of this study to include current demands. A map of the Kittery distribution system is presented on Figure 7-3.

A 12-inch ductile iron water main interconnection currently exists between the KWD and the YWD along US Route 1 for emergency purposes. The interconnection will also include a booster pumping station, which is currently under construction. The Kittery distribution and transmission system has evolved from the District's inception to provide high flows down a spine of transmission mains between the Boulter Pond supply and treatment facility and the Portsmouth Naval Shipyard. Significant hydraulic capacity exists within KWD's system along this transmission network, which is restricted locally several locations near where interconnection capacity to York is important.

Within the Town of Eliot, the Kittery distribution system terminates on US Route 236 with a relatively new 12-inch water main. The distribution system in this location is hydraulically strong from the nearby Eliot Storage tank. Opportunities to extend the water system north to South Berwick would likely originate from this location.



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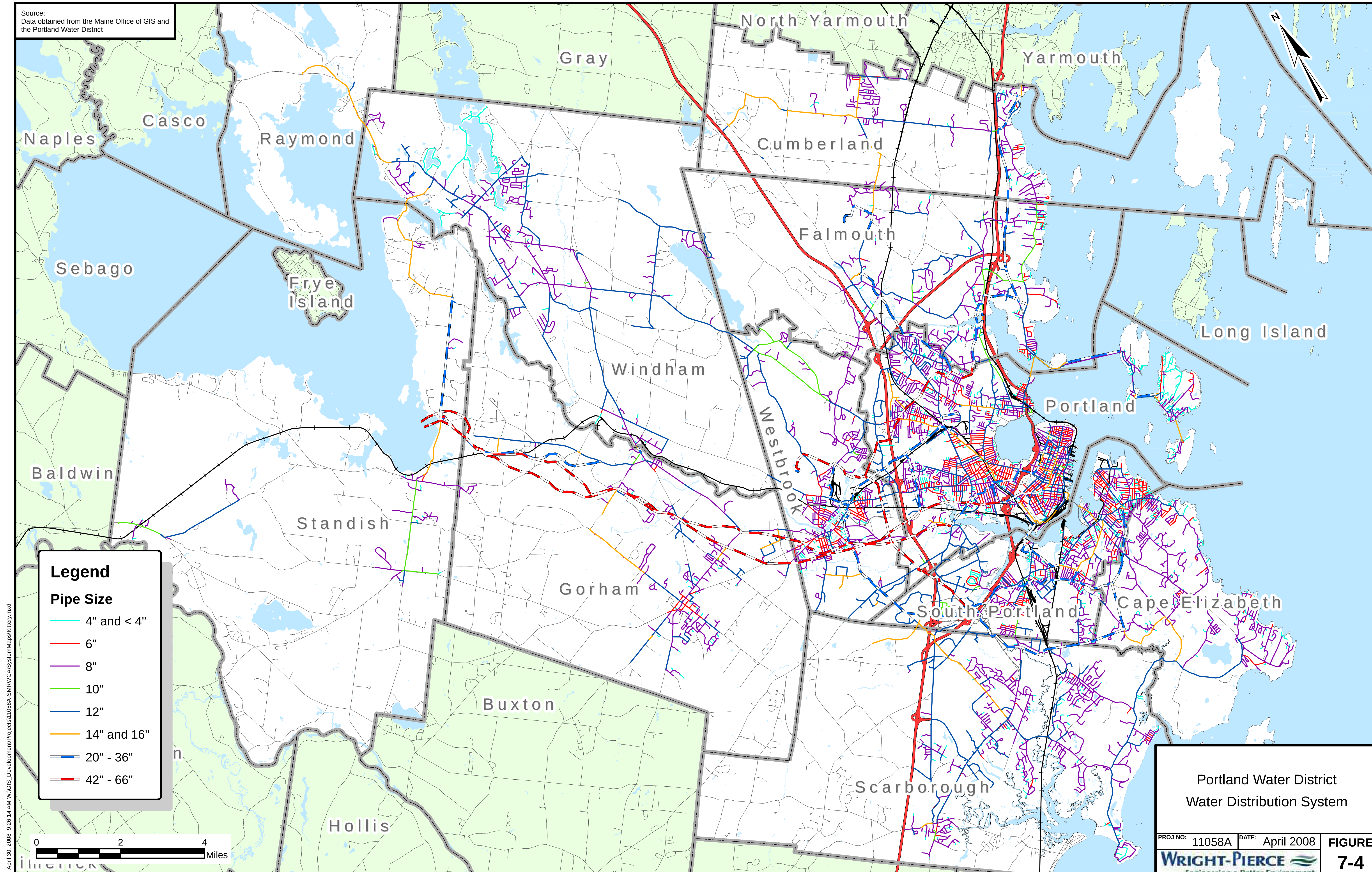
7.2.4 Portland Water District (PWD)

The Portland Water District provided a working copy of their existing hydraulic model for use in this evaluation. The model was created in conjunction with their Comprehensive Water System Plan developed in 2003. The model is extensive and includes all of the Districts transmission and distribution piping ranging in size from 2 - 60 inches in diameter. A map of the PWD distribution system is presented on Figure 7-4.

The MWSoft modeling software package was used to develop the hydraulic model. The model is well developed and is a good predictive tool of conditions in all areas of the PWD distribution system. Wright-Pierce conducted evaluations of potential interconnections to the BSWC system to the south using this model in the offices of the District.

The PWD evaluation was focused exclusively on the southern end of the system where it terminates along US Route 1 near the Scarborough/Saco town line. This location presents the only logical location where a mutual aid opportunity could be cost-effectively developed between the two water systems.

This location of the PWD distribution system is served from the Districts primary "Zone 267" service zone. This service zone operates at a hydraulic gradeline of El. 267 feet. Static pressures in the Payne Road/US Route 1 area of Scarborough range from approximately from 75 psi at high elevation areas to 110 psi at locations near sea level. The system appears well looped along US Route 1, Payne Road and Gorham Road with the majority of the water main being 12 to 16-inch in diameter. A primary 36-inch diameter transmission main serves the general Payne Road and Gorham Road area from Mussey Road in Scarborough. Many small diameter mains located between the 36-inch transmission system and the 12 and 16-inch local mains in the Payne Road area will restrict available flows if an interconnection is proposed at this location. This area of the distribution system lacks local storage which may also restrict hydraulic capacity for water transfers to BSWC.


Source:
Data obtained from the Maine Office of GIS and the Portland Water District
N
North Yarmouth
Yarmouth
Gray
Casco
Naples
Raymond
Cumberland
Falmouth
Sebago
Frye Island
Long Island
Windham
Westbrook
Portland
Baldwin
Standish
Gorham
South Portland
Cape Elizabeth
Buxton
Scarborough
Hollis
Legend
Pipe Size
4" and < 4"
6"
8"
10"
12"
14" and 16"
20" - 36"
42" - 66"
0
2
4
Miles
Portland Water District
Water Distribution System
PROJ NO: 11058A
DATE: April 2008
FIGURE: 7-4
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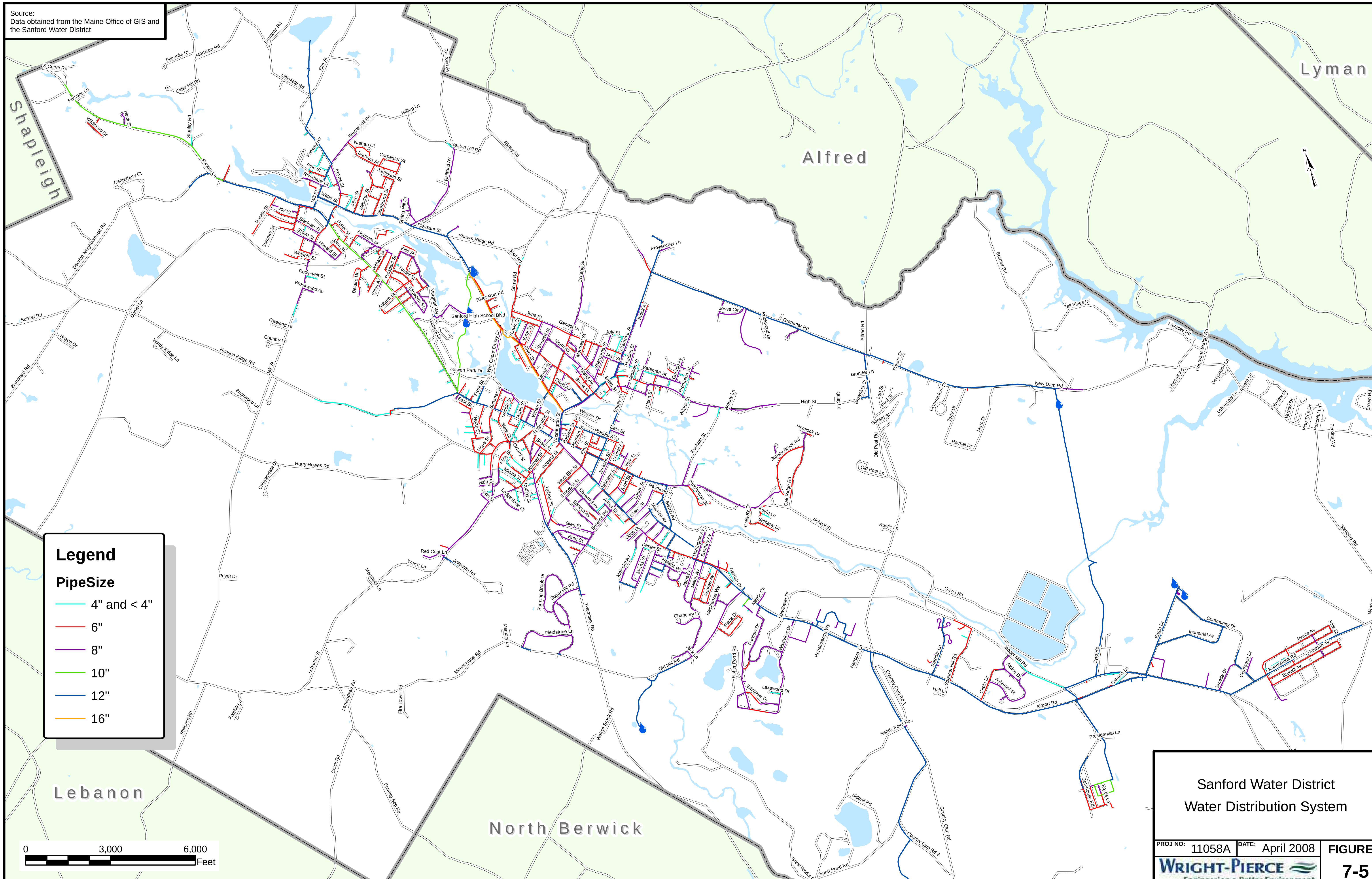
7.2.5 Sanford Water District (SWD)

Wright-Pierce completed the development of a hydraulic computer model for the Sanford Water District in 2007. The work was completed under a separate agreement with the District outside of the scope of this study. The model includes all of the Districts approximately 100 miles of piping in the system ranging in size from 1 to 16-inches in diameter. The model also includes well pumping stations, storage facilities and the delineation of pressure zones. Existing demands were allocated equally across the system using zoning maps and with specific allocated demands for large users. Pipe age, material and estimated "C-value" were used as pipe inputs; tank overflow elevations, pump capacity and operating head were used for system parameters. A map of the Sanford distribution system is presented on Figure 7-5.

The southeast portion of the distribution system was evaluated for a potential interconnection with the North Berwick Water Department along Country Club Road, as well as a potential interconnection with the KKW along US Route 99. Generally, the southeast portion of the system is well served by a large 12-inch loop. Service pressure in this area along Main Street often exceeds 100 psi in areas of low elevation. Impediments to regional cooperation will be evaluated between the Sanford Water District and the coastal water utilities. A connection to neighboring water systems appears problematic due to:

- The length of water mains required between systems is extensive.
- Dramatic differences in hydraulic gradeline between the systems and,
- A lack of storage in areas of South Sanford where opportunities for interconnections exist.



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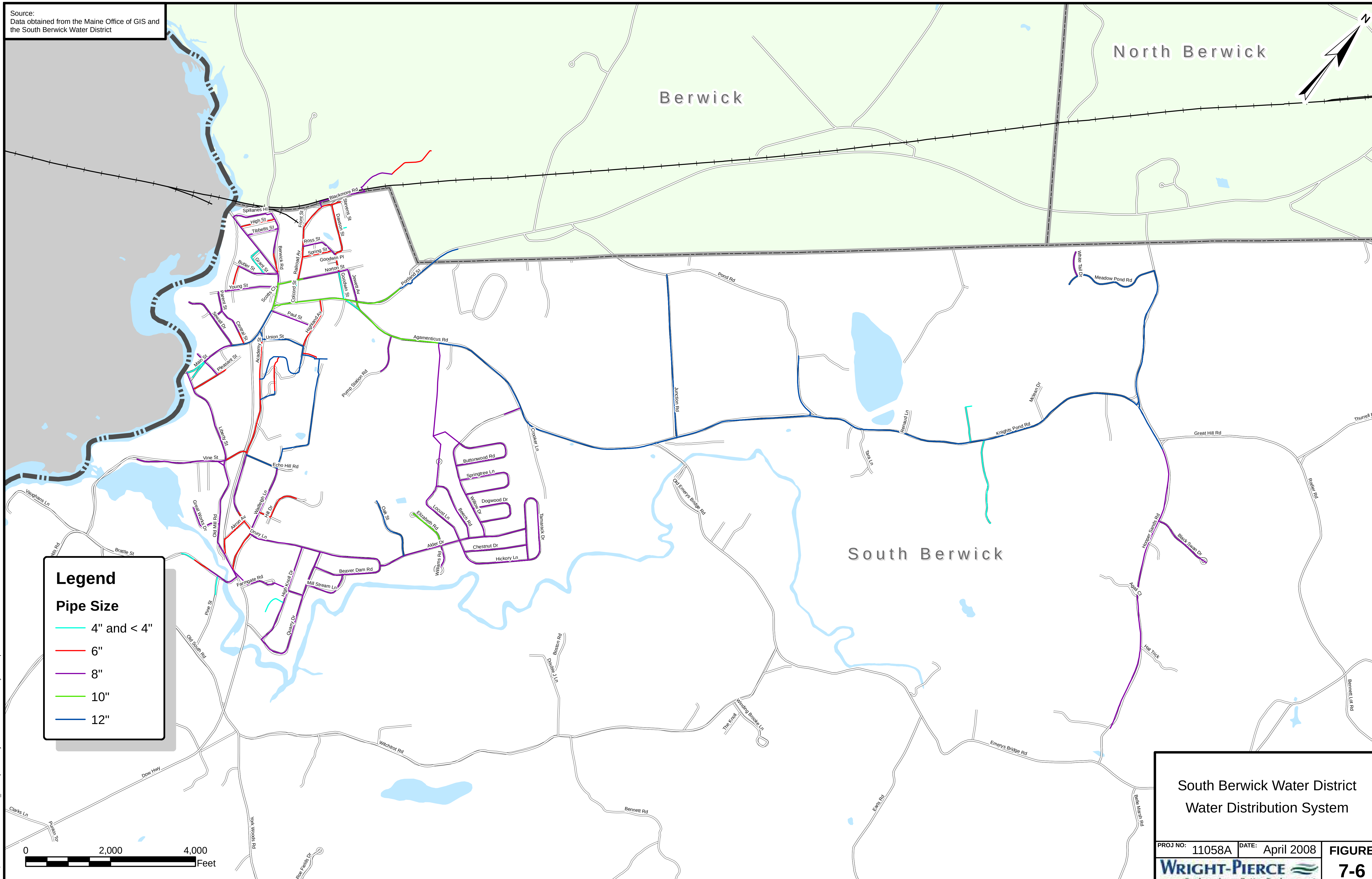
7.2.6 South Berwick Water District (SBWD)

Hydraulic impacts to the South Berwick system were studied using the District's existing hydraulic model, developed as part of their 2001 Comprehensive Water System Master Plan. The model includes approximately 30 miles of piping, including all piping larger than 6-inches in diameter in the South Berwick distribution system. The model was updated to include existing demands for use in this study.

The system consists of a single service zone supplied by multiple small capacity ground water sources and a centrally located storage tank on Powderhouse Hill. The system serves the village area of South Berwick and is generally well looped. Service pressure ranges between 40 to 85 psi. A 12-inch transmission/distribution main extends northerly along Knights Pond Road and terminates near US Route 4. A map of the South Berwick distribution system is presented on Figure 7-6. A map of the North Berwick distribution system is presented on Figure 7-7 for informational purposes only.

Extension of water service along US Route 4 from South Berwick to Sanford has been identified as a possible development corridor in the future which would pass through the North Berwick service territory and require cooperation from the North Berwick Water District. The US Route 4 corridor between this location and the terminus of the South Berwick distribution on US Route 4 near the South Berwick town line was ceded from the Town of Berwick to the South Berwick Water District in 2006.

The southern portion of the distribution system along US Route 236 has been studied as a potential interconnection with Kittery Water District. This location will be retested and modeled as part of this study using current demand patterns.



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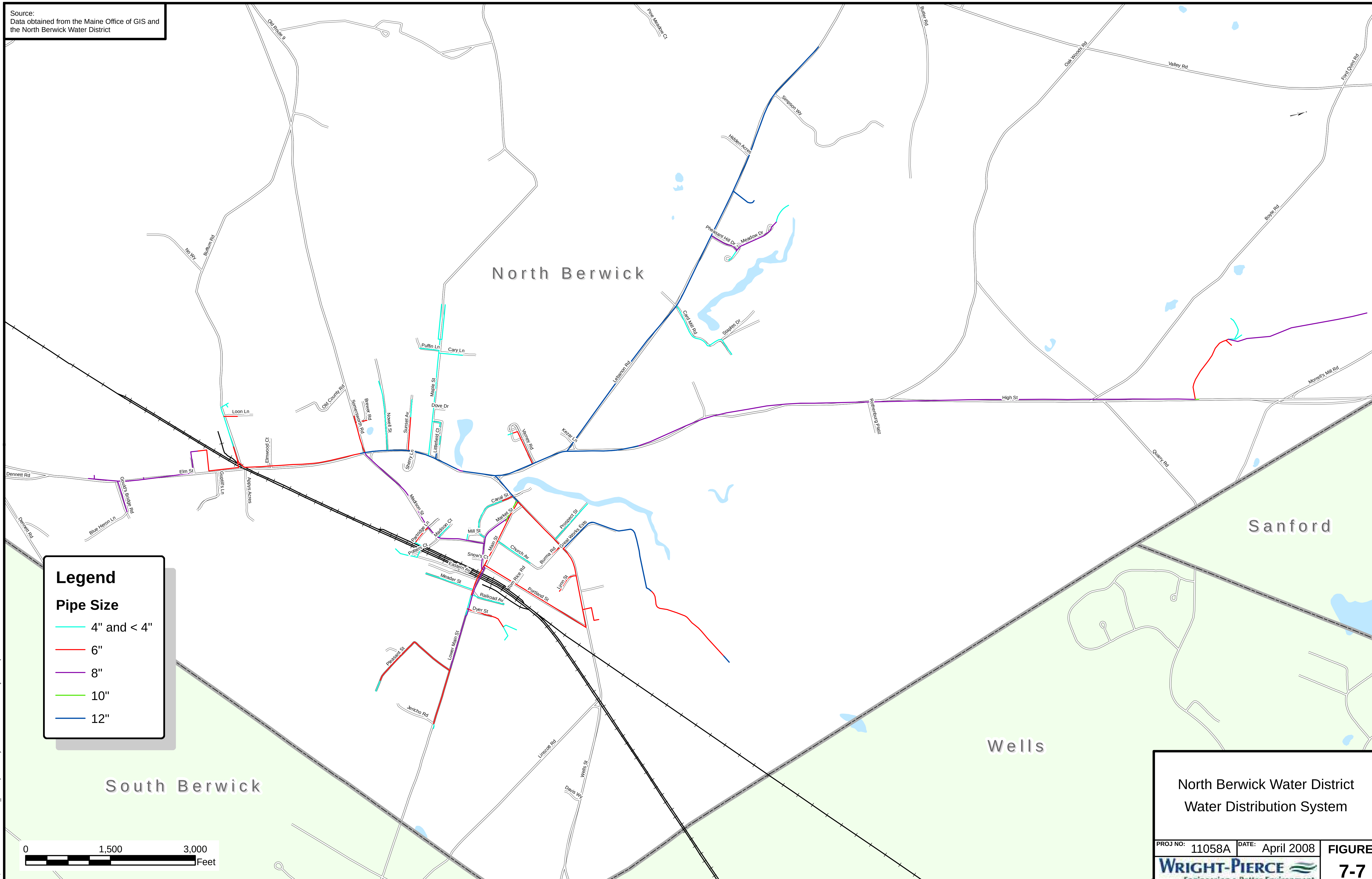

Source:
Data obtained from the Maine Office of GIS and the North Berwick Water District
North Berwick
Sanford
Wells
South Berwick
Legend
Pipe Size
4" and < 4"
6"
8"
10"
12"
0
1,500
3,000
Feet
North Berwick Water District
Water Distribution System
PROJ NO: 11058A
DATE: April 2008
FIGURE: 7-7
Wright-Pierce
Engineering a Better Environment

7.2.7 York Water District (YWD)

The hydraulic model developed for the District for its 2004 Master Plan was used as the basis for this study. The model includes approximately 80 miles of piping ranging in size from 2 - 16 inches in diameter. The model was updated for this study to include existing demands. A map of the York distribution system is presented on Figure 7-8.

The system is generally well looped with a strong hydraulic capacity north and south of the York Village area along US Route 1. The YWD is currently interconnected to both the KWD and KKW through existing interconnections on US Route 1 for mutual aid purposes. The connection with the KWD is served with 12-inch water main while the connection to KKW is served with 16-inch water main. Conveying large amount of water in and out of YWD's system will require pumping.

7.3 HYDRAULIC ANALYSES OF INTERCONNECTIONS FOR EACH SMRWC SYSTEM

Each existing and potential interconnection was evaluated in order to identify and bracket the hydraulic constraints of the existing infrastructure and to identify the needed improvements to meet the established conditions. As stated previously, the simulations were run under a range of average-day and maximum-day demands conditions to simulate cooperation conditions as well as mutual aid/emergency scenarios.

Each simulation was tested to maximize the transfer of water between systems and to meet or sustain expected levels of service.

York Water District
Water Distribution System

PROJ NO: 11058A	DATE: April 2008	FIGURE: 7-8

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The following limitations will be evaluated for each proposed interconnection opportunity:

Analysis for Utilities Selling or Wheeling Water to a Receiving Utility

- Flow limitations to maintain minimum system pressures.
- Flow limitations to maintain adequate pipe velocity in the system.
- Hydraulic profile along interconnection routes to meet pressure requirements.
- Need for pumping.
- Impacts on storage.

Analysis for Utilities Receiving or Purchasing Water from a Utility

- Flow limitations to prevent high pressures.
- Flow limitations to maintain adequate pipe velocity.
- Hydraulic profile along interconnection routes to meet pressure requirements.
- Need for pumping.
- Impacts on storage.

The conclusions drawn for the analysis will be presented on a conceptual future service plan for each of the systems and preferred corridors considered.

7.3.1 Biddeford & Saco Water Company (BSWC)

The Biddeford & Saco Water Company (BSWC) is well positioned in regards to adequate water supply far into the future. The Saco River is a high yield and relatively high quality supply. In this regard, they are not in need of developing interconnections with neighboring systems to meet normal demand conditions. They currently have an interconnection agreement with the Kennebunk, Kennebunkport & Wells Water District (KKW) through and interconnection located along US Route 1. This connection is served from their high pressure zone located in the southern end of their system in Biddeford.

The Saco River supply is viewed as an important and potentially critical source for member utilities to the south including the KKW, Kittery and York Water Districts. From a mutual aid perspective, the Saco River is important regionally. Under worse case conditions, should any of these utilities be without their primary source of supply for an extended period due to a catastrophic event during the peak summer demand season, the Saco River would be the logical source from which these utilities would likely turn.

In the case of a mutual aid/emergency scenario for the BSWC, a worse case scenario would occur if the Saco River became unusable due to a contamination or catastrophic event upstream of the intake. Because of the constant and high rate of flow of this river, any upstream event is likely to be somewhat brief in nature as the river will flush itself rather rapidly. None-the-less, it is plausible that a natural disaster could leave the river unusable for an extended period of time. Also, the treatment facility does not contain absorptive media such as granular activated carbon (GAC) which can protect customers against hydrocarbon or a highly soluble solvent contamination. Under this condition, the BSWC would have a projected ADD deficit of approximately 7 MGD in 2050. This would require the adjacent system of KKW or PWD to provide the needed demand. If such an event were to occur during a peak summer period, under existing conditions, the KKW would not be able to provide support and the BSWC would need to look to the north to the PWD. This scenario will be evaluated in the context of this study.

The BSWC could also consider partial cooperation with the KKW to serve their High Pressure zone only, in the event of the failure of the booster pump station or in the event or major piping failures.

The following scenarios were evaluated related specifically to the Biddeford & Saco Water Company:

- Hydraulic limitations within the BSWC system related to the existing interconnection with the KKW Water District along US Route 1.

- Mutual aid and emergency concepts with the PWD to meet needs in the BSWC system and to support adjacent utilities in the region.

7.3.1.1 Hydraulic Limitations of the BSWC Distribution System For Further Cooperation with the KKW Water District

For the analysis of the BSWC-KKW interconnection opportunities, the following baseline conditions were assumed:

- BSWC - Demand of 6.95 MGD, the reported 2050 average-day demand with the storage tanks in the high pressure zone operating at a hydraulic gradeline of EL 255 feet USGS was used for all simulations. The static pressure in BSWC at the junction between the systems at the BSWC high pressure zone is approximately 55 psi. However, pressures throughout the high zone, particularly in areas near the existing standpipe, appear less than 40 psi under existing operating conditions.
- KKW - Demand of 6.26 MGD, the reported 2006 maximum-day demand with the storage tanks operating at a hydraulic gradeline of EL 190 feet USGS was used for all simulations. The static pressure in KKW at the junction between the systems is approximately 30 psi.

a. *Hydraulic Constraints in the BSWC Distribution System While Transferring Water to the KKW Water District*

   Transferring 1 MGD under existing conditions results in a localized pressure decrease in the BSWC high service zone at the interconnection of 5 psi from 57 to 52 psi. However pressures within several areas of the high zone fall as low as 35 psi. Note that the BSWC high zone booster pump station is supplying 2,100 GPM (3 MGD) under this condition.

   Transferring 2 MGD under existing conditions and replacing approximately 3,100 linear feet of 12-inch water main to 20-inch water main along US Route 1 from the Biddeford town line north results in a decrease of localized pressure of 6 psi from 57 psi to 51 psi. However, pressures within several areas of the high zone fall as low as 30 psi under this scenario. Note that the high zone booster pump station is supplying 2,100 GPM (3 MGD) under this condition.

In order to serve the KKW for mutual aid purposes with flows above 2.60 MGD (the current capacity of the Arundel Booster Pumping Station), significant improvements to BSWC High Pressure zone distribution piping and booster pumping station are required. The improvements would consist of a minimum of increasing the booster station capacity to meet the desired flows to be transferred, piping improvements to accommodate the flows, and potentially increasing the gradeline in the zone by raising the existing standpipe.

b. *Hydraulic Constraints in the BSWC Distribution System While Receiving Water from the KKW Water District*

This analysis considers a scenario where the BSWC receives flow from the KKW to serve their high pressure zone only. Applying a flow of up to 2,100 GPM under existing conditions increases localized pressures in BSWC at the juncture between the systems by 20 psi from 57 psi to 77 psi. Pressures within BSWC's high zone increase marginally. The BSWC High Pressure zone appears well suited to receive flows from KKW. Limitations in the KKW systems are discussed further in this Section.

7.3.1.2 Mutual Aid and Emergency Cooperation Considerations

As noted previously, worse case conditions for the BSWC assume that they would be without the Saco River as a source of supply in the event of a catastrophic event. Under this condition, they would need to rely upon mutual aid from the neighboring systems of the KKW and/or the Portland Water District. Should a catastrophic occur during a peak summer demand period, the KKW will not have surplus capacity to assist and therefore any deficit would need to be made up from the PWD. Under projected average-day demand conditions in the year 2050, the BSWC will require up to 7.0 MGD. In a mutual aid situation, the PWD could require up to 42 MGD under 2050 average-day demand conditions. Flows this large would likely require multiple actions on the part of the PWD to meet demands throughout their entire system.

There are two logical locations for an interconnection between the BSWC and the PWD; (1) along US Route 1 at the Saco/Scarborough town line and (2) on Pine Point Road near the Scarborough Marsh. The Route 1 interconnection would require approximately 1,400 linear feet of transmission main to interconnect the systems in addition to the improvements detailed below. In addition, flows from the BSWC to the PWD will require a pumping station to overcome the difference in hydraulic gradeline between the two systems.

For the analysis of the BSWC-PWD interconnection, the following baseline conditions were assumed:

- BSWC - A demand of 7.00 MGD, the reported 2050 average-day demand with the storage tanks operating at a hydraulic gradeline of EL 206 feet and the Water Treatment Plant pumping >7 MGD was used for all simulations. The static pressure in BSWC at the junction between the systems is approximately 40 psi while pressures at various locations along Route 1 appear to be below 40 psi.
- PWD - An average-day demand in the Scarborough area of the system of 0.72 MGD as reported by the District with the storage tanks operating at a hydraulic gradeline of EL 267 feet was used for all simulations. The static pressure in PWD at the junction between the systems is approximately 80 psi.

a. *Hydraulic Constraints in the BSWC Distribution System While Transferring Water to the PWD*

Localized pressure along US Route 1 corridor decreases by 16 psi from 40 to 24 psi when a flow of 500 GPM is applied under a simulated transfer of flows to the PWD. In order to maintain pressure at an acceptable limit above 40 psi under this condition, the same improvements described above would be required including approximately 650 linear feet of 16-inch main is required from the end of Cascade

Road to Route 1 as well as the replacement of approximately 8,000 linear feet of 8-inch main with 20-inch main along US Route 1 from just south of Cascade Road to the Scarborough town line.

Increasing the flow to 1,400 GPM results in a decrease in localized pressure of 6 psi from 40 psi to 34 psi. In order to maintain pressure at an acceptable limit above 40 under this condition, approximately 650 linear feet of 16-inch main is required from the end of Cascade Road to US Route 1 as well as the replacement of approximately 8,000 linear feet of 8-inch main with 20-inch main along US Route 1 from just south of Cascade Road to the Scarborough town line.

For flows greater than 1,400 GPM while maintaining pressures below 100 psi will require the replacement of approximately 17,500 linear feet of 8, 16 and 20-inch water mains with 24-inch water main along US Route 1 between Spring Hill Road and the Scarborough town line. This condition may also necessitate the upgrade of the high service pumps in the water treatment plant or the addition of a booster pump station along the 24-inch transmission main. These findings are based on an un-calibrated skeletal model of the system and should be verified with subsequent detailed modeling. It should be noted that a flow of 2.0 MGD will meet the PWD's localized needs in Scarborough.

b. Hydraulic Constraints in the BSWC Distribution System While Receiving Water from the PWD

Several simulations were run to determine the upper extent of flow that could be transferred to the BSWC from the PWD to meet 2050 average-day conditions. A flow of 4,900 GPM (7 MGD) was applied from the PWD and resulted in an increase in localized pressures in the BSWC system of 37 psi from 40 psi to 77 psi. Pressures along US Route 1 further into the system increase above 40 psi. At the juncture of BSWC's existing 24-inch transmission main from the water treatment plant, an 11 psi increase in system pressure can be expected. In order to accommodate this flow, a number of distribution improvements are required in the BSWC system including the looping of the end of Cascade Road to US Route 1 with approximately 650 linear feet of 16-inch main and replacement of approximately 8,000 linear feet of 8-inch main with 20-inch main along US Route 1 from just south of Cascade Road to the Scarborough town line.

Should mutual aid be required during BSWC's peak demand season, upwards of 13 MGD is required in 2050. In order to receive this flow and maintain pressures below 100 psi in the BSWC distribution system, a number of improvements are required including the replacement of approximately 17,500 linear feet of 8 inch with 24-inch water main along US Route 1 between Spring Hill Road and the Scarborough town line. Localized pressures can be expected to increase by 35 - 60 psi.

7.3.1.3 Water Quality/Blending Considerations

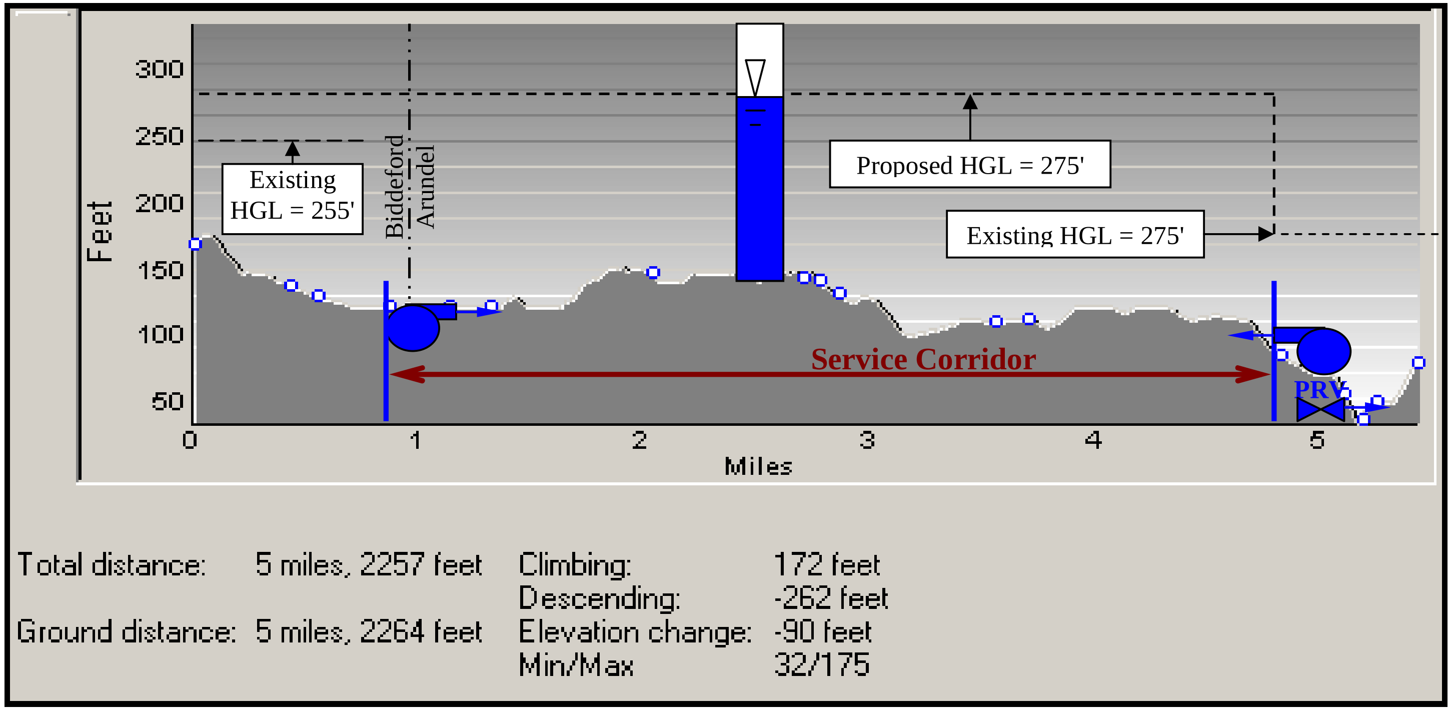
Both systems have similar water quality characteristics including a system pH greater than 8.0, and the use of chloramines for disinfection. We would expect minimal issues with blending the two systems. Localized effects from reversing flows may cause sediments to re-suspend and cause temporary color problems.

7.3.1.4 Conclusions

Service plans for each of the interconnections which were considered are presented in Figure 7-9 (interconnection between the BSWC and the KKW Water District) and in Figure 7-10 for and interconnection between the BSWC and the PWD.

Enhancements to the interconnection between the KKW Water District and the BSWC along Route 1 would improve hydraulics within each of the systems and would allow greater flows to be transferred between the systems. The improvements would require a new storage tank within

FIGURE 7-9
SERVICE PLAN FOR THE ROUTE 1 CORRIDOR BETWEEN THE
BIDDEFORD-SACO WATER COMPANY & KENNEBUNK, KENNEBUNKPORT & WELLS WATER DISTRICT



Connection Requirements	Biddeford-Saco WC Considerations	Kennebunk Water District Considerations
• Length to connect systems: Complete • Size of water main: 20" Diameter • Capacity Considered: 1-4 MGD • Recommended HGL: 275 feet • Storage tank (recommended), booster pumping station and/or pressure reducing valve.	• HGL: 255 feet • Recommended HGL: 275 feet • System Improvements: Improve hydraulic strength to existing tank consider 20" main upgrades along Route 1, existing booster pumping station upgrades are required for flows to Kennebunk's system. • Ability to service corridor: Can serve up to El 162' prior to re-boosting pressure.	• HGL: 190 feet • Recommended HGL: 275 feet • System Improvements: A booster pumping station is required for flows to Biddeford, a tank in Arundel is recommended or reconfiguration of the West Kennebunk zone. A pressure reducing valve is needed to connect the Arundel zone with the low zone. • Ability to service corridor: Adequate Service pressure can not be achieved. The HGL needs to be raised.

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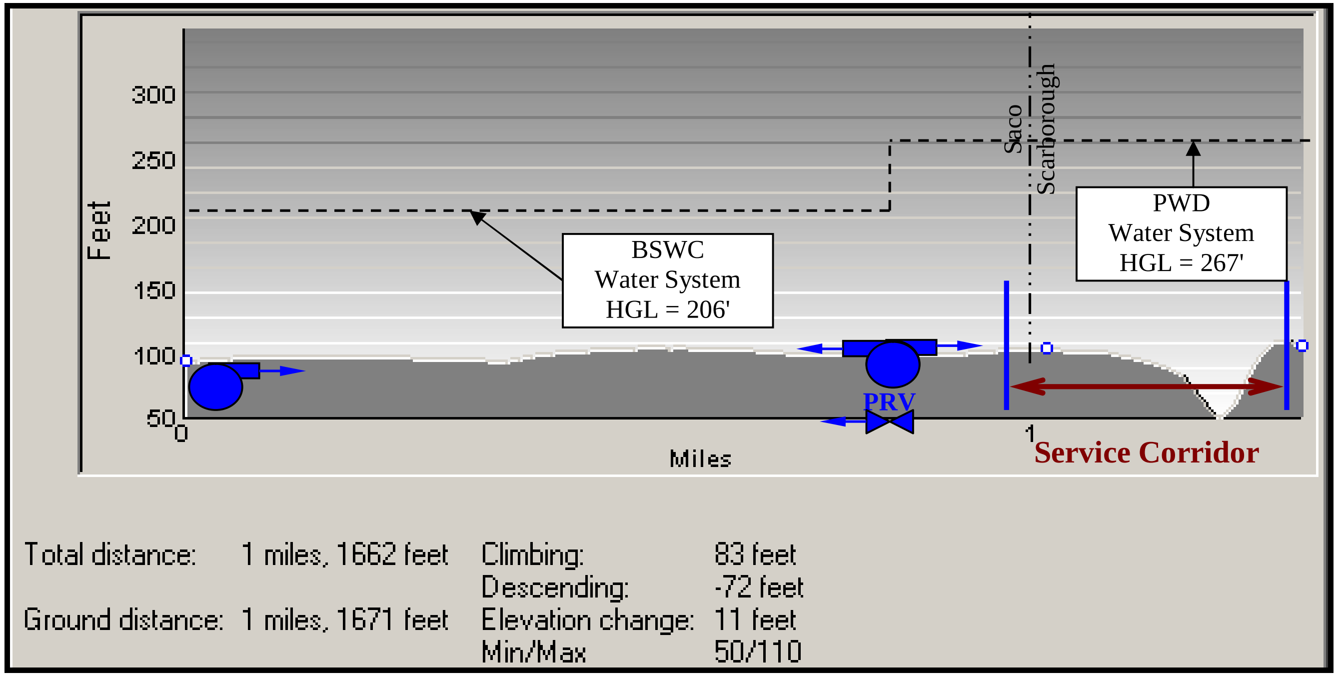
FIGURE 7-10
SERVICE PLAN FOR THE ROUTE 1 CORRIDOR BETWEEN THE BIDDEFORD & SACO WATER COMPANY & PORTLAND WATER DISTRICT



Connection Requirements

- Length to connect systems: 1,400 feet
- Size of water main: 20" Dia.
- Capacity Considered: 1-5 MGD
- Recommended HGL: 267 feet
- A booster pumping station is required between the two systems.

Portland Water District Considerations

- HGL: 267 feet
- Recommended HGL: 267 feet
- System Improvements: Replacement of 4,200 linear feet of 8 & 10" mains with 20".
- Ability to service corridor: PWD is well suited to provide water to BSWC.

Biddeford-Saco WC Considerations

- HGL: 206 feet
- Recommended HGL: 267 feet
- System Improvements: Replacement of 650 feet of 16" along Cascade to RT 1 and replace 8,000 linear feet of 8" with 20" along RT 1. May need a booster station in the system to increase RT 1 HGL for higher flows.
- Ability to service corridor: Not recommend without re-boosting.

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KKW to match or exceed the existing hydraulic gradeline in the BSWC high service zone. A small booster pumping station would be required in KKW to fill the tank.

An interconnection between the BSWC and the PWD would provide significant benefits to both systems. Hydraulics would be greatly enhanced in the vicinity of the interconnection and more importantly, the interconnection would establish the transfer of relatively large flows of water between the PWD to the north and all of the systems located to the south.

7.3.2 Kennebunk, Kennebunkport & Wells Water District (KKW)

Under average-day demand (ADD) conditions, the KKW system is projected to have adequate safe yield capacity through 2050 and will therefore not likely require reliance on an interconnection to meet demands. Under maximum-day demand (MDD) conditions however, the KKW Water District has a safe yield deficit through 2050. Although safe yield adequacy is not normally measured against a MDD benchmark, this information is provided simply to demonstrate the constraints under which the each system could face in the future and to reflect a prolonged summer demand condition that would put severe stress on an unregulated river supply such as Branch Brook.

The following scenarios will be evaluated related specifically to the Kennebunk, Kennebunkport & Wells Water District:

- Hydraulic limitations within the KKW system related to the existing interconnection with the York Water District along US Route 1.
- Hydraulic limitations in the KKW system related to the existing interconnection with the Biddeford & Saco Water Company (BSWC) along the US Route 1 corridor.
- Hydraulic limitations in the KKW system related to an interconnection with the Sanford Water District along the US Route 109 and 99 corridors.
- Mutual aid and emergency requirements to meet needs in the system and to support adjacent utilities in the region.

7.3.2.1 Hydraulic Limitations of KKW Distribution System For Further Cooperation with the York Water District

For the analysis of the York-KKW interconnection, the following baseline conditions were assumed:

- York Water District - A future maximum-day demand of 3.27 MGD (2025 MDD) was assumed with York's Simpson Hill and York Village tanks operating at a hydraulic gradeline of El. 189 feet. The static pressure in York at the junction of the systems was determined to be approximately 55 psi under this condition.
- KKW Water District- A demand of 6.35 MGD, the reported 2006 maximum-day demand with storage tanks operating at a hydraulic gradeline of El. 195.00 feet was used for all simulations. The static pressure in KKW distribution system at the junction of the systems is approximately 83 psi under this condition.

a. *Hydraulic Constraints in KKW Distribution System While Transferring Water to the York Water District*

   The maximum flow available to York from KKW is approximately 2.6 MGD while maintaining a minimum pressure of 40 psi under existing conditions from the existing interconnection booster station. This flow rate would decrease localized pressures on the suction side of the booster station in KKW by approximately 17 psi from 57 psi to 40 psi. The interconnection agreement between York and KKW at this location limits sale of water to 2.5 MGD, a flow rate which coincides well with the hydraulic capacity of the distribution system at this location.

   Model simulations using flow rates of 1.5 MGD, 2.0 MGD and 3.5 MGD, decrease localized pressures in the KKW distribution system by approximately 6 psi, 10 psi and 24 psi respectively from a static condition of 57 psi. For the same flow conditions noted above, replacement of approximately 3,000 linear feet of 10-inch water main to 16-inch water main along US Route 1 from intersection of

Bournes Lane extending south to the Ogunquit tanks would strengthen the capacity of the interconnection. This improvement will decreases localized pressures at the suction side of the booster pumping station in the KKW distribution system by approximately 0 psi, 5 psi and 10 psi, respectively, from a static condition of 57 psi for the three selected flow rates.

b. *Hydraulic Constraints in KKW Distribution While Receiving Water from the York Water District*

Model simulations using flow rates of 1.5 MGD, 2.0 MGD and 3.5 MGD into the KKW distribution system was simulated using the hydraulic model. At these rates, localized pressures in KKW increase by approximately 2 psi, 5 psi and 15 psi respectively from a static condition of 57 psi. Under the same flow conditions noted above, replacement of approximately 3,000 linear feet of 10-inch water main to 16-inch water main along Route 1 from Bournes Lane south to the Ogunquit tanks increases localized pressures in KKW by approximately 0 psi, 3 psi and 7 psi respectively from a static condition of 57 psi.

The present mutual aid agreement between York and KKW Water Districts limits flows from the York Water District to 1.0 MGD. On this basis, it does not appear that further optimization of the distribution system in KKW is warranted at this time.

7.3.2.2 Hydraulic Limitations of KKW Distribution System For Further Cooperation with the BSWC

The existing US Route 1 interconnection is the logical point of interconnection between the two distribution systems for several reasons:

- A high capacity transmission main exists in this location.
- The alternate the route through the Biddeford Pool area has mains with limited hydraulic capacity which would require significant upgrades.

- The transmission system has some low pressures areas which might be corrected with higher flow rates.

For the analysis of the KKW-BSWC interconnection, the following baseline conditions were assumed:

- KKW - A demand of 6.26 MGD, the reported 2006 average-day demand with the storage tanks operating at a hydraulic gradeline of El. 190 feet was used for all simulations. The static pressure in KKW at the junction between the systems is approximately 30 psi.
- BSWC - A demand of 6.95 MGD the reported 2050 average-day demand with the storage tanks operating at a hydraulic gradeline of El. 255 feet. The static pressure in the BSWC system at the junction between the systems at the BSWC High Zone is approximately 55 psi. In general, pressures throughout the high zone appear less than 40 psi under existing conditions.

a. *Hydraulic Constraints in KKW Distribution System While Transferring Water to the BSWC*

   Under existing conditions, KKW cannot supplement the BSWC due to low pressures along the US Route 1 corridor between Ross Road and the interconnection. Adding a booster pump station in KKW at the intersection of US Route 1 and Ross Road however, will increase the maximum flow to BSWC up to 3 MGD and will improve pressures along Route 1 north of Ross Road to a minimum of 40 psi under these conditions. This condition could be further improved by constructing a storage tank along the US Route 1 corridor to match the hydraulic gradeline of the west Kennebunk tank.

b. *Hydraulic Constraints in the KKW Distribution System While Receiving Water from the BSWC*

   The KKW distribution system at the juncture with the BSWC distribution system is well suited to accept large quantities of water due to low pressures and large capacity transmission mains. Significant improvements to the BSWC High Pressure zone infrastructure would be required however to realize large transfers of water.

Transferring 4 MGD increases localized pressures in KKW along Route 1 to Ross Road by approximately 10 - 30 psi. Transferring 5 MGD increases localized pressures in KKW along Route 1 to Ross Road by approximately 15 - 30 psi. Transferring 6 MGD increases localized pressures in KKW along Route 1 to Ross Road by approximately 20 - 55 psi. The maximum amount of flow which can be transferred under existing conditions while maintaining pressures in KKW below 100 psi is approximately 7 MGD.

Specific improvements required to the BSWC system to transfer these flows are discussed later in this Section.

7.3.2.3 Hydraulic Limitations of KKW Distribution System For Cooperation with SWD

Although located in close proximity to each other, the terminuses of the KKW and SWD water systems are separated by a distance of over 5.5 miles. As noted previously, the Sanford Water District is well positioned in terms of water supply capacity and meeting its future water needs. Under average-day demand (ADD) conditions, both systems have adequate safe yield and pumping capacity through 2050.

However, in a mutual aid/emergency worse case condition, KKW's yield could be reduced to as little as 1-2 MGD if they were to loose Branch Brook, resulting in a supply deficit of 1-2 MGD. It is likely that the deficit would be provided through the existing interconnection with the YWD or the BSWC. However, for the purposes of evaluating the hydraulics of a regional water system, we will assume that a portion (1 MGD) of the deficit will be supplied through and interconnection to the SWD.

Two corridors have been chosen as potential interconnection routes between the systems; US Route 109 and US Route 99. These routes have been identified by various planning agencies as future growth corridors. The US Route 99 corridor will require approximately 5-1/2 miles of 12 or 16-inch (depending on the amount of flow desired) transmission main to interconnect the systems. The US Route 109 corridor will require upwards of 7 miles of 12 or 16-inch (depending on the amount of flow desired) transmission main to interconnect the systems. In addition, both routes will require that a mutual storage tank be constructed and a pumping station will be required to move flows from KKW to the SWD due to the significant gradeline difference between the systems.

For the analysis of the KKW-SWD interconnection, the following baseline conditions were assumed:

- KKW - A demand of 6.26 MGD, the reported 2006 average-day demand with the storage tanks operating at a hydraulic gradeline of El. 265 feet was used for all simulations. The static pressure in KKW at the junction between the systems is approximately 23 psi.
- Sanford - A demand of 2.50 MGD, the reported 2006 average-day demand with the storage tanks operating at a hydraulic gradeline of El. 514 feet was used for all simulations. The static pressure in Sanford at the lowest ground surface elevation in the system is approximately 130 psi.

<u>US Route 99 Corridor</u>

a. *Hydraulic Constraints in KKW Distribution System While Moving Water to the Sanford Water District*

   A demand of 700 gpm was applied from KKW to the SWD which results in a decrease in localized pressures in KKW of 6 psi from 65 psi to 59 psi. This scenario can be supported by the KKW system.

b. *Hydraulic Constraints in KKW Distribution System While Receiving Water from the Sanford Water District*

Under this scenario, water would flow from a storage tank into the KKW distribution system by gravity. Applying a demand of 700 gpm results in an increase in localized pressures in the KKW distribution system of 4 psi from 65 psi to 69 psi. In the future, if flows greater than 700 GPM are desired, distribution improvements to improve the hydraulics to the West Kennebunk standpipe will be needed.

<u>*US Route 109 Corridor*</u>

a. *Hydraulic Constraints in KKW Distribution System While Moving Water to the Sanford Water District*

Similar to the US Route 99 analysis, a demand of 700 GPM was applied from KKW to the SWD which results in a decrease in localized pressures in KKW of 1 psi from 35 psi to 34 psi. Increasing the flow to 1,750 GPM results in a 2 psi pressure drop from 35 psi to 33 psi.

b. *Hydraulic Constraints in KKW Distribution System While Receiving Water from the Sanford Water District*

Under this scenario, water would flow from a new storage tank into the KKW distribution system by gravity flow. A flow of 700 GPM results in an increase in localized pressures in the KKW distribution system of 1 psi from 35 psi to 36 psi. Flows up to 1,750 GPM result in an increase of localized pressure of only 2 psi from 35 psi to 37 psi.

7.3.2.4 Mutual Aid and Emergency Cooperation Considerations

Development of an emergency response plan to meet demands in the KKW system is an important priority for the District. The KKW demand pattern is driven by summer demands. Peak summer demands are projected to increase from 6.35 MGD in 2006 to 8.95 MGD in 2050. The average-day demands are projected to increase from 2.83 MGD to 4.0 MGD during this same period. Loss of the Branch Brook supply from an inadvertent contamination event such as a chemical spill on Interstate 95, a jet fuel spill at the Sanford Airport or a similar catastrophic event could lead to a potential multi-week supply need during the critical summer month period.

This data suggests that the District would need improved reliance on one of the three existing supplemental sources to meet a short-duration supply emergency on Branch Brook which include:

- <u>Biddeford & Saco Water Company</u> - The current interconnection agreement limits flows for wholesale purchases to KKW to 2.0 MGD. The Arundel Booster Pumping Station which supplies all flows to KKW, has a maximum pumping capacity of 2.6 MGD
- <u>York Water District</u> - Emergency flows up to 1.0 MGD are available for short emergencies from the York Water District at the US Route 1 interconnection.
- <u>KKW Groundwater Supplies</u> - The Harriseeket and Merriland River well supplies can produce up to about 2,100 (3.0 MGD) GPM for a short-duration period of 3-4 weeks. The District estimates the yield to be about 2.0 MGD for a period of 2 months.

As presented previously, in the future, emergency flows up to 1.0 MGD could potentially be made available from the Sanford Water District should either the US Route 109 or US Route 99 corridors develop. Whereas this scenario is unlikely to develop in the near-term, it should not be considered as a viable alternative at this time.

On this basis, we suggest that the interconnection to BSWC and the Arundel Booster Pumping Station be improved to meet the supply deficit for this emergency condition. Since the Districts wells and the York Water District interconnection are limited and not reliable for long periods of time during the summer months and are not hydraulically situated to supply broad areas of the distribution system, we believe upgrading the Arundel Booster Pumping Station to produce between 3-5 MGD makes good sense and provides the best opportunity for a reliable source from a mutual aid/emergency planning perspective.

As noted in the hydraulic analysis presented previously, the transmission system extending from the Arundel Booster Pumping Station to the KKW distribution system is well suited to accept flows as high as 7.0 MGD from the BSWC system. The project would require upgrading the existing Arundel Pumping Station to produce flows greater than the current limitation of about 2.6 MGD.

This improvement would have additional benefits to the KWD and YWD as well since it is unlikely that KKW, YWD and KWD could provide meaningful support from one another during critical summer demand periods. For example, a summer supply emergency in York such as a loss of Chase's Pond would require the York Water District to receive emergency flows from both KKW and Kittery to meet summer demands. During the peak summer demand period, it is unlikely that KKW would have surplus supply from their own sources; however emergency flows could be wheeled through the KKW distribution system from the BSWC to York and/or Kittery through the existing interconnection with York. From this perspective, all three utilities could advance mutual cooperation by combining resources to implement this project.

Preliminary analysis suggests that the capacity of the Arundel Booster Pumping Station should be increased to 3-5 MGD. This would not only meet KKW's emergency response planning needs but would be sufficiently sized to meet an emergency in either the YWD or KWD that by wheeling water through the KKW distribution system. Additional study is suggested to test various hydraulic conditions which might effect pump selection and local pipe sizing.

7.3.2.5 Water Quality and Blending Considerations

The water quality and treatment practices between the KKW, BSWC and YWD systems are very similar. All three utilities practice chloramination and target a similar pH in the distribution system to manage nitrification and disinfection by-products. The KKW and BSWC have a long history of cooperation and sharing of water through the existing interconnection. Minor water quality issues have arisen in the past from small transfers of water related to increases in disinfection by-product formation between these systems. Should this interconnection be expanded to transmit large continuous flows, additional study is suggested to address any potential water quality regulatory concerns. On a temporary emergency basis, water quality can likely be managed and minor aesthetic issues could be acceptable.

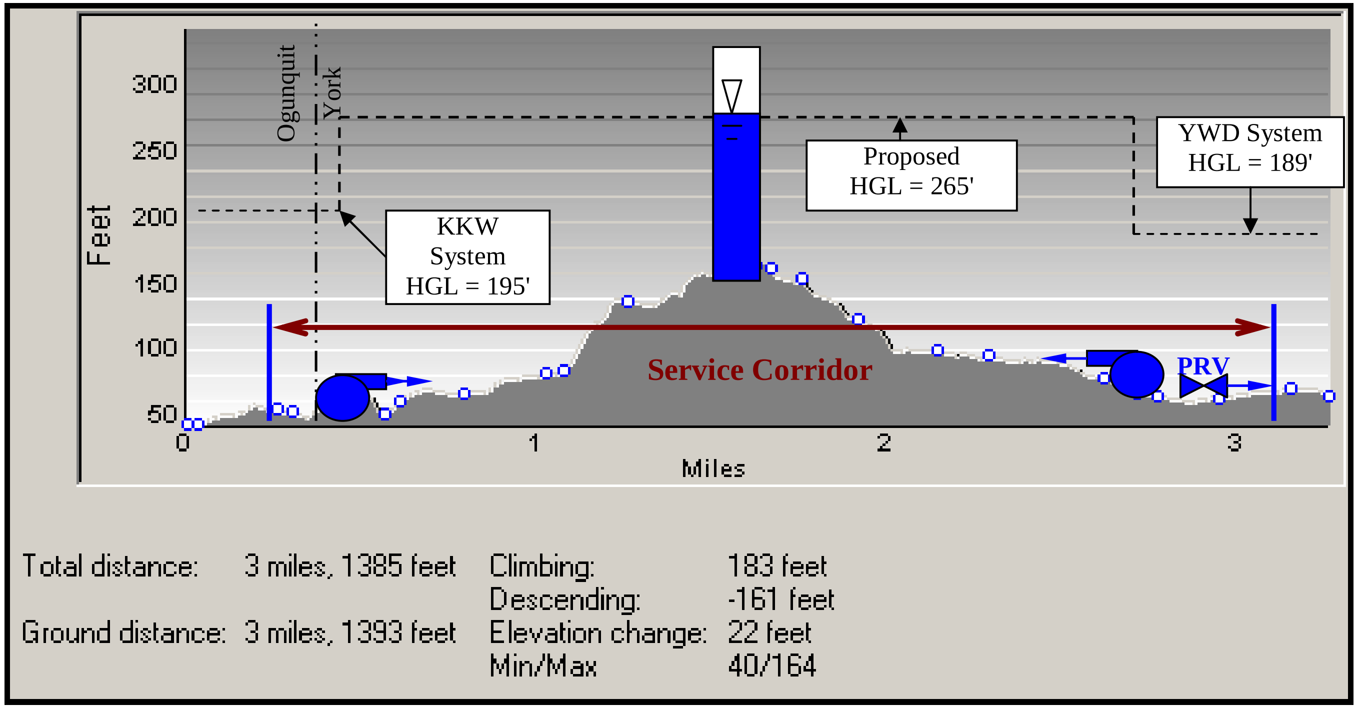
7.3.2.6 Conclusions

The findings and service plans for the various mutual aid and interconnection scenarios are presented as follows:

- Figure 7-9 presents a service plan between the KKW and the BSWC along US Route 1.
- Figure 7-11 presents a basic service plan for the KKW-YWD interconnection along US Route 1 in Ogunquit.
- Figure 7-12 and Figure 7-13 present service plans for the US Route 99 and US Route 109 corridors between the KKW Water District and SWD.

The greatest opportunity for enhanced cooperation and mutual aid appears to be available by making improvements to the existing Arundel Booster Station used to transmit flows between the BSWC to the KKW distribution system. An investment in upgrading this facility would not only benefit the KKW, but would insure a reliable supply to York and Kittery in the event of the loss of either systems primary source of supply(s).

FIGURE 7-11
SERVICE PLAN FOR THE ROUTE 1 CORRIDOR BETWEEN THE KENNEBUNK, KENNEBUNKPORT & WELLS WATER DISTRICT & YORK WATER DISTRICT



Connection Requirements

- Length to connect systems: Complete
- Size of water main: 16" Diameter
- Capacity Considered: 1-3 MGD
- Recommended HGL: 265 feet
- Storage tank (optional), booster pumping stations and pressure reducing valve (optional if tank is used).

Kennebunk Water District Considerations

- HGL: 195 feet
- Recommended HGL: 195 feet
- System Improvements: 16-inch main upgrades along Route 1 from Bournes Lane to Ogunquit tanks
- Ability to service corridor: Can serve up to El 102' prior to boosting pressure.

York Water District Considerations

- HGL: 189 feet
- Recommended HGL: 265 feet
- System Improvements: 16-inch upgrades along Cape Neddick Road and booster pumping station in proximity to Mountain Road
- Ability to service corridor: Can serve up to El 96' prior to boosting pressure. Consider a tank to serve higher elevations above 40 psi or a booster pumping station to maintain pressure.

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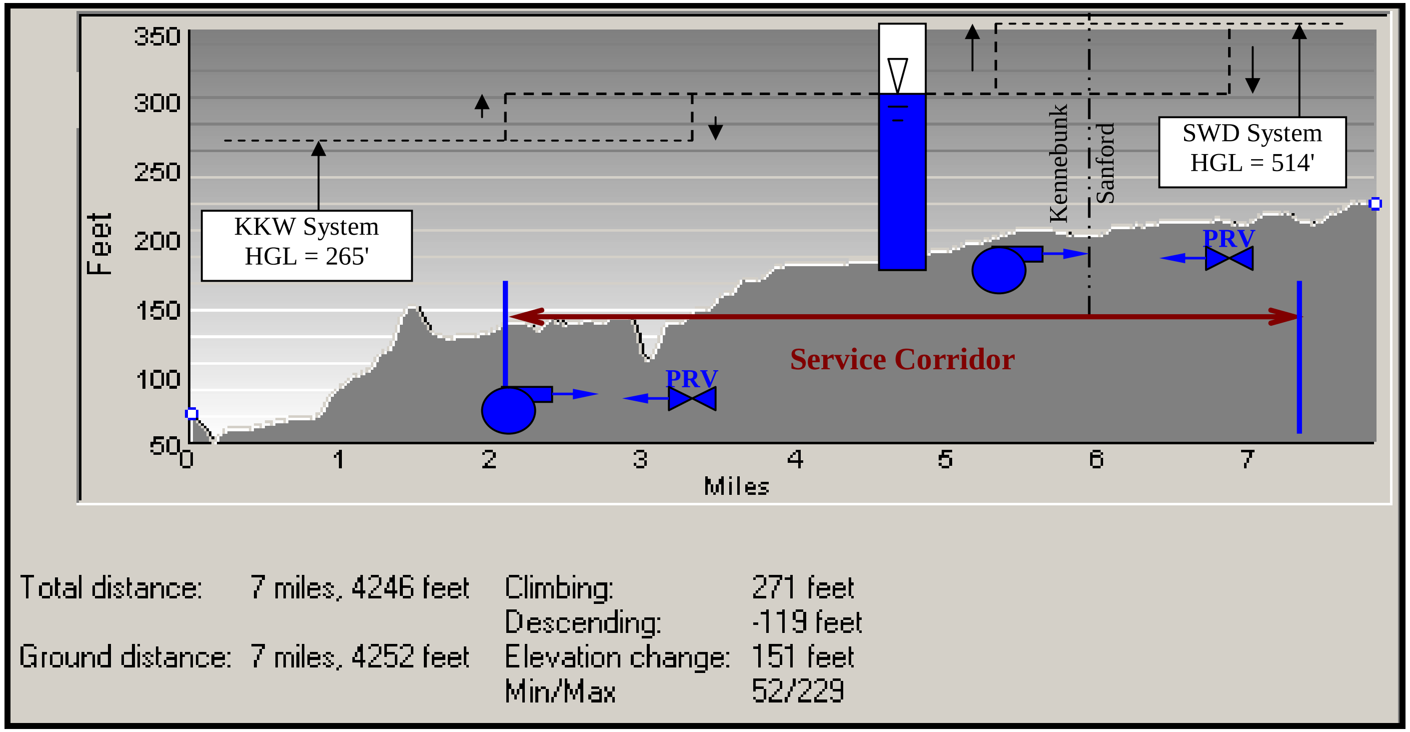
FIGURE 7-12
SERVICE PLAN FOR THE ROUTE 99 CORRIDOR BETWEEN THE KENNEBUNK, KENNEBUNKPORT & WELLS WATER DISTRICT & SANFORD WATER DISTRICT



Connection Requirements

- Length to connect systems: 5.5 miles
- Size of water main: 12 to 16" Dia.
- Capacity Considered: 1 MGD
- Recommended HGL: 400 feet
- Storage tank (optional), booster pumping station and pressure reducing valve

Sanford Water District Considerations

- HGL: 514 feet
- Recommended HGL: 400 to 450 feet
- System Improvements: Consider upgrading the 12" main to 16" along Main Street to Cyro Road & PRV for flows above 1 MGD.
- Ability to service corridor: Serve to minimum El of 285'. For elevation greater than 285' a pressure reducing valve is required.

Kennebunk Water District Considerations

- HGL: 265 feet
- Recommended HGL: 265 feet
- System Improvements: Improve hydraulic strength to West Kennebunk tank from Cat Mousam Road; a booster pumping station is required for flows to Sanford.
- Ability to service corridor: Can serve up to El 175' prior to boosting pressure.

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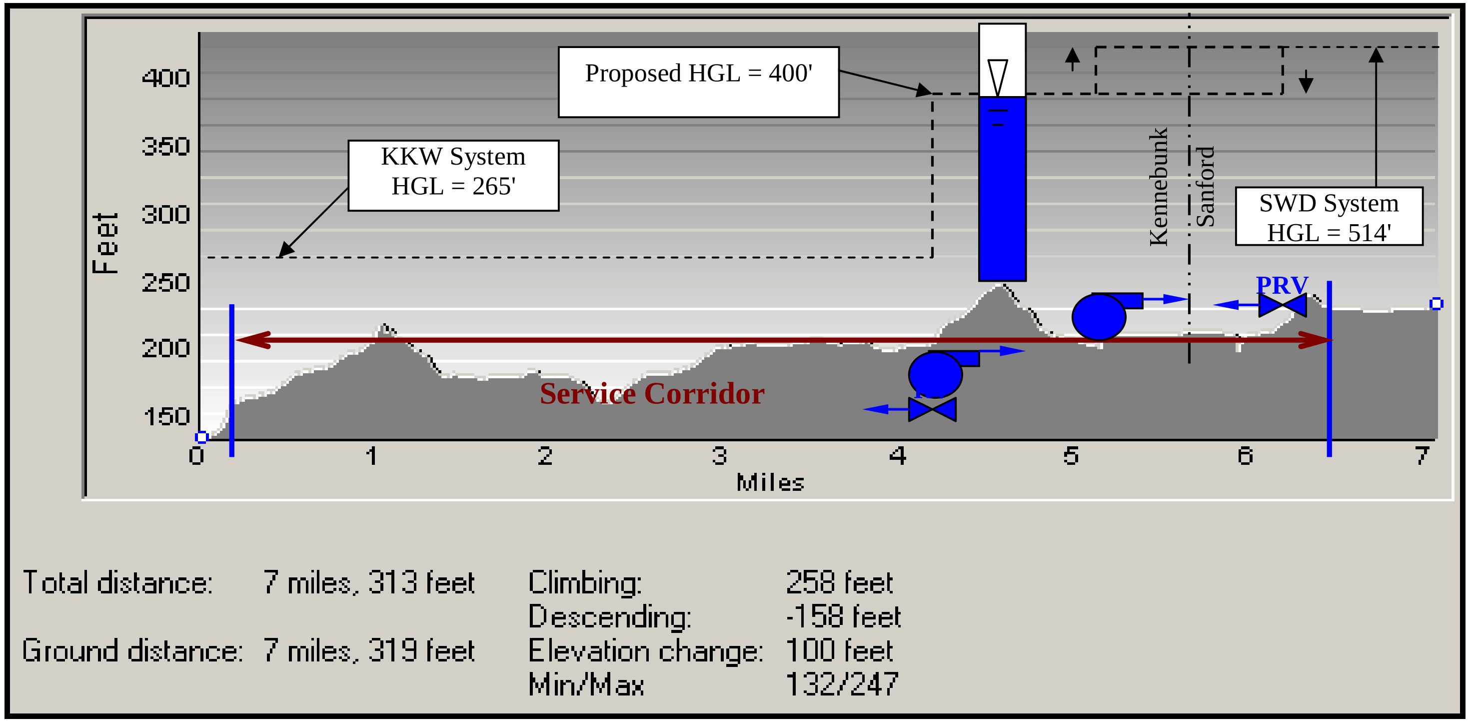
FIGURE 7-13
SERVICE PLAN FOR THE ROUTE 109 CORRIDOR BETWEEN THE KENNEBUNK, KENNEBUNKPORT AND WELLS WATER DISTRICT & SANFORD WATER DISTRICT



Connection Requirements

- Length to connect systems: 7.5 miles
- Size of water main: 12" diameter
- Capacity Considered: 1 MGD
- Recommended HGL: 400 feet
- Storage tank (optional), a booster pumping station and pressure reducing valve is needed at the zone break between the two systems.

Sanford Water District Considerations

- HGL: 514 feet
- Recommended HGL: 400 to 450 feet
- System Improvements: Consider upgrading the 12" main to 16" along Main Street to Cyro Road & pressure reducing valve for flows above 1 MGD.
- Ability to service corridor: Serve to Minimum of El 285' before a pressure reducing valve is required. If Sanford drops their HGL to 400 they could serve the entire corridor.

Kennebunk Water District Considerations

- HGL: 195 feet
- Recommended HGL: 206 feet
- System Improvements: Improve hydraulic strength to West Kennebunk tank from Cat Mousam Road. For flows to Sanford a booster pumping station is required.
- Ability to service corridor: Can serve up to El 102' prior to boosting pressure.

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If it is desired to provide cooperation or mutual aid to the BSWC, a number of improvements are required. The Route 1 segment in KKW between Ross Road and the Biddeford town line is deficient in pressure which restricts KKW's ability to provide supplemental flows to BSWC. Similarly, the BSWC high zone appears to have many areas which have normal operating pressures below 40 psi. One way to improve service in both systems and increase the capacity to transfer flows could be achieved by simply adding a booster pump station to transmit flows the BSWC. A second alternative which includes greater improvements in the KKW system would involve the creation of a new zone encompassing the US Route 1 segment in KKW and the BSWC high zone. This could be accomplished by:

a. Create a zone break in KKW along US Route 1 north of Ross Road or Summer Street. This would allow reconfiguration of the West Kennebunk zone to include the Arundel/US Route 1 corridor. Existing service pressure near the intersection of US Route 1 and Summer Street are less than 60 psi.
b. Raise the gradeline to approximately 280 feet by either (1) jacking the existing BSWC tank or (2) constructing a new tank in KKW will an overflow elevation of 280 feet north of the intersection of Ross Road and US Route 1.
c. Construct a booster pump station at the new tank which obtains supply from the primary KKW zone.
d. Upgrade BSWC's high zone booster pump station to accommodate the new gradeline and desired flow.

7.3.3 Kittery Water District (KWD)

The following scenarios will be evaluated related to the Kittery Water District:

- Hydraulic limitations within the Kittery system related to the existing interconnection with the York Water District along US Route 1.
- Hydraulic limitations in the Kittery system related to future interconnections with the South Berwick Water District along the US Route 236 or US Route 91 corridors.

- Mutual aid and emergency requirements to meet needs in the system and to support adjacent utilities in the region.

The Kittery Water District is projected to have adequate supply to meet the District's projected needs through year 2050. The surplus supply capacity could be made available to support growth into the identified regional growth areas or for cooperation and mutual aid purposes with the York Water District and/or South Berwick Water District.

7.3.3.1 Constraints which Limit Hydraulic Capacity with the York Water District

The existing agreement between the KWD and the YWD along US Route 1 was established for emergency purposes. The connection currently consists of piping only and movement of water between the systems can be accomplished by opening a single valve located at the Kittery/York town line. To date, neither utility has reported a need to utilize the interconnection. Both utilities will be jointly constructing a booster pumping station near the Dolly Gordon Brook which will insure an instantaneous means of moving water between the systems.

The agreement stipulates that Kittery can receive a maximum flow of 2.0 MGD from York and can provide a maximum flow of 2.0 MGD to York. The hydraulic analysis identified several improvements within the Kittery distribution system that should be considered over the next 20-40 years to improve the hydraulic capacity and reliability of this interconnection.

a. *Constraints in the Kittery Distribution System While Moving Water to York Water District*
   The maximum flow available from Kittery to York while maintaining a minimum pressure in the Kittery distribution system of 40 psi under existing conditions is approximately 250 GPM. Replacement of approximately 1,200 linear feet of 6-inch water main with 12-inch water main on US Route 1 between Goodwin Road and Kittery Point Road increases the available flow to York from 500 GPM to 2,000 GPM while maintaining 40 psi in Kittery.

b. *Constraints in the Kittery Distribution System While Receiving Water from the York Water District*

The maximum amount of water that can be transferred into the Kittery distribution system from York is approximately 1,000 GPM while maintaining pressures below 90 psi in the Kittery system and under existing conditions. This results in localized pressure increases in Kittery by about 45 psi from 45 psi to 90 psi.

Replacement of approximately 1,200 linear feet of 6-inch main to 12-inch along Route 1 between Lewis Road and Old Cutts Road increases the available flow by 1,600 GPM from 1,000 GPM to 2,600 GPM while maintaining localized pressures in Kittery below 100 psi.

These piping improvements will provide sufficient flow for cooperation and mutual aid needs.

7.3.3.2 Constraints which Limit Hydraulic Capacity with the South Berwick Water District

The Kittery and South Berwick Water systems are located at the far southern end of the study area, both situated along the border with New Hampshire. The terminus of each system at their closet point is separated by nearly 5.5 miles. To date there has not been any impetus for considering and interconnection between the systems as both systems have excess supply and pumping capacity under existing and future conditions. In addition, South Berwick has multiple groundwater sources and is unlikely to require outside support in the event of an emergency. For purposes of this study, we will however consider a scenario where up to 1 MGD is wheeled between the systems for future purposes.

Two potential routes were considered for this analysis; US Route 91 and US Route 236. The Route 91 corridor would require 29,000 linear feet of 12-inch transmission main to interconnect the systems while the Route 236 corridor would require 37,100 linear feet of 12-inch transmission main.

US Route 91 Corridor

Under static conditions, the initial analysis indicates an area of negative pressure northwest of the South Berwick-Kittery town line. This is due to a high point along US Route 91 at EL 240 feet (USGS). This condition would prevent the wheeling of water in either direction without significant improvements. In order to maintain a serviceable corridor, a tank would need to be constructed having a minimum overflow elevation of EL 330 feet (USGS) in order to maintain 40 psi at all locations. The KWD would be required to add a booster station to fill the tank for flow to the SBWD. Under this condition, transferring 1 MGD from KWD to SBWD decreases pressure in KWD's system by 6 psi, from 70 psi to 64 psi. Transferring 1 MGD from SBWD to KWD increases localized pressure in KWD's system by 6 psi, from 70 psi to 76 psi.

US Route 236 Corridor

A connection along this route would result in an increase in static pressures in Kittery to 110 psi. This condition would likely require a mainline pressure reducing valve or devices at individual services.

Pumping water from KWD to SBWD would require a booster pump station to match South Berwick's gradeline. The station could be located just east of the Eliot-South Berwick town line. Applying a flow of 1 MGD would result in a decrease in localized pressure of 1 psi, from 60 psi to 59 psi in Kittery.

Applying a gravity flow of 1 MGD from SBWD to KWD would result in an increase of approximately 20 psi, from 60 psi to 80 psi in Kittery.

7.3.3.3 Mutual Aid and Emergency Support Considerations

The Kittery Water District is projected to have an average-day water demand of approximately 3.16 MGD in year 2050. The safe yield of the District's combined reservoir system is approximately 5.6 MGD. The total safe yield of 5.6 MGD is the sum of the safe yields of each individual reservoir in the system.

The Francis B. Hatch Water Treatment Facility can be fed water from two segregated branches of the reservoir system. One branch of the reservoir system is the Boulter Pond-Bell Marsh subsystem. The safe yield of the Bell Marsh Reservoir is 2.5 MGD. The Bell Marsh Reservoir flows overland to Boulter Pond Reservoir which has a safe yield of 1.90 MGD. If a contamination were to occur in either of these two reservoirs, the District would lose 4.4 MGD of available yield.

The second branch of the reservoir system is the Folly Pond-Middle Pond subsystem. This branch of the reservoir system provides the remaining safe yield of 1.2 MGD. This branch of the system can be segregated from the Bell Marsh-Boulter Pond supply branch and can feed the treatment facility directly.

On this basis, prudent planning would suggest that the District should plan to meet its emergency supply needs based on loss of one of the reservoir supply branches in the system. The most conservative approach would be to assume loss of the larger Bell-Marsh-Boulter Pond supply branch. Under this scenario, the District would retain a safe yield of approximately 1.2 MGD in addition to the 2.0 MGD of supply available from the York Water District through wholesale purchase of supply at the US Route 1 interconnection. Under this scenario, the District could meet the projected 2050 average-day demand condition of 3.16 MGD in an emergency situation.

If the emergency condition were to occur during the peak summer demand period in the SMRWC service territory, it is likely that surplus supply would not be available in either the York or KKW water systems to provide the 2.0 MGD unless supplemented through the BSWC interconnection.

As discussed elsewhere in this report, it is recommended that the capacity of the BSWC interconnection be increased in size to meet the regional needs for mutual aid and emergency purposes in the KKW, York and Kittery Water Districts. From the perspective of the Kittery Water District, a potential of 2.0 MGD could be needed for wheeling through the KKW and

York water distribution systems to meet a summer supply emergency in the Kittery water system.

7.3.3.4 Water Quality/Blending Considerations

The water quality and treatment practices between the Kittery and York water systems may create some aesthetic problems if mixed in one of the distribution systems. The York Water District uses chloramines for disinfection and elevates pH well above 8.0 to maintain monochloramine as the primary chloramine constituent in the distribution system.

Kittery maintains a pH below 8.0 and uses free chlorine (sodium hypochlorite) for disinfection. Blending both of these supplies for short-duration mutual aid cooperation will create aesthetic taste and odor problems but will not present a problem to public health. The taste and order problems would be caused by creation of dichloramines from an unbalance of chlorine and ammonia in the distribution system. The problem should be tolerable for short-duration emergencies.

The second possible aesthetic problem that could occur in Kittery's distribution system is color problems from oxidation of residual iron and manganese in the distribution system caused by the higher pH from the York system. Again for short-duration water supply emergencies, this should be a manageable problem and not present a threat to public health.

Mixing of water between the Kittery Water District and South Berwick Water District is less problematic. Both systems use free chlorine (sodium hypochlorite) for disinfection and operate at a pH of 7.5-8.0. Long-term use of this interconnection would require reconsideration of the corrosion control strategy in each system to assure adequate lead and copper corrosion control.

7.3.3.5 Conclusions

Figure 7-14 presents a basic service plan to optimize the KWD-YWD interconnection along US Route 1. The interconnection is well designed but improvements to bottlenecks in either system could further improve the capacity to exchange flows at this location. This report should be consulted as older piping is replaced and upgrades are considered in the areas referenced herein.

Figure 7-15 and Figure 7-16 present service plans for the US Route 91 and US Route 236 corridors between the KWD and SBWD. It should be noted that US Route 236 has been identified as a potential growth zone by the Southern Maine Regional Planning Commission. The US Route 91 area has higher topography and will be more challenging to develop without storage tank(s) and a booster station. Furthermore, the US Route 91 corridor has been zoned for restricted development.

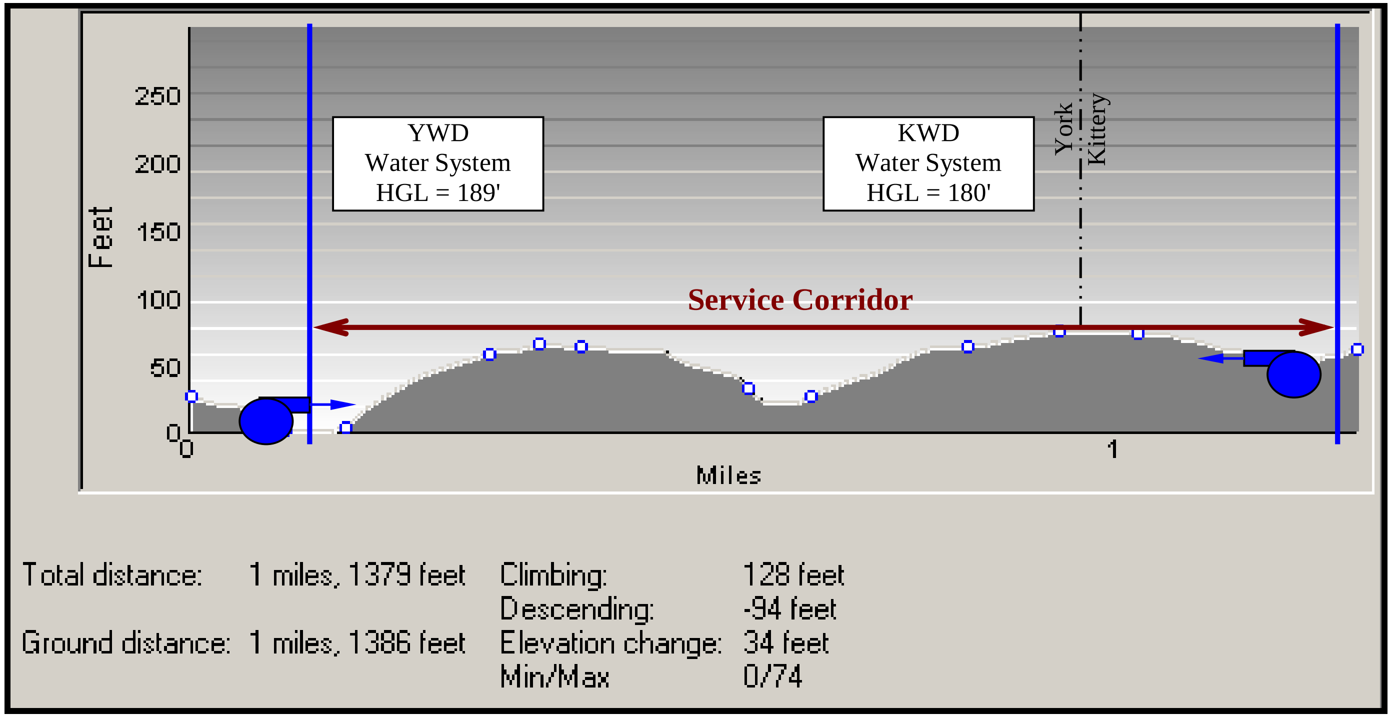
7.3.4 Portland Water District

The BSWC and PWD are the two largest water systems in the SMRWC. The two distribution systems are located in close proximity along US Route 1 at the north end of the study area. The demands of these two systems are the highest within the study area making mutual aid considerations a challenge. The BSWC operates its system at a hydraulic gradeline of El. 206, while the PWD operates its system at a hydraulic gradeline of El. 267.

Under normal operating conditions, both systems have ample supply to meet average and maximum daily demands far into the future. In fact, either one of these systems has surplus supply yield to meet the needs of the entire southern Maine study area if the distribution and transmission piping was sufficiently sized to transfer flows cost effectively.

The systems were evaluated under a mutual aid/emergency supply scenario assuming a worse case situation. In the case of the BSWC, a worse case scenario would occur if the Saco River became unusable due to a contamination event upstream of the intake during and average-day demand event. This would leave them with an ADD deficit of approximately 7 MGD in 2050. Because the supply is a river system, the extent of outage from a contamination event could be short-lived. It is still important to understand the hydraulic constraints of moving water between the systems.

FIGURE 7-14
SERVICE PLAN FOR THE ROUTE 1 CORRIDOR BETWEEN THE KITTERY WATER DISTRICT & YORK WATER DISTRICT



Connection Requirements

- Length to connect systems: Complete
- Size of water main: 12" Diameter
- Capacity Considered: 0.5 to 2 MGD
- Recommended HGL: 189 feet
- Booster pumping station high potential for a future storage tank but not necessary with current demands.

Kittery Water District Considerations

- HGL: 180 feet
- Recommended HGL: 180 feet
- System Improvements: 12-inch upgrades along Route 1, connect transmission mains add a booster pumping station.
- Ability to service corridor: Can serve up to El 87' prior to boosting pressure.

York Water District Considerations

- HGL: 189 feet
- Recommended HGL: 189 feet
- System Improvements: No piping upgrades required for flows below 2 MGD, a booster pumping station is required.
- Ability to service corridor: Can serve up to El 87' prior to boosting pressure.

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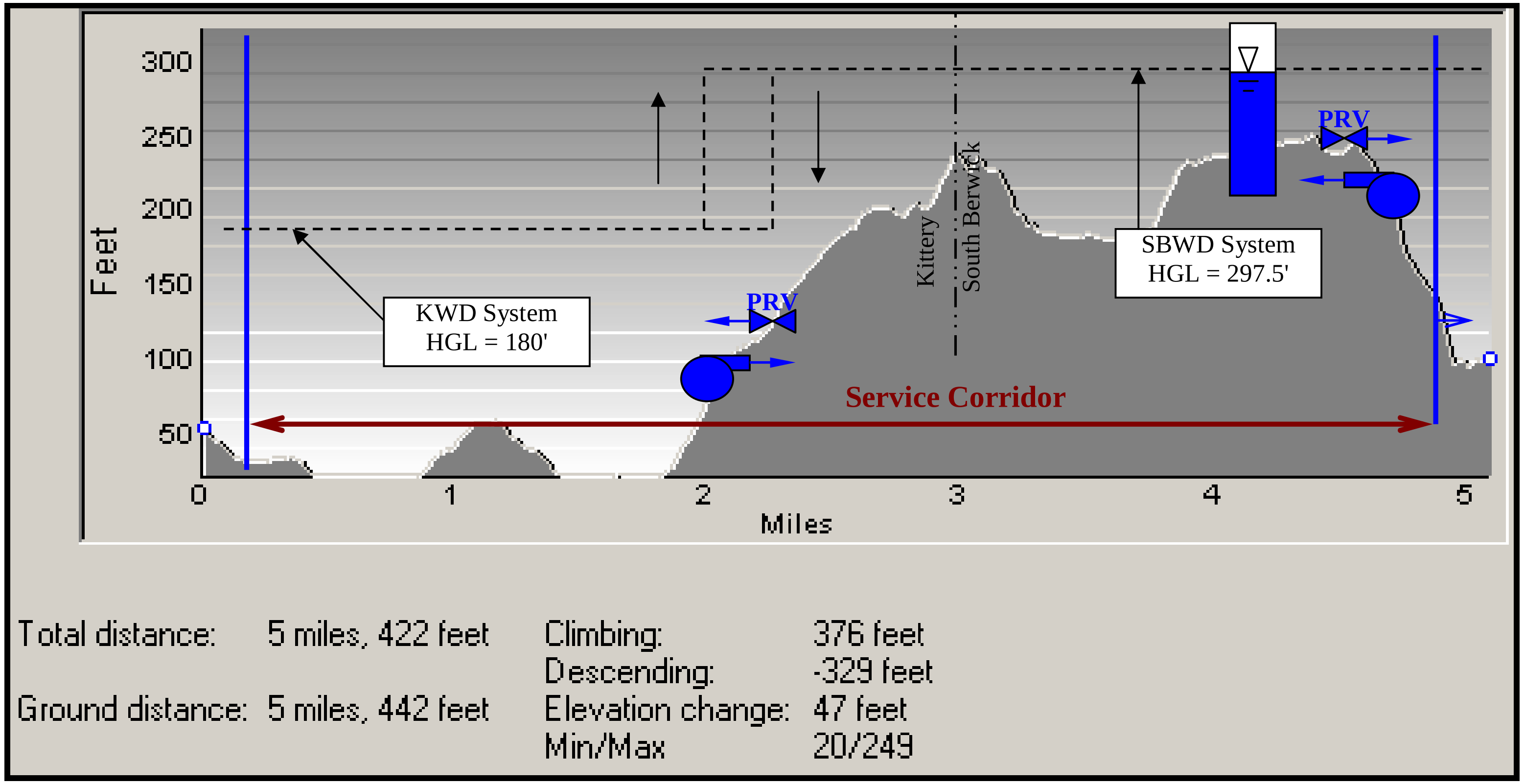
FIGURE 7-15
SERVICE PLAN FOR THE ROUTE 91 CORRIDOR BETWEEN THE
KITTERY WATER DISTRICT & SOUTH BERWICK WATER DISTRICT



Connection Requirements

- Length to connect systems: 5.5 miles
- Size of water main: 12" Dia.
- Capacity Considered: 1 MGD
- Storage tank

Kittery Water District Considerations

- HGL: 180 feet
- Recommended HGL: 180 feet
- System Improvements: booster pumping station and pressure reducing valve
- Ability to service corridor: Up to El 87'. Service above El. 87' will require a booster pumping station.

S. Berwick Water District Considerations

- HGL: 297.5 feet
- Recommended HGL: 297.5 feet
- System Improvements: Booster pumping station and pressure reducing valve
- Ability to service corridor: Service to minimum of El 65' before a PRV is required.

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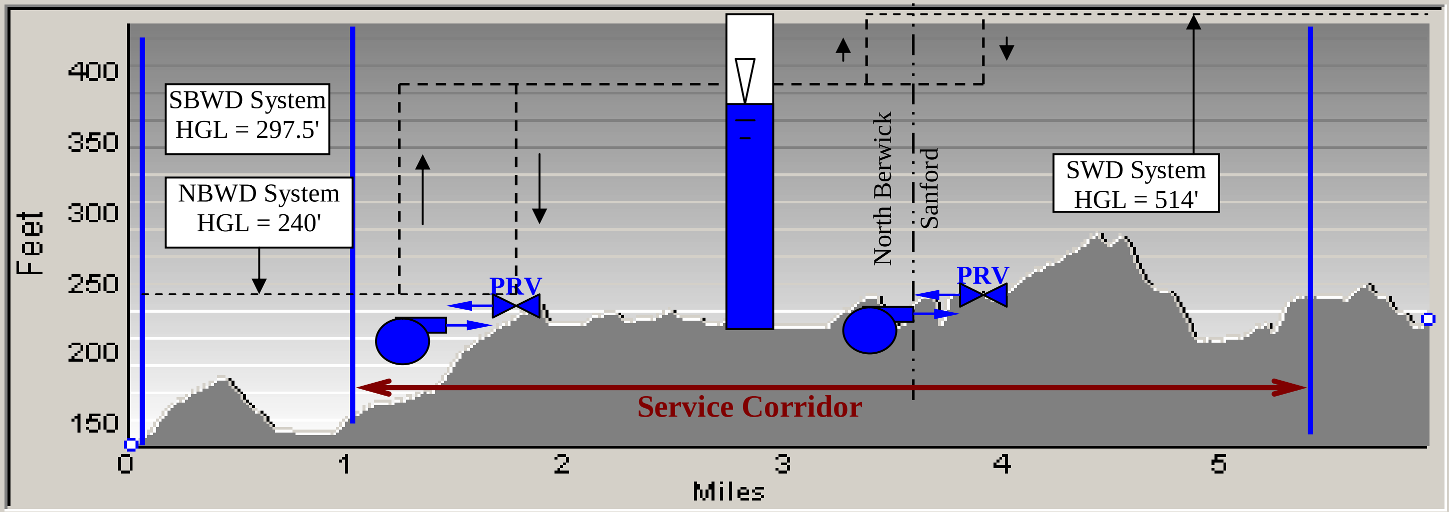
FIGURE 7-16
SERVICE PLAN FOR THE ROUTE 4 CORRIDOR BETWEEN THE SOUTH BERWICK WATER DISTRICT & SANFORD WATER DISTRICT



Total distance:	5 miles, 4928 feet	Climbing:	343 feet
		Descending:	-253 feet
Ground distance:	5 miles, 4940 feet	Elevation change:	89 feet
		Min/Max	132/283

Connection Requirements

- Length to connect systems: 5.3 miles (1.3 miles between SBWD & NBWD and 4 miles between NBWD and SWD)
- Size of water main: 12" Dia.
- Capacity Considered: 0.5 MGD
- Regional Tank, booster pumping station & pressure reducing valve
- Serve corridor with a tank at HGL ~ 400 ft

S. Berwick Water District Considerations

- HGL: 297.5 feet
- Recommended HGL: 297.5 feet
- System Improvements: None required other than main extension for connection to North Berwick.
- Ability to service corridor: SBWD could serve the 1.3 miles to connect to NBWD. NBWD would have to boost pressure to provide service.

Sanford Water District Considerations

- HGL: 514 feet
- Recommended HGL: 514 feet
- System Improvements: None required
- Ability to service corridor: Service to of El 283'. For elevations above 283' a pressure reducing valve is required.

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We have also assumed that the PWD could be without its supply for an extended period due to a major catastrophic event on the source of supply, or failure of the main transmission system from the water treatment facility. Either of these conditions would leave them with a deficit of approximately 42 MGD under 2050 average-day conditions. Any mutual aid scenario or cooperation with the BSWC to the south would be limited and apply to local areas with comparable demands.

The US Route 1 corridor has been selected as the most logical location for an interconnection between the systems. Various improvements were simulated in each system to determine the practical limitation of the two distribution systems in the general vicinity of US Route 1 where the two systems terminate.

- The two distribution systems are separated by a distance of approximately 1,400 feet.
- BSWC - A demand of 7.00 MGD (2050 MDD) coincident with storage tanks operating at a hydraulic gradeline of El. 206.00 feet were used for the model simulations. Water Treatment Plant pumping rate was retained below 7 MGD for the simulations.. The static pressure in BSWC at the junction between the systems is approximately 40 psi while pressures at various locations along US Route 1 appear to be below 40 psi.
- PWD - Demand of 0.72 MGD (Scarborough area 2006 ADD); tanks operating at a hydraulic gradeline of 267.00 feet. The static pressure in PWD at the junction between the systems is approximately 80 psi.
- A pumping station is required to transfer water from BSWC to PWD to overcome hydraulic grade line differential.

a. *Hydraulic Constraints in PWD System While Transferring Flows from the BSWC to the PWD*

Applying a flow of 700 GPM will result in an increase in localized pressures in the PWD system of 10 psi near Broadturn Road to more than 50 psi at the juncture of the connection from 80 psi to 130 psi. Under the conditions noted above and replacement of approximately 4,200 linear feet of 8 and 10-inch mains with 20-inch along Route 1 north to Broadturn Road maintains existing systems pressures of approximately 80 psi.

Applying a flow of 4 MGD results in an increase in localized pressures in PWD of 10-20 psi from 80 psi to 100 psi assuming that the following upgrades are made.; replacement of approximately 4,200 linear feet of 12 and 8-inch mains with 20-inch from Broadturn Road along Payne Road to Milliken Road and along Milliken Road to Route 1 will limit the localized pressure increase to 10 psi. Flows greater than 4 MGD would require upgrades to the 20-inch main along Route 1 to Gorham Road, depending on desired flow rate.

b. *Hydraulic Constraints in PWD System While Receiving Flows from the BSWC*
Applying a flow of 2,100 GPM results in a decrease in localized pressures in PWD of 40 psi from 80 psi to 40 psi. This scenario will require the replacement of approximately 4,200 linear feet of 8 and 10-inch mains with 20-inch along Route 1 north to Broadturn Road.

Applying a flow of 2,800 GPM results in a decrease in localized pressures in PWD of 40 psi from 80 psi to 40 psi assuming the replacement of approximately 4,200 linear feet of 8 and 10-inch mains with 24-inch along Route 1 north to Broadturn Road, and replacement of approximately 4,200 linear feet of 12 and 8-inch mains with 20-inch from Broadturn Road along Payne Road to Milliken Road and along Milliken Road to Route 1.

7.3.4.1 Water Quality/Blending Considerations

Similar to the discussion of the BSWC analysis, both systems have similar water quality which makes them well suited for blending. We do not foresee any major concerns with blending the water between the systems.

7.3.4.2 Conclusions

Refer back to Figure 7-9 for a basic service plan for the PWD-BSWC interconnection.

Major infrastructure upgrades will be required to transfer flows above 1 MGD in either direction of flow. Additionally, PWD's hydraulic gradeline is approximately 60 feet higher than BSWC's. BSWC could benefit from PWD's grade line by adding approximately 25 psi more system pressure than what currently exists. Given the nature of the existing infrastructure it is likely that a pumping station will be required to transfer water in both directions.

Based on the upgrade scenarios presented, PWD is well suited to give and receive 4 MGD. However, BSWC is unlikely to provide more than 2 MGD without creating an additional pressure zone to match PWD's. BSWC most likely can take all the water PWD can feasible transfer, by upgrading portions of US Route 1 to 24-inch.

7.3.5 Sanford Water District

The Sanford Water District has excess supply and pumping capacity under existing and future conditions. Similar to conditions within the South Berwick system, Sanford owns and maintains a number of groundwater sources throughout the system which positions them well for a variety of normal and emergency conditions. The District appears well positioned to meet their own needs and have not considered cooperation opportunities with neighboring systems. Their surplus supply capacity could be made available to support mutual aid opportunities with the South Berwick Water District (through and interconnection with the North Berwick Water District) and/or with the Kennebunk, Kennebunkport &Wells Water District (KKW) to support growth along regional areas targeted for development. Any concept of interconnection would require participation by the NBWD. This analysis will consider these potential future scenarios. *(Note: North Berwick did not participate in the study).*

The following scenarios will be evaluated related specifically to the Sanford Water District:

- Mutual aid/emergency cooperation with the South Berwick Water District through the North Berwick Water District along the US Route 4 corridor.
- Mutual aid/emergency cooperation with the KKW along the US Route 109 or US Route 99 corridors.

7.3.5.1 Mutual Aid and Emergency Cooperation Considerations with the South Berwick Water District through an Interconnection with the North Berwick Water District

This analysis will consider this potential future scenario and the interactions between the Sanford and North Berwick systems only. The impacts between the South Berwick Water District and the North Berwick Water District are presented under the South Berwick Water District analysis presented further in this section. *Note: North Berwick did not participate in the study.*

For purposes of this analysis, we will model a worse case scenario assuming one or the other system were to loose its primary source of supply due to a catastrophic event. Both systems have multiple supplies spread throughout their systems and therefore the likelihood of loosing more than one supply at a time is remote. For purposes of this study, we will consider a scenario where up to 0.5 MGD is wheeled between the systems.

For the analysis of the Sanford-North Berwick interconnection, the following baseline conditions were assumed:

- Sanford Water District- A demand of 2.50 MGD, the reported average-day demand in 2006, with the storage tanks operating at a hydraulic gradeline of 514.00 feet (USGS) was used for all simulations. The static pressure in Sanford system at the junction with the North Berwick system is approximately 125 psi.
- North Berwick Water District- A present average-day demand of 0.29 MGD (assumed), with the storage tanks operating at a hydraulic gradeline of 240 feet (assumed) (USGS) was used for all simulations. The static pressure in North Berwick at the junction with South Berwick is approximately 47 psi. The static pressure in North Berwick at the junction with the SWD is approximately < 20 psi.

The US Route 4 corridor was identified as the most logical route for interconnecting Sanford's system to the North Berwick system. The interconnection will require approximately 20,700 linear feet of 12-inch transmission main to interconnect the systems. A flow of 350 GPM (0.5 MGD) will be simulated. (*Projected impacts to the North Berwick distribution system have been included for informational purposes only. Actual conditions should be evaluated using an accurate calibrated model of the North Berwick water distribution system).*

Due to the relatively minor flows which have been projected to be conveyed between the systems, there appears to be little impact to either. Applying a flow of 350 GPM (0.5 MGD) from Sanford to North Berwick does not impact hydraulic conditions in Sanford or North Berwick. However North Berwick will require a pressure reducing control device to reduce Sanford's hydraulic gradeline. A booster pumping station will be required in North Berwick to overcome Sanford's hydraulic gradeline. A flow of 350 GPM (0.5 MGD) does not impact Sanford's distribution system in any significant way.

7.3.5.2 Mutual Aid and Emergency Cooperation Considerations with the KKW Water District

The analysis considers the transfer of up to 700 GPM (1.0 MGD) for mutual aid purposes assuming the following baseline conditions:

- Sanford - A demand of 2.50 MGD, the reported average-day demand in 2006, with the storage tanks operating at a hydraulic gradeline of 514.00 feet (USGS) was used for all simulations. The static pressure in Sanford system at the junction with the KKW system along US Route 109 and US Route 99 is approximately 125 psi
- KKW - A present maximum-day demand of 6.26 MGD with the storage tanks operating at a hydraulic gradeline of 265.00 feet (USGS) was used for all simulations. The static pressure in KKW at the junction with Sanford along US Route 109 is approximately 35 psi while the static pressure along US Route 99 is approximately 65 psi.

a. *Hydraulic Constraints in the SWD Distribution System While Flowing to and Receiving Water from the KKW Water District along US Route 109*

The Route 109 corridor will require 29,000 linear feet of 12-inch transmission main to interconnect the systems. This analysis considers conditions in the future of an interconnection for mutual aid purposes along the US Route 109 corridor. In the case of Sanford flowing water to the KKW Water District, several alternatives were considered. Applying a flow of 700 GPM does not impact pressures in Sanford. For purposes of understanding the limitations of the Sanford system, the flow was increased in to 1,750 GPM. This condition results in a decrease in localized pressures in Sanford of 15 psi from 125 psi to 110 psi. Replacing approximately 7,200 linear feet of 12-inch main to 16-inch main from Cyro Road west to Route 4 restores pressures. When Sanford receives a flow of 700 gpm from the KKW Water District, localized pressures in Sanford increase by 15 psi from 125 psi to 140 psi.

b. *Hydraulic Constraints in the SWD Distribution System While Transferring to and Receiving Water from the KKW Water District along US Route 99*

The Route 99 corridor requires 30,100 linear feet of 12 or 16-inch transmission main (depending on the quantity of flow desired) to interconnect the systems. This analysis considers similar flow conditions noted for the US Route 109 example. In the case where Sanford provides flow to the KKW, applying a flow of 700 GPM does not impact pressures in Sanford. Increasing the flow to 1,750 GPM, results in a decrease in localized pressures in Sanford of 15 psi from 125 psi to 110 psi. Replacing approximately 7,200 linear feet of 12-inch main to 16-inch main from Cyro Road west to Route 4 results in minimal decreases in localized pressure.

When Sanford receives flow from the KKW, a rate of 700 GPM results in an increase in localized pressures in Sanford of 15 psi from 125 psi to 140 psi. Replacing approximately 7,200 feet of 12-inch with 16-inch along Main Street to Cyro Road results in a slightly lower localized pressure increase in Sanford of approximately 10 psi from 125 psi to 135 psi. As flows are increased to 1,400 GPM, including the piping upgrades previously noted, localized pressures in Sanford by 25 psi from 125 psi to 150 psi.

7.3.5.3 Water Quality/Blending Considerations

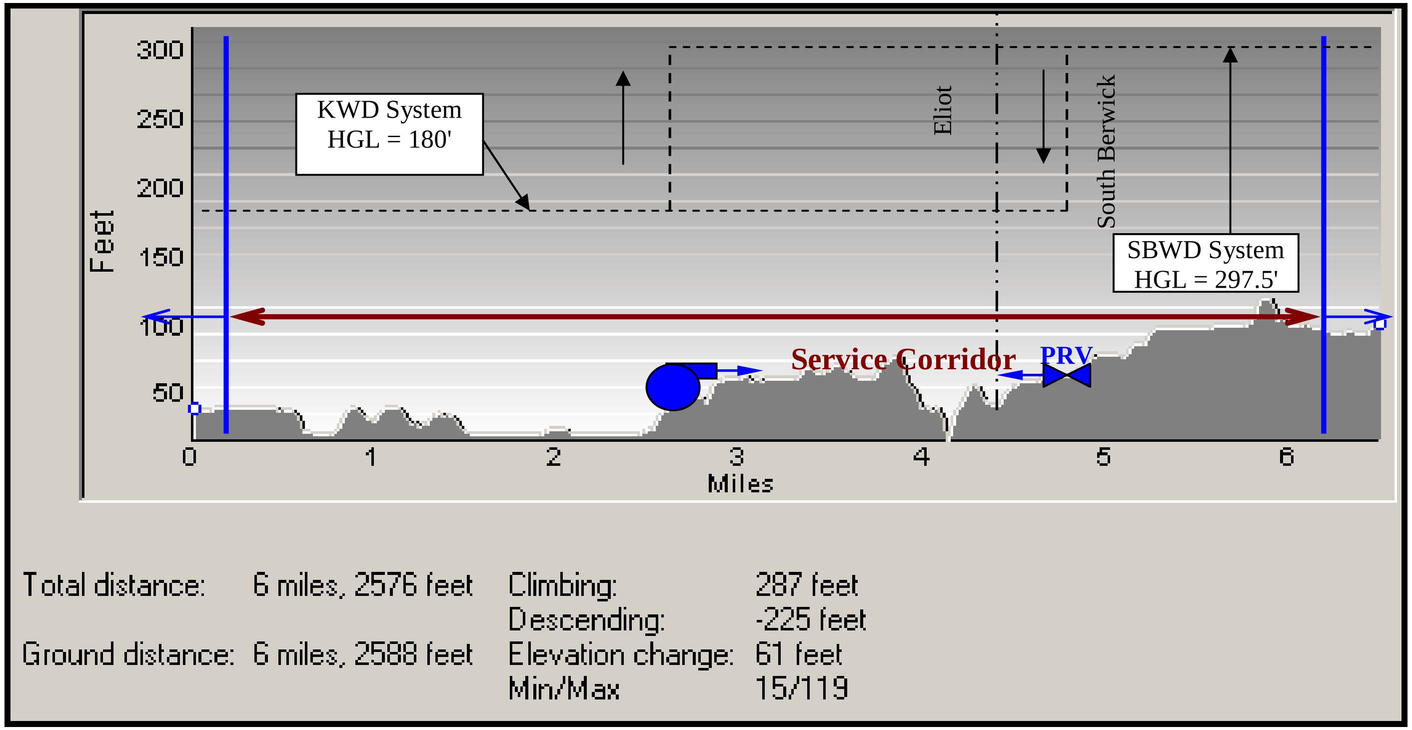
The SBWD provides primary disinfection at each of its well supply with free chlorine using sodium hypochlorite. The Sanford Water District (SWD) system is unchlorinated. Inter-mixing the two systems will likely require chlorination of the Sanford system before water could be routinely transferred to another water system. Introduction of chlorinated water into the Sanford Water District will be problematic because of the presence of moderate concentrations of manganese in the well supplies. The SWD is evaluating options to address this problem through treatment.

7.3.5.4 Conclusions

Figure 7-17 presents a basic service plan for the Route 4 corridor between the SWD and SBWD. Refer back to Figure 7-12 and Figures 7-13 for service plans between the SWD and KKW Water District.

Of the two route options, US Route 99 provides distinct hydraulic advantages over the Route 109 option if a mutual aid scenario were to be pursued. It simply requires less energy to transfer water both ways than the US Route 109 corridor. The route could be served with a 12-inch or 16-inch main (depending on the flow desired), a pressure reducing valve for service to KKW, and a small properly located pump station to transfer flows from KKW to Sanford. Given the pre-existing high pressures in the southeast portion of Sanford's system, any increase in hydraulic grade line would be unacceptable.

FIGURE 7-17
SERVICE PLAN FOR THE ROUTE 236 CORRIDOR BETWEEN THE KITTERY WATER DISTRICT & SOUTH BERWICK WATER DISTRICT



Connection Requirements

- Length to connect systems: 7 miles
- Size of water main: 12" Dia.
- Capacity Considered: 1 MGD
- Regional booster pumping station & pressure reducing valve.
- Could serve with a storage tank at HGL ~ 230 ft

Kittery Water District Considerations

- HGL: 180 feet
- Recommended HGL: 180 feet
- System Improvements: None required
- Ability to service corridor: Can serve up to El 87'. Service above El. 87' will require a booster pumping station.

S. Berwick Water District Considerations

- HGL: 297.5 feet
- Recommended HGL: 297.5 feet
- System Improvements: None required.
- Ability to service corridor: Service to minimum El of 65' before a pressure reducing valve is required.

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Servicing the US Route 109 corridor will be difficult and costly in the long term, primarily because of the shear distance and hydraulic gradeline differential between the systems. The Route 109 corridor adds 70 feet of hydraulic head above the US Route 99 option. This corridor would be better served with a tank having a hydraulic gradeline above 300 feet and as high as 400 feet with a PRV for flows to KKW. This would require KKW to pump water to this tank. Sanford could gravity feed the tank utilizing an altitude valve/PRV and receive water from the tank through an additional pumping station to Sanford.

Another alternative would be to add a new tank to lower the gradeline in Sanford. A new regional tank at a lower grade line may aid in suppressing this end of the system. As for KKW, system improvements would be limited to strengthening hydraulics between Cat Mousam Road and the Kennebunk standpipe. A new tank is not necessary for sharing water between systems; however it would be necessary to sustain reasonable service pressure along either corridor option.

7.3.6 South Berwick Water District

The South Berwick Water District is projected to have adequate supply to meet the District's projected needs through year 2050. South Berwick owns and maintains a number of groundwater sources throughout the system. The District appears well positioned to meet their own needs; none-the-less as presented in Section 2, the District has considered cooperation opportunities with neighboring systems. Their surplus supply capacity could be made available to support mutual aid opportunities with the Kittery Water District and Sanford Water District (through and interconnection with the North Berwick Water District) and to support growth along regional areas targeted for development.

The following scenarios will be evaluated related specifically to the South Berwick Water District:

- Mutual aid/emergency requirements to meet needs in the system and to support the Kittery Water District along the US Route 236 and US Route 91 corridors.
- Mutual aid/emergency requirements to meet needs in the system and to support the Sanford Water District through and interconnection with the North Berwick Water District along US Route 4.

7.3.6.1 Mutual Aid and Emergency Cooperation Considerations with the Kittery Water District

This scenario considers the case of mutual aid in the event that the KWD were to loose the larger of their two reservoir systems due to a catastrophic event; this would reduce Kittery's available supply yield from 5.6 MGD to only 1.2 MGD. Under 2050 average-day conditions, KWD would have a supply deficit of approximately 2 MGD, a small portion of which could be supplied by the SBWD.

For the analysis of the South Berwick-Kittery interconnection, the following baseline conditions were assumed:

- SBWD - A present average-day demand of 0.26 MGD, with the storage tanks operating at a hydraulic gradeline of 297.50 feet was used for all simulations. The static pressure in South Berwick at the junction between the systems (South Berwick/York/Eliot town lines) is approximately 85 psi.
- KWD - A present maximum-day demand of 4.42 MGD, with the storage tanks operating at a hydraulic gradeline of 180.00 feet was used for all simulations. The static pressure in the KWD at the junction between the systems (South Berwick/York/Eliot town lines) is approximately 70 psi for the Route 91 corridor and 60 psi for the Route 236 corridor.

Two potential routes were considered for this analysis; US Route 91 and US Route 236. The Route 91 corridor would require 29,000 linear feet of 12-inch transmission main to interconnect the systems while the Route 236 corridor would require 37,100 linear feet of 12-inch transmission main.

a. *Hydraulic Constraints in the SBWD Distribution System While Transferring Water to the KWD along the US Route 91 Corridor*

Under static conditions, the initial analysis indicates an area of negative pressure northwest of the South Berwick-Kittery town line. This is due to a high point along US Route 91 at EL 240 feet (USGS). This condition would prevent the wheeling of water in either direction without significant improvements. In order to maintain a serviceable corridor, a tank would need to be constructed having a minimum overflow elevation of EL 330 feet (USGS) in order to maintain 40 psi at all locations. Flows to the KWD would be provided from the tank would be required to add a booster station to fill the tank for flow to the SBWD.

Transferring 1 MGD from SBWD to KWD decreases localized pressure in SBWD's system by 3 psi, from 85 psi to 82 psi. This is well within acceptable ranges.

b. *Hydraulic Constraints in the SBWD Distribution System While Receiving Water from the KWD along the US Route 91 Corridor*

Transferring 1 MGD from KWD to SBWD increases localized pressure in SBWD's system by 13 psi, from 85 psi to 98 psi. This condition could require the installation of pressure reducing valves to individual services to reduce the increased pressure.

c. *Hydraulic Constraints in the SBWD Distribution System While Moving Water to the KWD along the US Route 236 Corridor*

Static pressures along this route would range from a low of 25 psi in South Berwick to a high of 110 psi in Kittery, depending on which system services the corridor.

Wheeling water from KWD to SBWD would require a booster pump station to match South Berwick's gradeline; the station could be located just east of the Eliot-South Berwick town line. Applying a flow of 1 MGD would result in an increase of 13 psi, from 85 psi to 98 psi in SBWD's system.

d. *Hydraulic Constraints in the SBWD Distribution System While Receiving Water from the KWD along the US Route 236 Corridor*

Applying a gravity flow of 1 MGD from SBWD to KWD would result in a decrease in localized pressure of approximately 3 psi, from 85 psi to 82 psi in South Berwick.

7.3.6.2 Mutual Aid and Emergency Cooperation Considerations with the Sanford Water District through the North Berwick Water District

This analysis will consider this potential future scenario and the interactions between the South Berwick and North Berwick systems only. The impacts between the Sanford Water District and the North Berwick Water District are presented under the Sanford Water District analysis presented further in this section. *Note: North Berwick did not participate in the study.*

For purposes of this analysis, a worse case scenario was modeled assuming one or the other system were to loose its primary source of supply due to a catastrophic event. Both systems have multiple supplies spread throughout their systems and therefore the likelihood of loosing more than one supply at a time is remote. For purposes of this study, we will consider a scenario where up to 0.5 MGD is wheeled between the systems.

For the analysis of the South Berwick-North Berwick interconnection, the following baseline conditions were assumed:

- South Berwick - A demand of 0.26 MGD, the reported average-day demand in 2006, with the storage tanks operating at a hydraulic gradeline of El 297.50 feet (USGS) was used for all simulations. The static pressure in South Berwick at the junction between the systems is approximately 72 psi.
- North Berwick - A present average-day demand of 0.29 MGD (assumed), with the storage tanks operating at a hydraulic gradeline of El 240 feet (assumed) (USGS) was used for all simulations. The static pressure in North Berwick at the junction with South

Berwick is approximately 47 psi. The static pressure in North Berwick at the junction with the SWD is approximately < 20 psi.

The US Route 4 corridor was identified as the most logical route for interconnecting the South Berwick system to the North Berwick system and for interconnecting the North Berwick and Sanford water distribution systems. Approximately 800 linear feet of 12-inch transmission main is required to interconnect South Berwick to North Berwick. 20,700 linear feet of 12-inch transmission main is required to interconnect Sanford to North Berwick. A flow of 350 GPM (0.5 MGD) will be simulated.

Projected impacts to the North Berwick distribution system have been included for informational purposes only. Actual conditions should be evaluated using an accurate calibrated model of the North Berwick water distribution system.

a. *Hydraulic Constraints in the SBWD Distribution System While Transferring Water to the NBWD*

   The impact of pumping a flow of 350 GPM (0.5 MGD) from the SBWD to the NBWD results in a decrease in localized pressures in SBWD of 7 psi from 72 psi to 65 psi. This condition also causes pressures along Knights Pond Road to fall below 35 psi. Localized pressures in the NBWD water system increase 39 psi from 47 psi to 86 psi.

b. *Hydraulic Constraints in the SBWD Distribution System While Receiving Water from the NBWD*

   The transfer of 350 GPM from North Berwick to South Berwick results in an increase in localized pressures in SBWD of 8 psi from 72 psi to 80 psi. Localized pressures in the NBWD water system decrease by 6 psi from 47 psi to 41 psi. Pressures within the interior of North Berwick's distribution system along US Route 4 north fall below 40 psi. In order to maintain pressures in the North Berwick distribution system, approximately 6,000 linear feet of 6-inch piping should be replaced with 12-inch piping along Route 4 between Dennett Road and Wells Street. This same result may better be accomplished by a pumping station.

7.3.6.3 Water Quality/Blending Considerations

South Berwick provides primary disinfection with free chlorine using sodium hypochlorite. The SWD well supplies are unchlorinated (occasionally temporary chlorination of specific wells is sometimes practiced by the District). Exchange of water from SWD to South Berwick would require installation of a temporary chlorination system. The SWD could expect some aesthetic issues from manganese and iron if water was introducted from South Berwick into the SWD distribution system.

7.3.6.4 Conclusions

Refer back to Figure 7-17 for a service plan between the SBWD and the SWD and Figure 7-15 and Figure 7-16 for service plans between the SBWD and the KWD.

The South Berwick Water District has adequate supply and multiple well resources to meet its needs into the future. However, the District should use the infrastructure plan developed with adjoining utilities as a cost benchmark before developing its next proposed well on US Route 4. The District has secured and tested a site in this location, which is far from the distribution system and may require a storage tank to complete the development and incorporate the well into the distribution system. The District should revisit the mutual aid opportunities with the Kittery Water District, as discussed in this report, which has an abundant supply, before developing this additional well supply.

7.3.7 York Water District (YWD)

The York Water District is projected to have adequate supply to meet the District's projected needs through year 2050. The surplus supply capacity could be made available to support growth into the identified regional growth areas or for cooperation and mutual aid purposes with the Kittery Water District and/or the Kennebunk, Kennebunkport & Wells District.

The following scenarios will be evaluated related specifically to the York Water District:

- Hydraulic limitations within the York system related to an interconnection with the Kittery Water District along US Route 1.
- Hydraulic limitations in the York system related to an interconnection with the Kennebunk, Kennebunkport & Wells District along the US Route corridor.
- Mutual aid and emergency requirements to meet needs in the system and to support adjacent utilities in the region.

7.3.7.1 Constraints which Limit Hydraulic Capacity with the Kittery Water District

As noted previously, the KWD and YWD have been participating in mutual aid planning by constructing an interconnection on US Route 1. Due to the similarity of hydraulic gradelines, pumping is required to move water in both directions and the utilities will be jointly constructing a booster pumping station at the York River for this purpose.

For the analysis of the York-Kittery interconnection, the following baseline conditions were assumed:

- Kittery Water District - A present maximum-day demand of 4.42 MGD was assumed with Kittery's Eliot and Rogers Road tanks operating at a hydraulic gradeline of El. 180 feet. The static pressure in Kittery at the junction of the systems was determined to be approximately 45 psi under these conditions.
- York Water District - A present maximum-day demand of 2.46 MGD was assumed with York's Simpson Hill and York Village tanks operating at a hydraulic gradeline of El. 189 feet. The static pressure in York at the junction of the systems was determined to be approximately 48 psi under these conditions.

Under an average-day demand (ADD) scenario, both systems have adequate safe yield and pumping capacity through 2050. Safe yield adequacy is not normally measured against a MDD benchmark, however, this information is provided simply to demonstrate the constraints under which the YWD could face in the future or during a sustained summer demand need. In addition, the YWD has a potential safe pumping/production deficit under MDD conditions in the case where one of their filter trains was unavailable.

a. *Hydraulic constraints in the York Distribution System when receiving water from Kittery*

A flow of 1 MGD increases localized pressures in York by approximately 7 psi, from 48 psi to 55 psi. Increasing the flow to 1.25 MGD increases localized pressures in York by approximately 10 psi, from 48 psi to 58 psi.

The maximum amount of water that can be transferred from Kittery to York while maintaining pressures below 100 psi in York's distribution system is approximately 2,100 GPM (3 MGD). This results in localized pressure increases in York from 48 psi to 100 psi. Piping improvements in YWD's system are not required for transfer of this quantity of water.

b. *Hydraulic Constraints in the York Distribution System while moving Water to Kittery*

The maximum flow available to Kittery while maintaining a minimum pressure of 40 psi in the York distribution system is approximately 700 GPM. This flow results in a decrease in localized pressures by approximately 8 psi from 48 psi to 40 psi.

A flow of 2 MGD under existing conditions reduces localized pressures in York near the interface between the systems by approximately 28 psi, from 48 psi to 20 psi while localized pressure at the intersection of Route 1 and Ferry Lane would decrease by approximately 20 psi from 72 psi to 52 psi. Although this pressure drop is acceptable from Maine PUC's perspective, pressures this low would likely need to be addressed in a sustained use situation. Transferring more than 2 MGD to Kittery will require water main upgrades along US Route 1 back to the intersection of York Street, or potentially looping Southside Road back to US Route 1.

In summary, the existing interconnection can be enhanced to increase available flows (Above flows in the present mutual aid agreement), if some additional piping improvements are made in this area of the York distribution system. As development occurs in this area and as old water mains are targeted for renewal, the District should consider the capacity of the interconnection in the analysis.

7.3.7.2 Constraints which Limit Hydraulic Capacity with the Kennebunk, Kennebunkport & Wells District

Similar to the agreement between the Kittery and York Water Districts, the YWD and KKW Water District have had a mutual aid/emergency type agreement for a number of years. Supplemental capacity when needed can be supplied through an interconnection which was constructed jointly by the Districts along US Route 1 in the Ogunquit-Cape Neddick area. The interconnection agreement limits sale of water from York to KKW to 1.0 MGD. The agreement limits the sale of water from KKW to York to 1.0 MGD. The interconnection contains two booster pumping stations which pump over high elevation areas along the interconnection route.

For the analysis of the York-KKW interconnection, the following baseline conditions were assumed:

- York Water District - A present maximum-day demand of 2.46 MGD was assumed with York's Simpson Hill and York Village tanks operating at a hydraulic gradeline of El. 189 feet. The static pressure in York at the junction of the systems was determined to be approximately 55 psi under this condition.
- KKW Water District - A demand of 6.35 MGD, the reported 2006 maximum-day demand with storage tanks operating at a hydraulic gradeline of El. 195.00 feet was used for all simulations. The static pressure in KKW distribution system at the junction of the systems is approximately 83 psi under this condition.

a. *Hydraulic Constraints in the York Distribution System from moving Water to the KKW Water District*

Under existing demand conditions, service pressures along the 16-inch interconnection water main in US Route 1 north of Pine Hill Road, range from a high pressure of about 55 psi to a low of 5 psi on the hill between the two systems. An air release valve is located at this high point to prevent the interconnection from becoming air bound, thus restricting flows of any kind. The remainder of the corridor is served by pressure above 35 psi.

The York Water District maintains a booster station on US Route 1 to pump flows over the large hill. The pumping station which is located just south of the Mountain Road/US Route 1 intersection can provide flows from this location up to 1.5 MGD. This would result in a decrease in pressure at the intersection of Route 1 and River Road by 20 psi, from 64 psi to 44 psi. This system capacity meets the agreement commitment of a maximum flow of up to 1.0 MGD.

Replacement of approximately 1,800 linear feet of 8-inch cast iron with 16-inch water main from US Route 1 along Cape Neddick Road to the Simpson Hill Tank would increase available flows to 3 MGD. Pressure at the intersection of Route 1 and River Road would only decrease by 5 psi, from 64 psi to 59 psi. The York Water District should consider these changes in the future if additional reliance on the supply is required by the KKW Water District.

b. *Hydraulic Constraints in the York Distribution System from receiving Water from the KKW Water District*

The maximum amount of water that can be transferred by agreement to the York Water District is 1.0 MGD from the KKW Water District to the YWD. Hydraulically only about 2.0 MGD can be pumped into the existing York distribution system while maintaining pressures below 100 psi. This flow rate would increase localized pressures in York by about 35 psi from 55 psi to 90 psi.

Replacement of the same 1,800 linear feet of water main described above would provide capacity to increase flows to 3 MGD while maintaining pressures below 100 psi in York's distribution system. Localized pressures in York would increase by 41 psi from 55 psi to 96 psi in the vicinity of the interconnection.

Flows above 3.0 MGD would require replacement of approximately 4,100 linear feet of 12-inch water main to 16-inch water main along US Route 1.

7.3.7.3 Mutual Aid and Emergency Cooperation Considerations

The York Water District is projected to have an average-day water demand of approximately 1.33 MGD in year 2050. The safe yield of the District's only source of supply, Chase's Pond, is approximately 2.05 MGD. Water from Chase's Pond is treated at the Josiah B. Chase Water Treatment Facility.

The York Water District currently maintains a mutual aid agreement with the Kittery Water District for a maximum flow rate of 2.5 MGD at the point of interconnection on US Route 1. In addition, the District also maintains a mutual aid agreement with the KKW District in Cape Neddick for a maximum flow of up to 1.0 MGD for emergency purposes.

Proactive planning would suggest that the District should plan to meet its average-day demand condition supply condition based on loss of Chase's Pond. For this emergency condition, the District would need to identify a 1.33 MGD source of supply. The most conservative approach would be to assume that the loss of the supply occurred in the summer under a maximum-day demand condition. The maximum-day demand condition in 2050 is projected to be 3.27 MGD. Under this scenario, supplemental water from both Kittery and KKW through existing emergency interconnections may be needed to meet this condition.

Under this emergency scenario, the District could meet the projected 2050 average-day demand condition of 3.27 MGD in an emergency situation. Similar to the prior discussion in Kittery, if an emergency were to occur in the summer, it is likely supplemental flows from the KKW water system could be purchased from the BSWC wheeled through the KKW distribution system. York Water District would have a vested interest in having adequate stand-by capacity from BSWC to meet a summer supply emergency in York.

Alternately, the York Water District could pursue a second alternative of purchasing raw water flows from the Kittery Water District through an overland piping interconnection between the Bell Marsh Reservoir in the Kittery system to Chase's Pond in the York water system to meet emergency needs. A concept plan for this project was developed and permitted in 2003 but not constructed, although both utilities agreed in principal to partner on the project. The concept plan called for installation of a 16-inch HDPE water main constructed on the ground surface and a pumping station for transfer of flows during the summer months. The plan called for discharge of flows directly into the northern end of Chase's Pond by flowing overland for a short distance.

This second alternative might be feasible for a dam breach scenario of Chase's Pond but would not meet the vulnerability of losing Chase's Pond to an inadvertent contamination such as a fuel spill or plane crash in the reservoir.

In summary, maintaining the interconnection to the KKW system for mutual aid purposes will continue to make sense for the York Water District far into the future should an emergency need arise for additional supply.

7.3.7.4 Water Quality/Blending Considerations

The YWD and the KKW practice disinfection with chloramination and target a similar pH in the distribution system to manage nitrification and disinfection by-products. Based on historical water transfers through existing interconnections, there have been no known water quality issues. In the future should flow quantity be increased, additional study is suggested to validate any potential water quality regulatory concerns. On a temporary emergency basis, water quality can likely be managed and minor aesthetic issues should be acceptable.

7.3.7.5 Conclusions

Refer to Figure 7-11 for a basic service plan between the YWD and the KKW Water District and Figure 7-14 for a service plan between the YWD and the KWD.

The Kittery and York Water District's should seek further collaboration if either District upgrades their respective water treatment facilities. The distribution systems are limited to transmit the amount of flow from one system to the other without large scale piping improvements. However, the close proximity of the reservoirs makes transfer of water to a point of central treatment a possibility in the future for both Districts. Any decision to improve piping in the Scotland Bridge area or along US Route 1, in the vicinity of the existing interconnection between both Districts, should consider possible joining of the two systems in these locations as a factor in sizing new water mains.

SECTION 8

FUTURE REGIONALIZATION IN SOUTHERN MAINE

8.1 SUMMARY OF FINDINGS

In prior report sections, it was concluded current water supplies are likely adequate to meet the water supply needs in the immediate future. The long-term supply reliability in some systems within the region however is uncertain. Many factors will likely drive the region towards large, stable sources of supply in the future. Continued demands for additional water supply will eventually, and in some cases are beginning to stress supplies at the local level. This reality combined with future environmental limitations on water withdrawal, economic development and population growth, climate change, and other factors may eventually drive utilities to consolidation and enhanced protection of the few remaining sources of potable drinking water.

In the interim, continued cooperation and reliance between members will be an important water supply management strategy to insure the reliability of service throughout the region. The following discussion details some of the more important findings and conclusions that have been drawn from the analysis presented in prior Sections of the Report regarding supply management and on-going cooperation between utility members.

- Supply Capacity - Each SMRWC utility is projected to have adequate supply capacity to meet their immediate needs. Supply capacity beyond this period is limited.
- Treatment and Production Capacity - Investment in water treatment works and other hard assets will be required by each utility to meet projected demands within their individual service territory. Limitations in supply resources could limit the extent of growth.
- Mutual-Aid Opportunities - Emergency support, mutual-aid and continued cooperation in the sharing of water, staff, professional services and other resources for emergency purposes and cost economics will continue to be important throughout the planning period. Some investment in infrastructure may be needed on an individual utility basis to insure that the cooperation objectives of the region are sustained.

- Regionalization Opportunities - Regionalization of the SMRWC utilities is a likely direction for water suppliers to meet future needs throughout the region. Expanded use of the few large, well protected supplies will likely be the only way to assure reliable water supply in the future. However, expansion of infrastructure will be needed to treat and distribute water from major sources of supply in the region.

The following issues will likely be the primary drivers that may change the local capacity of water supply in southern Maine and push the region towards a regional, integrated water supply system. These issues are further elaborated later in this Section.

- Capacity and Yield of Existing Resources - The adequacy of each members supply was measured against existing and projected average-day demands through the service territory. The findings assume that the full yield and capacity of each existing source of supply will be available for use as drinking water supplies.

  Example: Withdrawal from the Kittery Water District's Bell Marsh Reservoir is permitted through the Maine DEP Site Development Regulations which are subject to amendment, agency consultation and intervention from NGO's and the public if the permit is re-opened. Changes to the permit could alter the availability or capacity of this supply in the future.

- Environmental and Water Withdrawal Restrictions - Development of new sources of supply and expansion of existing supplies will become increasingly difficult for water utilities in the State of Maine under the proposed water withdrawal regulations, which will be implemented under a phased program beginning in 2008. In some instances, existing water supplies may have operational restrictions on flow and reservoir levels placed upon them in the future. This may reduce yield and withdrawals of existing supplies within the SMRWC membership and drive reliance towards large regional water supplies that have characteristics which permit larger withdrawals. Larger watersheds, large main-stem rivers, and large reservoirs will be less vulnerable to environmental restrictions under these rules. Systems which may be impacted by the proposed regulation include the Kennebunk, Kennebunkport & Wells Water District, York Water District and the Kittery Water District

Example: The KKW Branch Brook supply may be subjected to withdrawal restrictions to maintain minimum aquatic base flows in the river system for macro-invertebrates and fisheries purposes. Similarly, water level restrictions may be placed on reservoirs in the Kittery and York systems to control drawdown during summer months to meet water quality standards. Should any of these scenarios become reality, it will reduce the availability of supply from these systems.

- <u>Economic Development and Expansion of Public Water Infrastructure</u> - Extension of public and private utility infrastructure in Maine is primarily funded by development entities and is somewhat controlled by the Maine Public Utilities Commission (MPUC). Alternative funding mechanisms such as public-private partnerships, municipal partnerships and other approaches to development may predominate in the future and promote growth in areas presently unserved by public water.

  Changes in the economic climate in southern Maine, new water intensive development, deregulation of the water utility industry or specific large scale developments could stress the current and projected local water supply balance in the region. There are many examples throughout the State where local municipalities have offered development entities creative incentives to invest and relocate to a community using tax-increment financing (TIFs), public-private partnerships, or municipal funding to extend public water systems. These types of situations which impact future water-use are not easy to measure or quantify.

- <u>Supply Disruption from Climate Change, Drought, Pollution or Other Natural or Man-made Events</u> - The findings of this study assume that existing historical yield and quality of present water supplies will be statistically similar in the future and that precipitation and land-use patterns will essentially remain unchanged in the southern Maine region in the future.

The scientific community continues to study and quantify how climate change may affect water supplies. Large surface water bodies and main-stem river systems with large watershed areas will continue to provide better stability and reliability during prolonged drought periods.

Pollution of water supplies is a constant threat, even in today's atmosphere of heightened awareness of the importance of protecting existing and potential potable sources. An example of a regional water quality issue is MTBE dispersion from precipitation. Although the extent of MTBE dispersion from fossil fuel combustion does not appear widespread in southern Maine, it does present an example of an unforeseen water quality and potential public health challenge that could be best managed from a large regional water supply and treatment facility.

The following analysis will consider these variables and will outline a regionalization concept that could be implemented within the region.

8.2 LONG-TERM DRIVERS FOR REGIONALIZATION

8.2.1 Population Patterns and Demographic Changes

The total population of the 23 communities served by the SMWRC member utilities is projected to grow from approximately 316,000 residents in year 2000 to approximately 425,000 residents in year 2050. Based on current and projected estimates, over 75% of the total population within the region will likely be served by public water. In addition, residents on private water supplies will continue to use public water through local businesses, public schools and downtown commercial districts. The analysis in this report has assumed that the percentage of the population served by public water in the future would remain the same as the current percentage of the population served. This data is presented in Table 4-14 of the report for each SMWRC water utility. As an example, approximately 82% of the entire resident population of Town of York is presently served by public water. This is relatively high for the region because the Town of York ordinances encourage new developments to be serviced by public water as a growth management tool.

Demographic shifts in population within regions of the United States, New England, and within regions of individual states is complex and dynamic. For example, southern Maine has experienced a demographic shift in population growth driven by the lack of housing stock in Massachusetts. Population projections are affected locally by planning initiatives, land availability and prices and other economic factors. Revitalization of urban centers, high transportation costs and other factors can drive population back into city centers which offer public infrastructure. These changes are difficult to predict with any certainty and should be periodically monitored.

The SMRWC should establish a protocol for monitoring population demographics every 10 years after census data is published and institute a process to re-assess assumptions in this report.

8.2.2 Regulatory Changes

8.2.2.1 Environmental Restrictions on Future Supply Development and Water Withdrawal

Water withdrawal management and regulation of surface water and groundwater supplies may impact current and potential supply availability. Reductions in availability and restrictions on development or expansion of existing supplies could be a driver for a regional water supply. The new water management regulation is designed to insure sustainability of the resources throughout the State. Some general trends in water supply management which can be expected in the State of Maine in the future include the following:

- Development of New Surface Water Supplies - New surface water supplies will be difficult to permit and will likely require maintaining high summer lake levels and minimum stream flow requirements for environmental purposes. This type of flow regime may render new supply development opportunities uneconomic.

- Development of New Groundwater Supplies - Although not currently regulated, groundwater supplies will likely include flow restrictions to maintain conservation flows in adjacent streams and surface water bodies in the future. Many groundwater supplies rely heavily on direct influence or recharge from surface water bodies to provide a viable yield. Development of new groundwater sources will likely be restricted to an amount less than the full hydrogeologic capacity of a well supply, as is current practice in the State of Maine. The Maine Geological Survey (MGS) is currently facilitating a preliminary rulemaking process regarding regulation of future groundwater development. SMRWC members should be tracking this rulemaking process.
- Maine DEP Surface Water Withdrawal Regulations - Recently enacted regulations will require re-permitting of existing surface water supplies when additional withdrawals are needed in the future. Expansion of supply withdrawals in excess of a systems hydraulic capacity of existing project components in place prior to May 2007 will be difficult to permit and implement.

During 2008 and 2009, each SMRWC member with a surface water supply will be required to establish firm hydraulic capacities and operation rules for each source of supply in accordance with the new sustainability rules. The long-term viability and capacity of existing sources of surface water supply may be less than assumed for this analysis. The findings of this report should be revisited after water withdrawal provisions are established for each water utility in 2010.

8.2.2.2 Deregulation of the Water Industry

Deregulation of the water industry would open water utilities to freely expand into currently un-served areas within their service territories based on the need and financial capacity of the utility. Under the current MPUC rules, expansion can occur on a somewhat restricted basis as long as it can be demonstrated that the extension benefits the overall customer base and/or the extension is funded in whole by the entity seeking new service.

New extensions are likely to occur in existing undeveloped areas and locations where larger concentrations of potential customers exist and extension of public water makes economic sense. The extensions will likely close the gap between systems and make interconnecting on a regional basis more feasible.

8.2.2.3 Horizon Issues in Water Treatment

The SMRWC utility members produce finished water that meets public health standards. All the utility members have master plans or treatability plans designed to address short-term regulatory issues within their system.

However, the USEPA is currently evaluating several long-term horizon issues for regulation that are expected to impact SMRWC utility members over the next 10-20 years. These issues could require extensive investment in treatment upgrades or could force utilities to consider alternative sources as a strategy to meet the treatment requirements. Regionalization may be one solution to these pending issues. SMRWC membership should be engaged in the future USEPA rulemaking process by monitoring potential impacts to water treatment. As each individual utility approaches planned decisions to upgrade a water treatment facility or to upgrade major transmission infrastructure, the cost and complexity of new treatment requirements should be revisited from a regional perspective. Horizon issues which are expected in the future include the following:

- <u>New Candidate Contaminant List (CCL)</u> - The 1996 amendments to the Safe Drinking Water Act established a mechanism for the USEPA to introduce rulemaking for new pathogens, pesticides, biological toxins or disinfection by-products that research suggests might be a threat to public health.

In February 2008, a new list of 104 contaminants was issued for public comment. The list includes 11 microbial contaminants and 93 chemical contaminants. Most of these contaminants are rare in the environment and will not impact present sources of supply. The SMWRC should track regulation development for these contaminants and revisit recommendations in this report as each utility considers a decision to treat a local source of supply.

- Pharmaceuticals and Personal Health Care Products (PPCPs) - This family of contaminants includes health care products used by individuals such as cosmetics or medications, illicit drugs, veterinary products, agribusiness products and residues from hospitals or manufacture of pharmaceutical products. These products enter the environment from wastewater treatment facility discharges, run-off from livestock yards and other sources.

  The family of chemicals under consideration for regulation could require changes in existing treatment processes that might drive reconsideration of alternative or regional supplies.

8.2.3 Climate Change

The impact of climate change is a growing concern and the local impact on the southern Maine region is not well understood at this juncture in time. The Climate Change Institute is an interdisciplinary institute at the University of Maine that is coalescing research into areas that could impact water supply in the southern Maine region. The institute is a good forum to track local climate change issues in the State of Maine. The types of problems currently being researched by the institute include:

- Sea level rise along the Maine coast
- Changes in weather and precipitation patterns
- Changes in lake hydrology and watersheds

- Monitoring techniques for changes in watersheds
- Impacts of microbial organisms to climate change

Climate change, increased frequency and extremity of drought events and flooding concerns may be manifestations of climate change that could impact local water supplies and increase the viability of a regional supply solution. Larger main stem rivers and large lakes are more resilient to climate effects and droughts.

8.2.4 Economic Development

A conservative methodology for projecting future water needs in the region was selected for the study. The analysis presumes that future residential, commercial and industrial development and growth will continue at a moderate pace in the future. The growth projections also reflect current Maine PUC regulation which somewhat controls extension of public water. The water demand projections were compared to the existing supply capacity throughout the region to determine the adequacy of the sources. Projections of population, development and water demand over long periods of time is an inexact science which may not reasonably capture all potential conditions and variables that could occur in the future. For example, a large water demand user could locate into the region in the future that had not been forecast by planners at the time of this study. The needs of this "new" user could far surpass the projections and available capacity projected in the region.

Similarly, future state or federal economic investment in the region designed to enhance job creation or, some other large initiative, could be a trigger to develop a regional supply solution. When one considers that both state and federal agencies funded a $16-18 billion dollar investment for construction of the Boston Highway Arterial, a large regional water supply investment is conceivable. Additional approaches to development and types of developments that could drive a regional water supply plan are discussed below.

8.2.4.1 Water-Intensive Industries

All of the SMWRC utility members in the southern Maine region would have difficulty or be unable to provide service to a large water intensive industry (5-10 MGD) without major investment in infrastructure expansion and/or some level of regionalization. Examples of water intensive industry which could develop in southern Maine include breweries, power generation facilities, metals refineries, and research and development institutions. The Devens Finance Authority in Devens Massachusetts, the entity responsible for redevelopment of the former Devens Air Base, was successful in attracting a large pharmaceutical development to the site over competing sites in other states based solely on availability of water and wastewater infrastructure.

8.2.4.2 Local and Municipal Development Initiatives

Chapter 65 of the rules and regulations established by the Maine Public Utilities Commission (MPUC) generally requires a development interest to fund extension of public water unless it can be demonstrated that there is a greater benefit to the rate payers at large. The rule applies to both small and large development and has created somewhat of a disincentive for large scale expansion of public water infrastructure.

However, local communities through a number of alternative financing mechanisms are able to promote and extend public water to serve development through tax-increment financing (TIFs), local zoning, creation of enterprise zones and other techniques. Large scale development initiatives in the region might call into question the sustainability of local water supplies.

8.2.4.3 Regional Development Projects

Regional development through a voter-initiated ballot initiative or other incentives might create an environment where large scale development which requires a significant water demand could occur in southern Maine. A recent example of this type of development was the 2004 referendum which proposed a casino resort in southern Maine. Had this initiative passed, the proposed project would have been the largest single development project in the State of Maine. Local water utilities may no have been able to provide public water supply to serve this development which would have required transmission of supply from another region or utility.

8.2.5 Stricter Regulation of Private Water Supply

Residents, and in some cases business and industry who do not have access to public water or sewer, are served through private on-site wells and disposal systems. In many cases in southern Maine, New England and the country, large high density developments have emerged which do not have access to public water and wastewater disposal infrastructure. Concentrated development in un-sewered areas can lead to groundwater contamination from subsurface disposal fields. In the future, it is plausible that regulation could be adopted regulating water quality in private supplies. This type of rulemaking could drive expansion of public water infrastructure outside present service areas.

8.3 REGIONAL WATER SUPPLY OPPORTUNITIES

Establishment of a regional water system in southern Maine would have several challenges. The first challenge facing the SMRWC membership will be to identify sources of supply having sufficient capacity to meet the needs of the region far into the future. A regional source of supply would need to meet several criteria:

- Sufficient yield to insure a continuous supply under drought conditions.
- Appropriate protection from potential contamination and other activities which could compromise water quality.
- Permittable for use as a public water supply.
- Be located in relative proximity to existing demand centers.

The following discussion takes a closer look at potential supplies in southern Maine which would satisfy these criteria.

8.3.1 Existing Supplies

8.3.1.1 Saco River

The Saco River is presently the sole source of water supply for the Biddeford & Saco Water Company. The supply is treated with a traditional conventional treatment process, producing high quality water that meets public health standards. The Saco River system is one of the five great river basins in the State of Maine which also includes the Kennebec River, Androscoggin River, St. Croix River and the St. John River. The Saco River basin consists of the main river stem and two major tributaries; (1) the Ossipee River and the (2) Little Ossipee River.

The Saco River is a proven and highly valuable source of supply with abundant surplus yield that can be further developed as a regional water supply. The river has benefitted tremendously from regulation under the Federal Clean Water Act, which has improved water quality in the river. The decline of a small but important light industrial base in the river valley has also contributed to improved water quality. The Saco River has many advantages as a potential region source of water supply including:

- <u>Sustained Yield</u> - The Saco River Watershed drains approximately 1,704 square miles above the Biddeford-Saco urban center. The estimated safe yield during a drought condition is approximately 1,000 MGD. This amount of flow is well in excess of projected needs in the entire SMRWC region far into the future.
- <u>Regulation of Water Withdrawals</u> - Water withdrawals from large main-stem rivers such as the Saco River are less vulnerable to environmental restrictions.
- <u>Hydropower Development and Federal Energy Regulatory Commission Jurisdiction (FERC)</u> - The FERC and hydropower owners have established water quality standards for the river through the 401 Water Quality Certification process under the Clean Water Act. This provision of the proposed water withdrawal regulations, to be administered through the State of Maine Department of Environmental Protection, will encourage protection of

the resource and provide a mechanism for establishing expanded water withdrawals from the Saco River.

- Watershed Protection, Water Quality and Stewardship - Land-use in the Saco River basin north of the Biddeford-Saco urban center is not intensively developed and contains no widespread history of industrial land-use or development. Although impractical to acquire and fully protect this large land mass, the headwaters of the river basin are under federal protection in the White Mountain National Forest. Land uses in the lower reaches of the river basin consist primarily of agricultural and residential land use. Existing awareness for protection of the Saco River water quality is well established. Many institutions such as the Saco River Corridor Commission, land trusts, fishing clubs and other prominent institutions dedicated to protection of the watershed and water quality of the Saco River are active and in-place. Specific, on-going efforts aimed directly at the protection of the Saco River watershed and water quality are detailed below.
    - New Hampshire River Management and Protection Program (RMPP) - Approximately 427 square miles (including the headwaters) of the total Saco River drainage area is located in the State of New Hampshire (NH). Approximately 80 percent of this land area is protected within the White Mountain National Forest. In 1990, this segment of the Saco River was designated into the NH Rivers Management and Protection Program (RMPP). The Saco River is the only large river in the state of New Hampshire that meets all of the surface water quality standards designated under the USEPA Clean Water Act.
    - Maine Outstanding River Segment Designation - The Saco River from the confluence of the Little Ossipee River to the NH border is designated as an "outstanding" river segment by the State of Maine Legislature. The program designates and protects the most important rivers in the State of Maine. This designation requires a high standard of care for any changes to the flow regime in the river, wastewater discharges, hydropower development or other potential changes to water quality. The statute states that "The Legislature declares that certain rivers because of their unparalleled natural and recreational value,

provides irreplaceable social and economic benefits to the people in their existing state".

- Land Trust Advocacy - The Nature Conservancy has purchased riparian floodplain forests and other important parcels of land along the Saco River corridor to protect the long-term water quality in the river. Other land trust efforts are also progressing in the watershed which will contribute to the long-term security of the river quarter quality.
- Saco River Corridor Commission (SRCC) - The SRCC was formed to protect and preserve the Saco River and its key tributaries from unplanned development. The SRCC issues permits for any activity located within 500-feet of the river. Each of the twenty municipal members has a vested stake in the river and appoints one member to the Commission.
- Fisheries Advocacy - The Saco River Salmon Club is an active constituency working to restore the sea-run wild Atlantic Salmon fishery in the river. The survival of the salmon species requires that the river quality be maintained at the highest standards. This organization is an example of a private entity dedicated to preservation of the Saco River water quality.

The Saco River water quality has improved dramatically since inception of the Federal Clean Water Act. In addition, improved treatment of wastewater discharges, comprehensive watershed protection, public education and ongoing conservation efforts to protect water quality are in place and growing in importance in the watershed.

When considering use of any large river system as a regional source of supply, land-use control and an established ethic of water quality protection is essential. In addition, future regulation of home health care products and pharmaceuticals from non-point sources and wastewater discharges will reduce vulnerability of the supply in the future. The SMRWC membership can participate and effectuate river protection policy in the future.

8.3.1.2 Sebago Lake

Sebago Lake has been the primary source of supply for the Portland Water District (PWD) since the 1800's. Sebago Lake is a pristine source of supply which has been protected under an excellent stewardship plan for over a century. Similar to the Saco River, protection of this large valuable resource by many constituencies and the public at large in the State of Maine has required cooperation and advocacy at many levels.

Because of these efforts, Sebago Lake has high value as a potential regional water supply beyond the present service territory of the PWD. The SMRWC membership can participate and advocate for continued efforts to protect Sebago Lake for the region. The following important factors make Sebago Lake valuable as a potential regional source of supply. In addition, a brief summary of on-going stewardship and protection efforts promoted by the PWD and other stakeholders is included.

- Sustained Yield - The actual safe yield of the Sebago Lake basin is not well understood and has not been studied in a rigorous manner. The historical yield of the supply has thought to have been approximately 150 MGD. The actual yield is thought to be much higher and is changing as lake level management, and hydropower licensing provisions have changed over time. For the purposes of this report, we have used a yield figure of 100 MGD. A detailed safe yield analysis considering various operation and water use scenarios is needed to quantify the available flow for water supply purposes from the lake and to validate the assumptions made in this study.
- Lake Level Management - The lake levels in Sebago Lake are controlled by the S.D. Warren company at the Eel Weir Dam, which discharges into the Presumpscot River. The company has controlled lake levels in Sebago Lake since 1875. Historically, S.D. Warren has varied lake levels between El. 260.5 feet to El. 266.6 feet. Only about 5% of the outflow of the lake is used for drinking water purposes. The remaining outflow (95%) from the lake is used for hydropower generation on the Presumpscot River. An application with the Federal Energy Regulatory Commission (FERC- Project 2984)

which includes a detailed lake level management plan is still pending licensing. Understanding how this large outflow for hydropower generation is managed in the future and opportunities to re-allocate portions of this usage for drinking water purposes will be an important factor in determining the value and amount of yield available as a regional drinking water supply.

- Watershed Protection, Water Quality and Stewardship - Sebago Lake has excellent water quality due to the natural characteristics of the source water and extensive protective activity by numerous interest groups throughout the region. In particular, the Portland Water District is involved extensively in the preservation and protection of the lake water quality and watershed. Expansion of the water treatment works, transmission system and other components of the water system should be mindful of opportunities for expansion of the lake as a regional supply. Specific efforts aimed directly at the protection of the Sebago Lake watershed and water quality are detailed below.
    - Intake Protection Zones - In 1913, the State of Maine Legislature approved a special law prohibiting human contact within 2 miles of the Sebago Lake intake to protect water quality in the Lower Bay of the lake. Later amendments allowed for a 3,000 foot no-trespassing zone around the intake. These measures are strictly enforced through regular surveillance on the lake.
    - Conservation Easements and Land Protection - The PWD has an active program of purchasing lakefront properties (within 500-feet of the shoreline) in the Lower Bay of Sebago Lake to preserve water quality. Along with other efforts from local land trusts, these efforts are assuring that the high quality of the lake will be sustained far into the future.
    - Existing Shoreland Zoning and Development - The State of Maine has adopted a state-wide shoreland zoning ordinance that guides development on large water bodies. In general, all new structures must be set back 100-feet from the shoreline of any lake within the state of Maine unless more restrictive setbacks are adopted locally. A Private and Special Law enacted by the State of Maine Legislature extended the setback for structures to 200-feet on Sebago Lake and delegates oversight responsibilities to the PWD on construction standards.

- Public Education and Outreach - The PWD has a comprehensive outreach program to local schools and other interested parties to promote good recreational practices and use of Sebago Lake as a resource. Most recently, these efforts have expanded to promote good boating practices to control introduction of evasive plant species into the lake. These efforts are intuitional and historical, creating a good foundation to further protect the lake as a potential regional source of supply.
- Water Quality Sampling - The PWD has maintained a comprehensive water quality sampling program on Sebago Lake since the District was formed in the 1800's. Maintaining high quality source water is essential in minimizing treatment and protecting public health for the District's customers.
- Property Consultations and Stewardship Grants - The PWD maintains active engagement with homeowners, recreational users of Sebago Lake and other members of the public to promote best management practices on the lake and surrounding shoreline. These efforts include stewardship grants and consultations with homeowners.
- Other Stakeholder Groups - The Friends of Sebago Lake and other advocacy groups are active on Sebago Lake seeking improved protection of the resource for public use and as a drinking water supply.

8.3.2 Other Potential Regional Supplies

The coastal plain in the southern Maine region has limited opportunity for further supply development to meet the combined needs of the region due to limited large watershed drainage basins and small surface water supplies. The immediate coastal plain is characterized by shallow glacial soils with limited depth for groundwater storage. Glacial marine deposits of silt and clay also predominate in this area. More pervious glacial outwash (sand and gravel) and esker deposits (river deposits of sand and gravel) predominate the interior York and Cumberland County area.

None-the-less, potential water sources that could serve as regional water supplies were screened and evaluated. In addition to existing sources of supply, two river supplies were identified as having sufficient drainage area for consideration as drinking water supplies to support regional needs. In addition, a general evaluation of desalination as a potential source of drinking water was also evaluated. A brief description of each of these supply opportunities follows.

8.3.2.1 Salmon Falls River

The Salmon Falls River is a major tributary of the Piscataqua River which forms the boundary between the States of New Hampshire and Maine. Great East Lake and the smaller Horn Pond form the headwaters of the Salmon Falls River and provide some minor regulation of flows. The river joins the Cocheco River to form Piscatauqua River in Dover, New Hampshire before flowing to Portsmouth Harbor and the Atlantic Ocean. The Salmon Falls River is currently used as a public water supply by the Town of Berwick, Maine and City of Somersworth, New Hampshire.

The river is tidally influenced below the dam in South Berwick. The drainage area of the Salmon Falls River above the dam in South Berwick is approximately 302 square miles. Using a traditional estimate of 600,000 gallons per day of yield per square mile of drainage area, suggests that the river can provide a sustained yield of 120-150 MGD in the lower reaches during a drought year.

The water quality in the Salmon Falls River is highly colored and subject to turbidity swings during high flow events. In addition, the Salmon Falls River drainage area is located in both the State of New Hampshire and the State of Maine and is highly developed with a history of industrial use.

On this basis, the Salmon Falls River does not appear to have sufficient capacity or watershed protection to warrant consideration as a regional water supply in the future. Because of its proximity far from the majority of the utilities in southern Maine, it would also require the development of an extensive infrastructure system to convey flows to the north, making it cost prohibitive as compared to other alternatives.

8.3.2.2 Mousam River

The Mousam River is a primary river which bisects central York County and flows from its headwaters in Mousam Lake and Square Pond in Acton, Maine to the Atlantic Ocean in Kennebunkport. The river is tidal inland up to a series of dams located on the main stem of the river in West Kennebunk. The Mousam River is not currently used as a public water supply.

The river has multiple dams and small impoundments throughout its length. In earlier years, the river powered the industrial mill complexes in downtown Sanford through multiple flumes and power canals constructed into older industrial buildings.

The drainage area of the Mousam River above the dams in West Kennebunk is approximately 107 square miles. Using a traditional estimate of 600,000 gallons per day of yield per square mile of drainage area, suggests that the river can provide a sustained safe yield of 50-70 MGD in the lower reach of the river during a drought year.

On this basis, the Mousam River does not appear to have sufficient capacity or watershed protection to warrant consideration as a regional water supply in the future.

8.3.2.3 Desalination of Seawater and Brackish Water

Desalination of seawater or brackish water from the Atlantic Ocean should be considered in the future as a source of supply for the southern Maine region. From a quantity perspective, is an unending source of supply.

Desalination is accomplished through reverse osmosis (RO) membranes to remove salt from brackish or seawater. Desalination of seawater in colder climates (higher water density) remains cost prohibitive and energy dependant. In addition, the cost of desalination is highly dependant on salinity in the supply. In New England, ocean water has a salinity of about 35,000 mg/L. Brackish water has lower salinity concentrations depending on an estuary's proximity to the ocean, tidal action, water depth and other factors.

The desalination process is very energy intensive which is why many desalination facilities are co-located at power generating facilities to take advantage of lower energy costs (power generating costs without power distribution costs). In addition, many states now regulate discharges of brine concentrate, a waste product from desalination facilities, which is often discharged and diluted with cooling water at power generating ocean outfalls to reduce salt concentrations back to ambient ocean concentrations.

Recent studies completed in other regions of New England by Wright-Pierce determined the cost of seawater desalination to be between approximately \$4.00 - \$8.00/1,000 gallons of water treated excluding the cost for distribution. The existing marginal cost to produce and treat water for the SMRWC utility membership is approximately \$0.20 - \$0.80/1,000 gallons.

Desalination in southern Maine has cost and environmental limitations that would not make it feasible as a potential source of supply at this time. As RO treatment technology continues to improve, its cost is likely to decrease. If present fresh water sources became unusable, the SMRWC could consider desalinization as a potential solution.

8.3.3 Regional Supply Conclusions

The Saco River and Sebago Lake are the only practical sources of supply in the southern Maine region that are sufficient to meet the needs of the entire SMRWC service territory. The Salmon Falls River, Mousam River and desalinization have limited opportunity at this time to meet the needs of a regional water supply.

It is conceivable the Saco River could be developed as a regional water supply producing 100-120 MGD to meet the entire needs of the southern Maine region south of the Portland Water

District service territory. The Saco River remains a valuable resource to be preserved as a potential regional water supply for southern Maine.

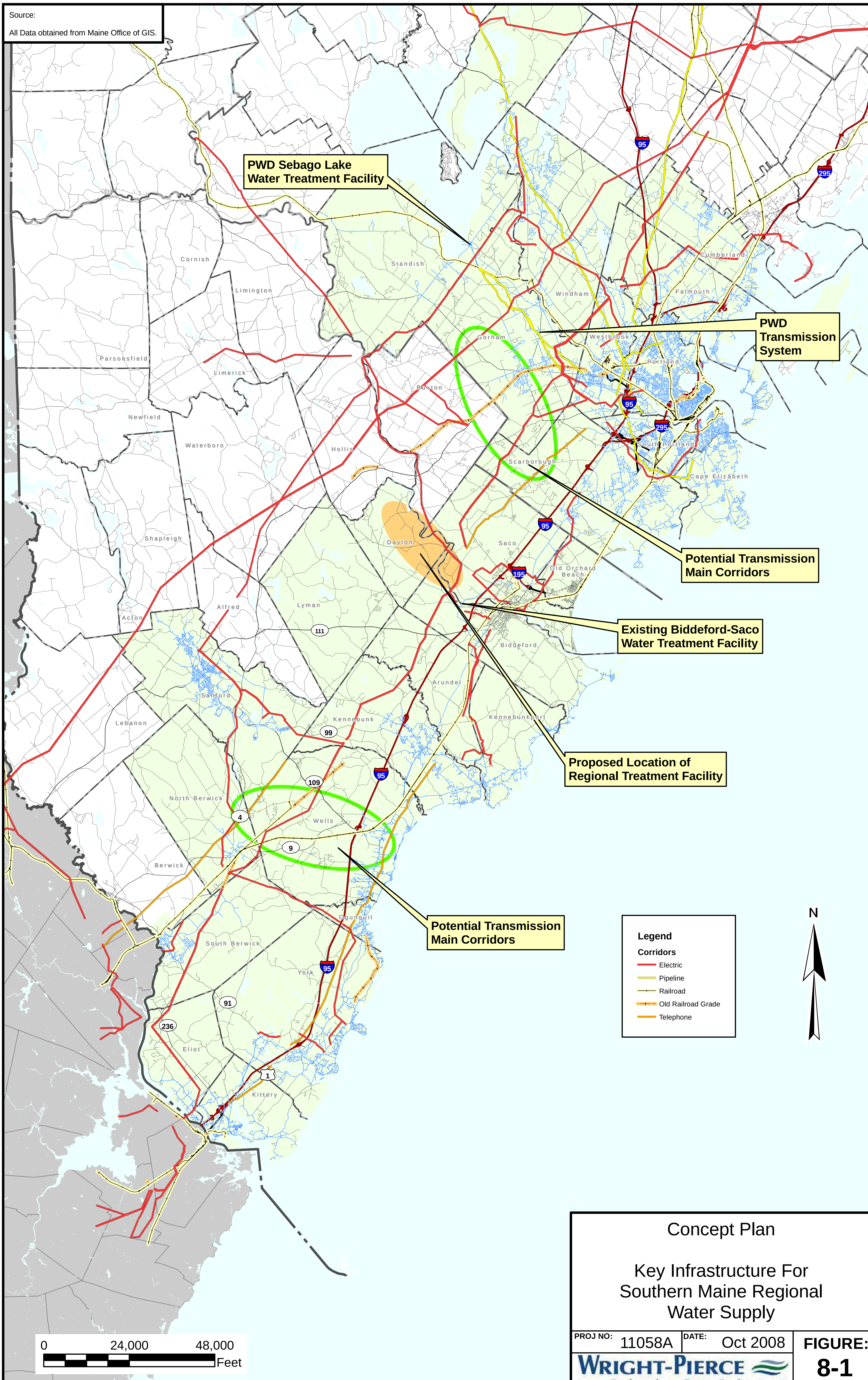
Sebago Lake has benefited from over 100 years of comprehensive watershed protection, public education and ongoing conservation efforts to protect water quality. The lake remains a pristine water supply that has value and capacity to be preserved as a potential regional water supply for southern Maine.

A concept plan to develop the Saco River and Sebago Lake to regional water supplies will be discussed later in the report.

8.4 CONCEPTUAL INFRASTRUCTURE REQUIREMENTS FOR A REGIONAL WATER SUPPLY

A concept plan for a regional water supply system is presented on Figure 8-1. The concept plan has been developed based upon the water needs of the region, the availability and location of supply sources, and infrastructure needed to move water throughout the region. The conceptual plan identifies sources of supply, and general treatment and major transmission piping locations.

Ownership models and potential governance plans for a water supply authority that might be formed to own these assets is discussed later in this Section. The concept plan retains both the Saco River and Sebago Lake as the primary supply sources for the region. The following describes the concept plan in general terms including treatment, transmission and corridor routes, potential limitations, additional information needs and the basic operation of the system.



Concept Plan

Key Infrastructure For Southern Maine Regional Water Supply

PROJ NO: 11058A DATE: Oct 2008

FIGURE: 8-1

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8.4.1 Treatment and Primary Transmission Between Sebago Lake and the Saco River

The regional concept plan would utilize the existing sources of supply from the Saco River and Sebago Lake as previously identified. The Portland Water District would continue to retain control of Sebago Lake as its primary source of supply and maintain its current treatment facility in Standish. Transmission of finished water to the PWD service area would continue via the existing transmission mains from the Standish treatment facility. The PWD has targeted an upgrade of the primary transmission system as a future capital project to insure reliability and to accommodate increased demands in the PWD system.

Under a regional water supply plan model, the existing transmission system would be upgraded in the future as required to transmit both the projected PWD demands as well as a portion of the flows to and from a proposed regional treatment facility located at the Saco River. The proposed interconnection to the Saco River treatment facility would originate from the current or future upgraded transmission system in Gorham and could be constructed along existing natural gas or electric distribution service easements. This concept would require a hydraulic analysis of the existing PWD transmission system to properly size upgrades to this existing infrastructure. Consideration of potential future flows to and from a future Saco River treatment facility should be considered in the design. Water from Sebago Lake could either be blended with the Saco River supply to improve water quality or it could simply be used as a redundant source used only on an as-needed basis.

Preliminary analyses suggest that the proposed transmission system would be a minimum of 36-inch in diameter in order to accommodate flows from Sebago Lake to the Saco River treatment facility by gravity flow. In addition, this pipeline would be sized to allow flows from a Saco River treatment facility to be pumped back to the PWD transmission system as a back-up supply to Sebago Lake for the PWD system.

The benefit of the proposed transmission configuration is that it would provide a redundant supply to the PWD system as well as providing a mechanism for wheeling supplemental or redundant flows to the southern region of the SMRWC service territory. Since the PWD supply would be treated, the flows to the Saco River facility would be for convenience of pumping and for wheeling of water south.

Proper selection of pipe sizes and facility requirements would be dependant on defining the firm yield of both the Saco River and Sebago Lake and quantifying the permitting and environmental impacts of expanded withdrawal at both the Saco River and Sebago Lake. The relationship and operational regime between these two sources and the quantity of yield will guide the sizing and location of key infrastructure.

8.4.2 Primary Transmission from a Saco River Facility to Southern Maine

From a Saco River treatment facility, a major transmission spine would be constructed extending southerly along one or more of the existing utility corridors to provide service to the SMRWC utilities. The primary transmission main to the south is envisioned to be capable of transmitting flows of 100 MGD or more to serve the needs of the region over a time horizon of 100-years. The actual pipeline size will depend on a variety of factors:

- Projection of need in southern York County.
- Projections of need to areas/utilities outside of the SMRWC service area. For example, this could include the NH seacoast communities if deemed desirable in the future.
- The safe yield and permitted quantity available from the Saco River and Sebago Lake.
- Points of interconnection to primary east-west corridors (Route 109, Route 111, etc.).

The development of a regional transmission system is likely to occur in incremental steps based on need and/or specific local requirements. For instance, any efforts to expand cooperation between the BSWC and KKW Water District should consider future sizing requirements for the regional system along US Route 1 for the primary transmission main.

Selection of utility corridors will require additional detailed study(s) to include elevation profiles, engagement of property owners to establish legal rights of access, easements and other rights to construct the facilities. Existing corridors to be considered for the primary transmission mains from north to south include:

- US Route 1 between the Saco River and the NH border.
- The Maine Central Railroad corridor.
- CMP electrical transmission corridors.
- Maine Natural Gas pipeline corridors.
- Maine Turnpike right-of- way.

Figure 8-2 presents an overview of each of the corridor routes which should be considered in the future for construction of transmission mains. A brief description of each follows.

8.4.2.1 US Route 1

From a hydraulic perspective, the US Route 1 corridor is the most logical utility corridor to locate major transmission infrastructure south of the Saco River for the following reasons:

- <u>Proximity to Local Utility Transmission Mains</u> - The transmission systems of the BSWC, KKW, Kittery and York all intersect transect US Route 1, making them logical points of interconnection in the future between a regional transmission system and the local utility distribution systems. These points of intersection could be where wholesale metering facilities are constructed to purchase flows from a regional water supplier.
- <u>Proximity to proposed East-West Highway Corridors</u> - A primary transmission main located along US Route 1 would accommodate connection to primary east-west corridors identified in this study (US Route 236, US Route 109, etc.).
- <u>Established and Existing Rights of Access</u> - As public utilities, the SMRWC membership has legal rights to access the US Route 1 right-of-way without purchasing land, easements or rights of access.

- Existing Large Capacity Infrastructure - This highway corridor already has large capacity infrastructure which may have value and potential to be incorporated into a regional transmission system.
- Proximity to Demand Centers in Southern Maine - The primary water-use demand centers in southern Maine such as the Biddeford-Saco urban center, York Village, and downtown Kennebunk and Kittery all bound the US Route 1 corridor.

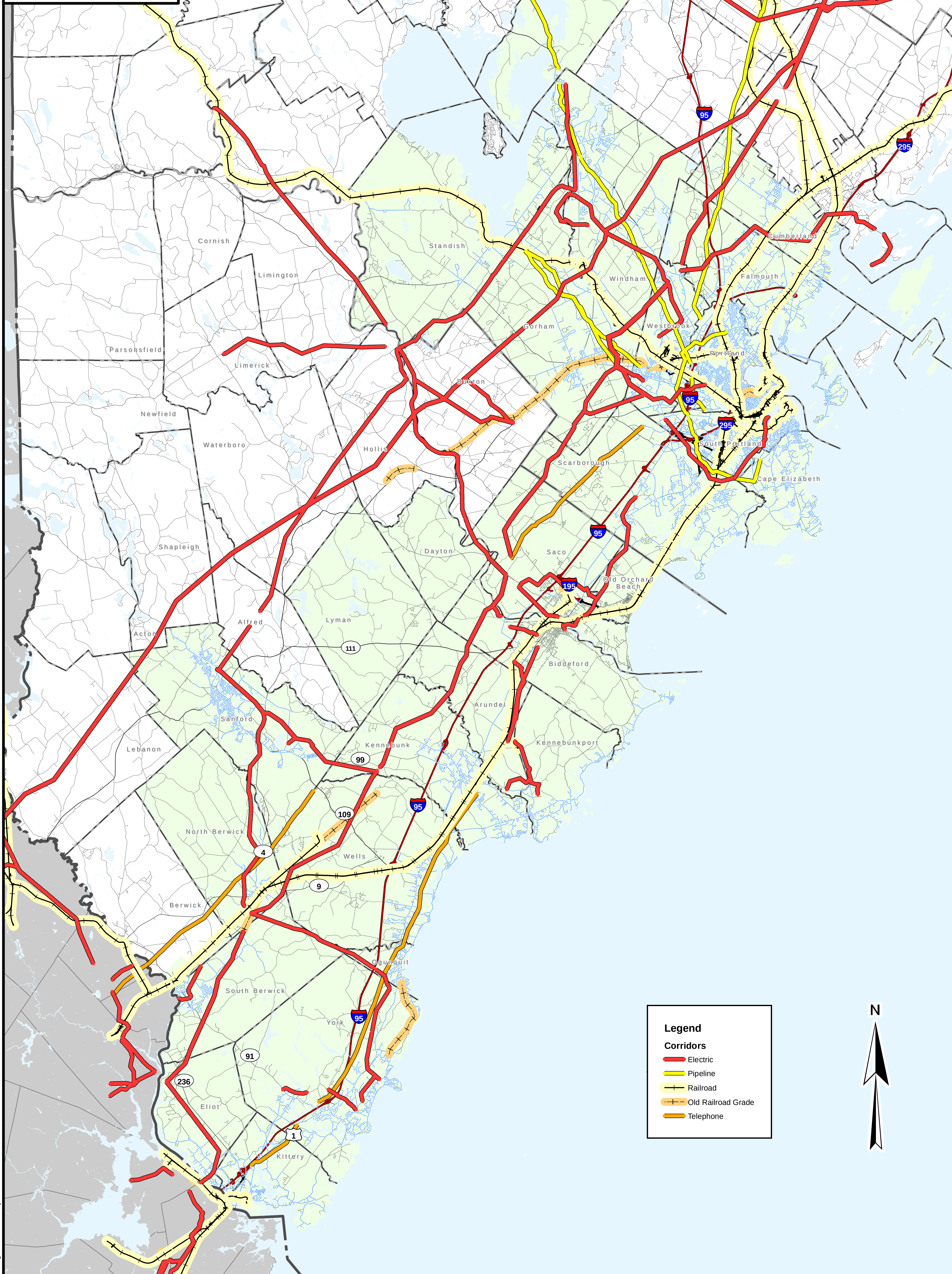
The disadvantages of US Route 1 include:

- Construction Cost and Complexity - The cost to construct transmission infrastructure along the US Route 1 corridor would be much higher because of business and residential congestion, as compared to construction in less congested rural areas. Adding to the cost and complexity of this work would be traffic management, bridge crossings and substantial pavement repairs. An undeveloped utility corridor, such as a wooded electric transmission corridor, would be significantly less costly to develop.
- Highway Opening Fees and Costs - Construction of a large pipeline along US Route 1 will require highway opening fees and possible acquisition of rights on land abutting the right-of-way in order to construct the proposed transmission mains. Relocation of other utilities and drainage structures would also likely be required.
- Economic Disruption - A construction project of this magnitude within the US Route 1 corridor would create economic disruption in local communities. A complex plan for traffic control, public relations and communications would be an important aspect of any future plan to pursue such a project.

In summary, construction of a region water transmission system along US Route 1 is the most logical location for a regional transmission system. However, significant upfront planning, permitting and approvals will be required which should be included in any plan to utilize this corridor.

Source:

All Data obtained from Maine Office of GIS.



SMRWC
Regional Water System Master Plan

Utility and Rail Corridors

PROJ NO: 11058A
DATE: Oct 2008
FIGURE: 8-2

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8.4.2.2 Active Railway Corridors

The Guilford Transportation rail line corridor extends from the Portland metropolitan area through Biddeford-Saco, Kennebunk, Wells and South Berwick and continues through New Hampshire to the major switching yard in Billerica, Massachusetts. Amtrak operates the Downeaster Commuter line between Portland and South Station in Boston on this rail line.

The railroad is strategically located through the coastal area of the southern Maine region and could serve as a potential water transmission main corridor in the future. However, obtaining approval to construct within the railroad right-of-way is unlikely and may require legislative action. Railroad safety provisions could also require acquisition of land though much of the corridor to allow adequate construction buffer from the active rail line.

8.4.2.3 Abandoned Railway Corridors

Several abandoned railroad corridors are intertwined throughout southern Maine which has the potential for construction of major water transmission infrastructure. Many of the existing railroad corridors are currently being converted to recreational trial systems such as bikeways, hiking trails or for other passive uses for public use. The majority of these corridors however are segmented and not generally practical for a continuous pipeline project.

8.4.2.4 Existing and Proposed Electric Transmission Corridor

Central Maine Power Company, a subsidiary of Energy East Company, owns and operates a series of electrical transmission right-of-ways throughout southern Maine. Their primary corridors are shown in Figure 8-2.

Electric transmission corridors present a potential opportunity to construct primary water transmission mains. These corridors are often located cross-country and away from other infrastructure, businesses and homes, and roadways making construction less costly than tradition roadway projects. One of the downsides to constructing pipelines adjacent to electrical transmission mains is the need to provide cathodic protection to prevent galvanic corrosion of pipe materials. However, the additional costs for cathodic protection can be offset by the savings in construction as outlined previously.

The most promising electric corridor is CMP's 345 kilo-volt transmission line, which extends northerly from Newington, New Hampshire through the Portland metropolitan area, to Orrington, Maine. This major transmission corridor is located parallel to and west of Interstate I-95. A proposal to upgrade this transmission line capacity was announced to the public in May 2008. The proposed project would include upgrading the entire 200 miles electrical transmission system over its entire length and acquisition of additional abutting properties to accommodate new equipment.

This site could have value as a corridor for a water transmission main in the future. It is recommended that the SMWRC become engaged with this process and investigate whether rights of access can be obtained and secured should this pipeline route be needed in the future for regional water supply purposes.

The primary electrical transmission main between the Saco River and the Portland Water District transmission system in Gorham may also serve as a potential link to provide larger capacity mains to a Saco River treatment facility. Construction along this corridor would likely be significantly less costly than construction along local and state roadways.

8.4.2.5 Natural Gas Pipeline Corridors

The Maritimes and Northeast Pipeline Company and Portland Natural Gas Transmission system jointly own a 30-inch high pressure natural gas pipeline which extends approximately 101 miles from Westbrook, Maine to Dracut, Massachusetts.

The pipeline is located in a utility easement that meanders cross country generally away from developed areas. The SMRWC could explore potential opportunities to utilize this corridor for future water transmission piping to meet the needs of the southern Maine region.

8.4.2.6 Maine Turnpike Authority Corridor (Interstate Highway I-95)

The Maine Turnpike corridor parallels US Route 1 throughout the southern Maine region and could serve as a potential location for construction of a major transmission main. The Maine Turnpike corridor has many of the advantages of US Route 1 and is close to major coastal urban centers and local utility distribution systems. However, the Maine Department of Transportation (MDOT) and the Maine Turnpike Authority (MTA) has established policies that do not permit parallel utility construction in major highway right-of-ways. At this juncture, it is unlikely that the MDOT or MTA would permit a project of this scope and breadth unless policy changes are instituted by the State of Maine Legislature.

The SMRWC should track any policy developments regarding this issue going forward and preserve rights of access in the future.

8.5 REGIONAL SUB-SYSTEMS AND INTERIM STEPS TOWARDS REGIONALIZATION

A regional water transmission may evolve incrementally within smaller, locally focused sub-systems and related projects. As noted earlier in this report, smaller subsystems have already begun to form in southern Maine driven by local needs and the desire to have redundant supply systems in-place. Development of local sub-systems is expected to continue into the future driven by the desire for redundancy, dwindling supply capacity, environmental and regulatory issues and development pressures. Decisions on how best to interconnect sub-systems should be made in consideration of larger facilities that might meet a regional need at some later date. Specific examples of sub-systems which have or are considering forming include the following:

8.5.1 Cooperation Between the York and Kittery Water Districts

The York Water District and Kittery Water District have held informal discussions over the last several years regarding the consolidation of their water supplies. Each District retains a separate and distinct reservoir system located in the Town of York. The close proximity of these sources of supply to each other, the contiguous watershed protection and public ownership of land surrounding the reservoirs, and surplus supply yield in the Kittery reservoir system, make the potential for local cooperation between the two utilities possible. The following detail several drivers that may trigger the joining of supplies between York and Kittery.

- <u>Surplus Yield in Kittery</u> - The Kittery Water District constructed the Bell Marsh Reservoir in York in 1987 in response to projected long-term need at the Portsmouth Naval Shipyard, its largest and most important commercial water customer. Projected water needs at the facility, however, never materialized making this large supply available for other needs.
- <u>Kittery Water Treatment Facility</u> - The Francis B. Hatch water treatment facility located at the lower end of Boulter Pond is used to treat the District's sources of potable water. The plant is approaching 50 years in age and will require replacement or upgrade in the near future. When planning for a new facility, consideration should be given to upsizing the facility to accommodate the consolidation York reservoir system at one centralized location. The existing treatment site can accommodate expansion for an increase in treatment capacity up to 10 MGD to meet the projected needs of both the Kittery and York Water Districts. In addition, the existing intake system should be adequate to supply the increased flows without major upgrades.
- <u>Chases Pond Facility</u> - The Josiah P. Chase Water Treatment facility at Chase's Pond is a newer facility that is sized to meet the projected needs of the Town of York through the next 20-30 year period. Recently, the District has conducted several studies to improve the yield of the Chases Pond supply including raising Chase's Pond dam and pumping surplus flows overland from the Kittery Water District's Bell Marsh Reservoir. Expansion of treatment capacity in York significantly above 4.0 MGD should consider

the hydraulic capacity of the intake system and raw water supply line to the water treatment plant. Consolidation of treatment in York and Kittery at one location should be studied further before any formal plan is made to upgrade the Josiah P. Chase Water Treatment facility.

It is important to point out that the transfer of raw water and consolidation of treatment between York and Kittery will require pumping and new pipelines to interconnect the two reservoir systems at either existing location. This must be considered in a final analysis.

Cooperation between the York and Kittery Water Districts would improve supply balance in the local region and could provide an interim step towards more widespread regionalization in the future.

8.5.2 Cooperation Between the South Berwick and Kittery Water Districts

The South Berwick Water District (SBWD) is currently considering securing property to develop additional well supplies to increase the future supply capacity to meet projected demands. As an alternative to developing new sources, the SBWD has considered the potential economics of an interconnection with the Kittery Water District from an avoided cost perspective. Recently, the two Districts' conducted an informal study to determine the relative magnitude of costs required to construct an interconnection between the two utilities along US Route 236. The technical requirements for this interconnection were also explored in this report.

In the future, any further discussion on the merits of an interconnection between these two systems should include consideration of regional water transmission needs. At a minimum, a cost estimate should be developed for the conceptual mutual aid interconnection studied in this report. Costs should be compared and extrapolated over the life of the project to development of the new groundwater supply in South Berwick. The size of any piping, pumping and storage facilities should also be made in light of the regional needs.

8.5.3 Cooperation Between the Kennebunk, Kennebunkport & Wells Water District and the Biddeford & Saco Water Company

The Kennebunk, Kennebunkport & Wells Water District (KKW) has an existing agreement for the purchase of wholesale water from the Biddeford & Saco Water Company (BSWC) for emergency needs and to meet high demands during summer months, as previously described. In addition, opportunities to improve mutual-aid have been identified in this report by increasing the capacity of the existing transmission pipeline and booster pumping system along US Route 1 between Biddeford and Kennebunk.

As a potential corridor for a regional transmission system, any decision to upgrade this existing interconnected transmission system should consider potential use of this corridor for a regional transmission main. Although a mechanism for funding this type of improvement does not exist presently within the bylaws and charter of the SMRWC, the membership should target this project as an opportunity that may have value to the entire region in the future.

8.6 GOVERNANCE AND OWNERSHIP MODEL OF A REGIONAL WATER SUPPLY ENTITY

The Saco River and Sebago Lake supplies would be the centerpiece of any regionalization initiatives for southern Maine. The control, ownership and transmission of water from these assets will be an important aspect of regionalization efforts in the region. A brief description of several conceptual ownership models for infrastructure in the region is presented as follows.

8.6.1 Regional Water Supply Authority

Under a regional water supply authority governance model, ownership and operation of key supply assets would fall under control of an "Authority", while local distribution would remain under the control of local utilities. Simply stated, primary assets of a regional system would fall into one of two categories:

- Regional infrastructure assets and infrastructure
- Locally owned utility assets and infrastructure

Regional infrastructure could include either or both sources of supply(s) including the Saco River and Sebago Lake, primary transmission piping designed exclusively to distribute flows throughout the region, and any treatment, pumping and storage infrastructure hydraulically required to move water throughout the transmission system.

Local infrastructure assets could include distribution piping, pumping and storage used in the every day operation of each utilities service area. Control and operation of individual water systems would remain under local control. This model has been adopted by the electric industry in Maine. As an example, power-generation assets are owned an operated by one entity (Ex. Florida Power and Light (FPLE)) and local distribution assets are owned by Central Maine Power (CMP).

Regional water supply authorities are common throughout the United States, in particular in arid or urban regions, where major sources of supply tend to be located some distance from the end users. The water supplies for the cities of New York, Boston and Seattle are located in secluded watershed basins, far from the distribution systems. Within the water utility industry locally, the Massachusetts Water Resources Authority (MWRA) is an example of an organization that operates under this model.

The MWRA is an independent authority that provides wholesale water and sewer services to more than 2.5 million people and more than 5,500 businesses in 61 communities in eastern and central Massachusetts. The MWRA was created by an act of the Massachusetts State Legislature in 1984 inheriting operations from the Metropolitan District Commission (MDC). The MDC was originally formed to manage and provide drinking water to the City of Boston. The role and mission of the MDC evolved into that of a regional supply authority in response to development growth in suburban communities and dwindling local water supplies.

The MWRA system includes the Quabbin and Wachusett reservoirs, transmission mains and supply tunnels and treatment facilities. The transmission system supplies treated flows to primary points of interconnection with local member utilities where flows are metered for wholesale purchase of water. Local utilities retain control over their distribution system assets including tanks, distribution mains, booster pumping stations, and in some cases, separate local sources of supply to supplement MWRA flows. Similar to how an electric power bill is configured in a deregulated energy market (one portion is for power generation, one portion is for distribution), a customer on the MWRA system receives a bill comprised of costs from the local utility and the MWRA wholesaler. Customer billing, rate management and control, maintaining distribution system water quality and primary customer relationship are functions retained by the local utility.

The MWRA is managed by a Board of Directors whose members include two representatives from every served community, as well as planners and other political appointee's. The Board of Directors provides financial oversight of expenditures and comments on capital investments, planning and policy and procedures of the MWRA. Some members of the Board of Directors are appointed by an Advisory Board which provides by statute further financial oversight and cost control to the MWRA Board of Directors.

Water customers can affect policy in an MWRA type water supply model through several avenues:

- Advisory Board Appointees
- State Legislature and Governors Office through the Legislative Process
- State and Federal Agencies
- Citizen Advisory Committees

A similar water supply authority model could be adapted to the southern Maine region which would manage and control primary supply, treatment and transmission assets. Treated water would be delivered to the SMRWC utility members through a network of primary transmission mains to a point of interconnection where water would enter the local distribution systems. The basic internal distribution system infrastructure would be managed and controlled by each local utility member, retaining the local control at the utility level. Similar to the MWRA, a mechanism for retaining existing treatment works to reduce reliance on the wholesale system could also be considered.

Wellesley and Weston, Massachusetts represent two community systems having differing relationships with the MWRA. Both of these systems are medium sized located in urban areas in eastern Massachusetts adjacent to one another.

The town of Wellesley owns and operates its own independent municipal public water system consisting of three groundwater wellfields, treatment facilities, pumping and storage and distribution mains. The town is near full build-out with little or no opportunity for developing additional groundwater supply within the town boundaries. The town operates the system with a water department staff under the direction of a Public Works Department.

The town also maintains an interconnection with the MWRA to supplement supply during summer months. Water supplied from the MWRA is purchased at a wholesale price and pumped into the distribution system through a locally controlled booster pumping station. The station is operated as if it were a separate water supply. Water revenues collected from customers funds the operating expenses and the cost for wholesale water purchased from the MWRA.

The town of Weston purchases 100% of its water supply from the MWRA as a wholesale customer through a single booster pumping station; the town maintains no local sources of supply. All water pumped through the town's booster pumping station is metered by the MWRA at the station. The quality of the water purchased from the MRWA is also monitored through analytical instruments and operators at the station to insure it meets the specified parameters stipulated in the agreement with the MWRA. The town retains responsibility of managing distribution system water quality on the discharge side of the booster pumping station, delivery to customers, fire protection, billing and other functions required to manage and operate a public utility.

8.6.2 Integrated Regional Water Utility

An integrated regional water utility model could consolidate all water supply assets under a single large regional water utility who would be responsible for all aspects of water supply, transmission *and* delivery. This type of model would relinquish local control of all aspects of water system management to this larger utility. Governance of this type of organization could be through a Board of Commissioners, Trustees or Directors comprised of representatives from SMRWC member utilities and communities.

The quasi-municipal water District is the most common form of governance for water utilities in Maine. Maine is unique in this regard throughout New England where local municipal management of water supplies is more common. The District governance organization was originally developed as a means to effectively supply and manage potable supplies, which were often located outside of their political boundaries and away from population centers, over a wide geographical area. The District model facilitated access to these sources. A large water District comprising the SMRWC membership would essential be an extension of this ownership model.

There are many examples of regional water utilities throughout Maine and New England including the KKW Water District, the Portland Water District, Augusta Water District and Kennebec Water District.

8.6.3 Impediments to Regionalization

In addition to the issues presented previously, there are a number of other challenges and impediments to regionalization in southern Maine. These impediments include:

- <u>Desire for Local Control and Accountability</u> - The SMRWC expressed a short-term desire to maintain local control of assets within each utility's service territory, including supply. A regional water authority model for ownership and control of assets would satisfy this requirement.

- Local and Regional Need - Insufficient supply is typically one of the primary drivers for regionalization. This study identified no immediate need to regionalize because of inadequate supply. This situation will change in the future as discussed. Other factors could also effectuate regionalization such as significant commercial or industrial development into areas where insufficient supply exists or regulatory requirements which make ownership and operation of private water supplies cost prohibitive.
- State and Federal Legislative Authority - A regional water supply organization would require legislative action at either the state or federal level as a manifestation of one of the major drivers discussed in this report. This process would likely incorporate a stakeholder process, which could create the lengthy, complicated environmental approval process.
- Funding - A major source of funding would be required to implement a regional system. This would likely involve a federal or state funding mandate to fund the operation of the system or a plan to construct the system incrementally as participation increases. This is likely the biggest challenge to the formation of a regional system.

8.7 SUMMARY OF FINDINGS

8.7.1 Saco River and Sebago Lake are Primary Sources of Supply for Southern Maine

The Saco River and Sebago Lake are and will continue to be the primary sources of supply in southern Maine far into the future. These supplies are valuable and should be protected and preserved as future water supplies for the region. When and if a regional water supply system becomes a reality, the type of ownership model selected by the SMRWC membership will drive the location, configuration and size of potential treatment works and transmission mains.

A conceptual regional water supply plan which encompasses the findings presented above is presented on Figure 8-2. Treatment of the supply(s) would be located along the Saco River at a logical intersect of a transmission system north to serve the Greater Portland area, and south to the New Hampshire boarder. The primary transmission network for a regional system will likely be constructed along one of several existing utility and transportation corridors identified in this report. Pumping and storage facilities would be located at key hydraulic points as determined in a subsequent hydraulic analysis. And finally, metering locations would be located a logical points of intersection with each utility. Further details regarding specific assets follows.

- Regional Water Treatment Facility at the Saco River - A new 100-120 MGD regional water treatment facility could be constructed at the Saco River to meet the projected needs of the entire region. Utilities located to the south of the treatment facility would be supplied water from the Saco River, while the Portland Water District would retain Sebago Lake as their primary source of supply. The exact size of a regional treatment facility would be determined in part based on final withdrawal permitting, further safe yield studies, hydraulic considerations of major pipelines and other factors.
- Regional Water Transmission System - A new large diameter transmission network would be constructed north and south of the regional treatment supply at the Saco River as described above. In addition, east/west transmission laterals would be constructed to supply the western utilities. The primary water transmission system would extend south from the new water treatment facility at the Saco River along existing corridors. The supply pipeline would interconnect to local distribution systems at logical points within each system. Transmission to the north would allow for the exchange of water to the Portland Water District Service area as needed using existing electric transmission or state highway corridors. A series of smaller supply transmission mains would be extended along east-west highways to interconnect the Sanford and South Berwick Water Districts. Selection of the preferred corridors, sizing of the transmission system, need for pumping and other hydraulic factors will require further study
- Local Distribution and Metering - Under a regionalization plan, the local utilities would maintain control over their systems and connect to the supply transmission system through individual metering interconnection points.
- Retain and Modernize the Sebago Lake Water Treatment - The existing water treatment facility and transmission system should be retained and modernized as needed to meet

both PWD's needs and as a primary regional water supply. Any upgrades of the facility should be made in consideration of regional supply needs and this facilities necessity to serve as a supplemental/redundant source.

8.7.2 Protection of the Saco River and Sebago Lake Supplies is Essential

The Saco River and Sebago Lake are valuable as regional water supplies beyond the value both resources provide to their respective utilities and customers. The SMRWC should establish a role in the organization for advocacy and protection of these resources in the future and through FERC licensing procedures and other actions taken at the state and federal level. The SMRWC should establish itself as a formal stakeholder with these agencies to assure regional water supply needs and rights are retained. Examples of this include:

- <u>Saco River and Presumpscot River FERC Licensing Proceedings</u> - The SMRWC should register as a formal stakeholder during all National Environmental Policy Act (NEPA) actions to relicense any hydroelectric facility on the Saco River and Sebago Lake in order that regional interests in water quantity and quality are preserved.
- <u>Saco River Corridor Commission</u> - The SMRWC should register as a formal stakeholder with the Saco River Corridor Commission to comment on any development within the river valley that may compromise water quality in the region.

8.7.3 Drivers for a Regional Water Supply System

Each utility appears well positioned to meet the needs within their own system for the immediate future. Changes to the population and demand projections, economic development, future environmental restrictions regulating the use of ground and surface water, deregulation of the water industry, regulatory issues, and changes in the climate and hydrological cycle could change the timing for regionalization.

8.7.4 Localized Water Supply Sub-Systems

Smaller local supply sub-systems have already begun forming in southern Maine. This trend is likely to continue in support of emergency and mutual aid needs. Upgrades required to facilitate implementation of local sub-systems should be made in consideration of a future regional supply system.

8.7.5 Potential Transmission Corridors

There are numerous utility and transportation corridors throughout southern Maine that have been identified as potential routes for a regional water transmission system. As individual systems continue to invest in infrastructure and if the SMRWC decides to pursue a regional model, membership should become active in seeking access for construction of transmission infrastructure through these corridors.

8.7.6 Asset Ownership Model

Two distinct asset ownership models have been presented for consideration. The regional water authority model would place ownership of the supply and primary infrastructure under the control of an autonomous governing body. The authority would be responsible for the management of the supply and transmission of wholesale water throughout the region. Local assets would remain under local control. A second model would transfer assets current under local control to a new governing body that would also be responsible for the supply and transmission system. This organization would operate similar to existing water Districts only on a grander scale.

8.8 RECOMMENDATIONS

8.8.1 Safe Yield Studies of Sebago Lake and the Saco River

It is recommended that the SMRWC conduct detailed safe yield analyses of both the Saco River and Sebago Lake basin to quantify the supply capacity of these sources. Safe yield studies have not been conducted on either water resource. A rigorous analysis should consider the following factors:

- Potential minimum river flows in the Saco River.
- Potential operational scenarios on Sebago Lake.
- Scenarios for various water withdrawal limitations.
- Other potential environmental factors to protect water quality.
- Flood mitigation.
- Potential operations scenarios for the Eel Weir facility.

8.8.2 Hydraulic Study of Portland Water District Transmission System

It is recommended that the Portland Water District consider regionalization as part of any planned upgrade to the supply transmission system from the Sebago Lake Water Treatment Facility. This would involve evaluating flow scenarios of the transmission system between the treatment facility and the potential point of interconnection to a regional transmission system along the Saco River to accommodate regional flow needs.

8.8.3 Establish Rights in Primary Transmission Corridors

The SMRWC should investigate and establish its rights within major utility and transportation corridors identified in this report. These efforts can be done through formal consultation, representation during hearings and public meetings and advocacy with the specific agencies as a stakeholder.

As an example, Central Maine Power recently proposed expansion of their 345 KVA transmission line through southern Maine. This process presents a good opportunity for SMRWC membership to identify and reserve rights of access in the future.

8.8.4 Hydraulic Study of the Proposed Transmission System South of the Saco River

A more detailed hydraulic study should be undertaken at some point in the future to refine the conceptual plans presented in this initial study. The cost and location of key facilities should be confirmed and property protection requirements identified to allow the SMRWC to explore opportunities for siting key facilities associated with a regional supply system.

8.8.5 Consider Regional Hydraulic Needs in Local Treatment Facility Upgrades

The SMRWC should establish an internal working group whose purpose is to coordinate local planned supply improvements with the goal and objectives of a regional water supply system. This would be accomplished through the exchange of local master plans, capital planning projects, annual water main improvements and other projects that may have value as regional facilities in the future. One meeting per year should be dedicated to exchange of this information for internal cross-referencing with the findings and recommendations of this report.

Projects which may be of interest to the SMRWC include:

- <u>Transmission Mains</u> - Large diameter transmission mains in US Route 1 or extensions to primary east-west corridors identified in this study.
- <u>Planned Water Treatment Upgrades</u> - The Kittery and Biddeford & Saco Water Treatment facilities are the oldest facilities in the region. The PWD Water Treatment facility will be upgraded to comply with the proposed Long-Term 2 Enhanced Surface Water Treatment Rule. All SMRWC members shall establish an internal procedure such that the size and capacity of any upgrades to these facilities can consider the impact of regionalization.
- <u>Projects in Identified Roadway Corridors</u> - Large diameter main renewals in any major corridor identified in this study should be identified for discussion.

8.8.6 Consider Legislation Establishing the Saco River and Sebago Lake as Regional Water Supplies

The SMRWC should consider introducing legislation to identify and establish the Saco River and Sebago Lake as sources of supply of regional significance for drinking water in the future.

8.8.7 Consider Establishment of a Sub-committee to Interface with New Hampshire Water Supply Stakeholders

The seacoast region of New Hampshire has had regional supply deficit that has been a concern and unresolved for decades. A possible outcome of a regional water supply system for southern Maine is the extension of the system to New Hampshire seacoast border communities. This concept could fund portions of the regional distribution infrastructure and be a driver towards formation of a regional water supply entity. The SMRWC should consider establishing a committee to initiate discussions in the State of New Hampshire and determine if cooperation can become a driver to begin a regionalization plan in southern Maine.

8.8.8 Establish a Liaison with the State of Maine Legislature and the Governors Office

The SMRWC should establish a liaison or contract with a communications firm that can provide advice and consultation on regional planning and development initiatives with State government. Primary contacts could be the State of Maine Planning Office, Maine Department of Transportation or other key legislative committees and subcommittees to assure that major project developments and funding are communicated directly to the SMRWC membership.

SECTION 9

FINDINGS AND RECOMMENDATIONS

9.1 GENERAL

The Southern Maine Regional Water Council (SMRWC) was formed to promote regional cooperation between member utilities, to improve customer service and to lower the cost of water for the customer base served by water systems in southern Maine. The southern Maine region is typical of much of coastal New England, experiencing population and development growth in areas with limited sources of public water supply. These conditions are causing utilities to seek new ways to improve efficiency within their individual water systems and within the region.

The purpose of this study was to conduct a general evaluation of each system, assess the capacity of each water supply and determine regional water needs over the next 40-50 years. One of the possible outcomes of this analysis is the acknowledgment that a regional water system may one day be the best and most efficient means to provide reliable water service to existing and future customers. Yet at the same time, it is the expressed desire of the SMRWC membership to maintain the individual integrity of each utility while seeking cooperation with neighboring utilities when required or essential.

This Section of the report summarizes the findings and recommendations derived from this study.

9.2 REGIONAL WATER SUPPLY ASSESSMENT

Several economic and environmental drivers were identified in the study that could drive regionalization in southern Maine:

- Major shifts in population demographics in the region.

- Future limitations of water withdrawal from major surface supplies.
- Horizon issues in treatment that force supply consolidation.
- Climate change.
- Major economic development initiatives.
- Stricter regulation of private water supply.

Creation of a water supply authority that controls the regions major sources of supply and transmission assets could be created. The following findings and recommendations were developed should one of these drivers push the region towards more formal cooperation as a regional water supply.

9.2.1 Current and Projected Water Supply Needs of the Southern Maine Region

- The 2006 residential population within the service area of the SMRWC membership is estimated to be approximately 329,000 persons of whom approximately 75% or 248,435 persons are estimated to be served by a public water system. The population within the service area is projected to increase to 425,000 persons by 2050 of which 75% or 318,750 persons are projected to be served.
- The composite average-daily demand for the SMRWC utilities members is projected to grow from approximately 38 MGD in 2007 to 61 MGD in 2050 (13,870 MG/year to 22,300 MG/year).
- The composite maximum-daily demand in the region for the SMRWC utilities members is projected to grow from approximately 63 MGD in 2007 to 95 MGD in 2050 (23,000 MG/year to 34,700 MG/year).

9.2.2 Water Supply Adequacy in the Southern Maine Region

- The combined sources of supply for the SMRWC membership, in aggregate, can meet the regions projected needs for public water in the immediate future.
- The Saco River and Sebago Lake are the only sources in southern Maine with sufficient capacity to meet all the combined projected water needs in the region.

- The total available safe yield of the existing sources of supply in the SMRWC service area is estimated to be approximately 1,118 MGD in a severe drought period (the drought of record for the region is that which occurred during 1963-1967).
- The existing infrastructure (piping, tanks, pumps, etc.) limits the ability to exploit the full capacity of the water supply resources in the region.
- Large main stem river systems such as the Saco River, and large lakes such as Sebago Lake, are best positioned to leverage the surplus yield as water withdrawal restrictions in the State of Maine are phased in over the next 2-3 years.

9.2.3 Regional Water Supplies

- The Saco River and Sebago Lake are the only sources of supply with sufficient capacity and water quality to meet the demands of the entire southern Maine region.
- The Saco River has surplus quantity, good water quality and yield and excellent watershed protection measures in place to serve as a regional supply.
- Sebago Lake has pristine water quality and moderate surplus yield beyond the projected needs of the Portland Water District to support the region as a regional supply.
- Other potential new sources of supply in the region, including the Salmon Falls River, the Mousam River and desalination of seawater were screened as potential regional water supplies. All of these sources were found to be deficient in quantity and quality to be viable as regional sources of supply.

9.2.4 Conceptual Design of a Regional Water System

- A conceptual regional supply and transmission system was developed for southern Maine to integrate the Saco River and Sebago Lake supplies.
- The conceptual design includes a major treatment facility on the Saco River, a large diameter north-south transmission main through the region and a secondary transmission system between the Portland Water District transmission system and the Saco River treatment facility.
- The conceptual design would integrate the Sebago Lake supply and treatment facility and Saco River supply and treatment facility through a series of major transmission pipelines.

- Electric transmission, natural gas, state and federal highways and railway transportation corridors in southern Maine were screened and evaluated for possible siting of primary transmission pipelines in the future.

9.2.5 Conceptual Governance Models for a Regional Water System

- Two ownership models were screened and evaluated for management of regional water systems assets; (1) Regional Water Supply Authority and (2) an integrated Regional Water Utility.
- The regional water supply authority model would own major treatment and distribution assets and wholesale water to local utilities which would distribute, supplement and serve retail customers in the region.
- The integrated regional water utility model would consolidate all the regions assets into a single water utility responsible for distribution, supply and retail delivery to customers.
- A regional water supply authority model was found to be more favorable for the region.

9.2.6 Recommended Actions and Additional Information Needs

- Rigorous safe yield studies of the Saco River and Sebago Lake basin have never been conducted under current regulatory and operational constraints. Safe yield studies of these two critical supplies are recommended.
- A hydraulic study of the Portland Water District transmission system should be conducted relative to possible use of a portion of the system to transmit flows to the southern Maine region in the future.
- The SMRWC should establish internal protocols to cross check planned infrastructure projects each year within each utility to coordinate regionalization enhancements as part of each local capital improvement project.

9.2.6.1 Establish Methodology for Reserve Capacity for Sebago Lake and Saco River Treatment Facilities

- Consider establishing a formula for reserving treatment capacity at local treatment facilities. For regional purposes, this would include the Biddeford & Saco Water

Company facility at the Saco River and the Portland Water Districts Sebago Lake Treatment Facility. Sub-systems should consider similar measures as an interim step to regionalization. These include the Kittery and York treatment facilities.

- Consider establishing a regional wholesale pricing model based on emergency and mutual-aid.

9.2.7 Regional Planning Initiatives and Efforts

9.2.7.1 Consider Expansion of the SMRWC to New Members

The SMRWC may want to consider expansion of its charter to include new membership. Increasing membership may provide additional opportunities for leveraging the regions buying power. Potential partners include:

- Yarmouth Water District - The Yarmouth Water District maintains two points of interconnection with the Portland Water District in Yarmouth and North Yarmouth.
- Brunswick-Topsham Water District - Maintains an interconnection with the Bath Water District and by extension the Wiscasset Water District. Closing a small gap in the distribution systems in Freeport could allow continuous exchange of water north to Wiscasset from the Portland Water District.
- South Freeport Water District - The South Freeport Water District is connected to the Yarmouth Water District on US Route 1.
- Alfred Water District, North Berwick Water District, Town of Berwick - These three small water utilities in York county have critical infrastructure that could be important along primary corridors in southern Maine.
- Coastal New Hampshire - Coastal New Hampshire communities have struggled with supply issues for decades. The issue is still unresolved. If deemed viable, these communities could participate in the council.

9.2.7.2 Continue Leveraging SMWRC and Seek Additional Opportunities for Regionalization and Study Grants

The SMRWC should continue to track and seek grant funding to further the regions water supply knowledge including funding investigations identified in this study. Potential examples of funding may include:

- State grants focusing on non-point pollution to protect water quality.
- Transportation Funds which may require a National Environmental Policy Act (NEPA) review to balance project specific and future environmental impacts. An example might include and environmental impact statement (EIS) that may be required for the proposed electrical transmission corridor upgrade proposed for southern Maine.
- EPA Regionalization Grants.
- Funding from states in southern New England that may desire water supply from Maine in the future.
- Economic Development funds from specific projects or state initiatives.

9.2.8 Establish SMRWC as a Stakeholder and Constituent in Critical Organizations

- Consider establishing the SMRWC as a formal stakeholder group with the Saco River Corridor Commission to represent the value of the Saco River as a regional water supply in the future.
- The SMRWC should establish its rights as an entity and stakeholder with all the primary transmission corridor owners (ex., Central Maine Power, Guilford Transportation, etc.) in the region. These efforts should also consider a hydraulic evaluation of the priority corridors to understand relative value of each location for future use as a water transmission corridor.
- Consider establishing SMRWC with formal intervener status with FERC hydropower relicensing for hydroelectric projects on the Saco River and for the Eel Weir Hydroelectric Facility at Sebago Lake to protect the value of the two supplies as regional water supplies.

- Consider establishing the SMRWC as a formal stakeholder with the Maine DEP regarding wastewater discharges and permit applications on the Saco River and Sebago Lake drainage basins.
- The SMRWC should consider establishing a communication protocol directly with the State of Maine Planning Office, which is situated in the executive branch of state government, to track regional planning initiatives of importance in southern Maine. A communication plan will assure that SMRWC is kept abreast of regional developments in southern Maine that may have large-scale impacts on public water supply.
- The SMRWC should consider establishing a working sub-committee to facilitate discussion on water supply with southern New Hampshire communities.

9.2.9 Consider Introducing Legislation Designating the Sebago Lake and Saco River as Sources of Water Having Regional Significance as Drinking Water Supplies

The SMRWC should consider introducing legislation that would formally designate the Sebago Lake Basin and the Saco River as sources of drinking water supply of regional significance. Such a designation will establish a formal level of importance with the many constituencies in southern Maine and throughout the State.

9.2.10 Monitor Future Regulations and Rulemaking

The SMRWC should be represented formally as an organization for any rulemaking regarding the following:

- State of Maine Groundwater Withdrawal rulemaking.
- State of Maine Surface Water Withdrawal Regulations Development (Chapter 587).
- Public Utilities Commission regulation.
- Special designation, rulemaking or legislation regarding the Saco River or Sebago Lake.
- USEPA regulations-negotiation process for candidate contaminants.

9.2.11 Monitor Regional Planning and Growth Initiatives

The SMRWC should establish a formal subcommittee or designee to interface with the following agencies regarding local and regional planning studies and initiatives:

- Greater Portland Council of Governments
- Southern Maine Regional Planning Commission
- State of Maine Executive Branch Special Task Forces
- State of Maine Planning Office
- Local municipal planning Offices

9.2.12 Conduct Workshops in Each Service Community to Present Concepts of Water Service Expansion in Identified Corridors

As a consequence of this study, workshops and public informational meetings in each of the SMRWC service communities to present the findings and concepts developed in this study would be logical next step. These workshops can be structured to help the SMRWC establish the Saco River and Sebago Lake as regional supplies of significance to be included in local comprehensive plans and planning documents.

9.3 INDIVIDUAL UTILITY WATER SUPPLY ASSESSMENT

An assessment of existing supply sources was conducted to determine if sufficient capacity is present to meet current and projected water needs within each utility. The supply was also aggregated and assessed on a regional basis as previously discussed. In addition to existing supply sources, other potential sources of supply were screened to supplement any projected deficit in the southern Maine region.

The adequacy of each local supply was determined based on current population and demand trends, and projections of population and water need.

The following details specific findings and recommendations from this effort.

9.3.1 Current and Projected Water Supply Needs of SMRWC Utilities

Supply is projected to be adequate in each utility's service territory to meet current and near-term projected demands. However, several individual supplies are/will become stressed. Regionalization will continue to become important over time. Demand and supply statistics and projections specific to each utility are presented as follows:

- *Biddeford & Saco Water Company (BSWC)* - Average-day demands in the BSWC service area are projected to increase from 5.72 MGD in 2006 to 6.95 MGD by the year 2050. Maximum-day demands are projected to increase from 10.51 MGD in 2006 to 12.78 MGD in 2050.
- *Kennebunk-Kennebunkport-Wells Water District (KKW)* - Average-day demands in the KKW are projected to increase from 2.83 MGD in 2006 to 4.00 MGD by the year 2050. Maximum-day demands are projected to increase from 6.35 MGD in 2006 to 8.95 MGD in 2050.
- *Kittery Water District (KWD)* - Average-day demands in the KWD are projected to increase from 2.62 MGD in 2006 to 3.16 MGD by the year 2050. Maximum-day demands are projected to increase from 4.42 MGD in 2006 to 5.34 MGD in 2050.
- *Portland Water District (PWD)* - Average-day demands in the PWD are projected to increase from 23.45 MGD in 2006 to 42.00 MGD by the year 2050. Maximum-day demands are projected to increase from 36.04 MGD in 2006 to 60.90 MGD in 2050.
- *Sanford Water District (SWD)* - Average-day demands in the SWD are projected to increase from 2.50 MGD in 2006 to 2.80 MGD by the year 2050. Maximum-day demands are projected to increase from 3.13 MGD in 2006 to 3.46 MGD in 2050.
- *South Berwick Water District (SBWD)* - Average-day demands in the SBWD are projected to increase from 0.26 MGD in 2006 to 0.39 MGD by the year 2050. Maximum-day demands are projected to increase from 0.40 MGD in 2006 to 0.60 MGD in 2050.

- *York Water District (YWD)* - Average-day demands in the YWD are projected to increase from 1.00 MGD in 2006 to 1.33 MGD by the year 2050. Maximum-day demands are projected to increase from 2.46 MGD in 2006 to 3.27 MGD in 2050.

9.3.2 Findings and Recommendations for Enhanced Cooperation Between SMRWC Members

The existing SMRWC members cooperate and share water under various mutual aid agreements. The following recommendations are made to reduce each water system's vulnerabilities and to improve mutual-aid during emergencies.

9.3.2.1 Biddeford & Saco Water Company

- The critical vulnerability in the BSWC system would be loss of the Saco River supply from contamination or other catastrophic event. A contamination event for a large river system such as the Saco River is likely to be transient and of short duration however. None-the-less, water service could be interrupted. And, because of the anticipated transient nature of this type of emergency, emergency planning on an average-day basis makes the most sense for the BSWC.
- Cooperation from the KKW Water District and the Portland Water District is essential to maintain service during emergency conditions. Transmission system improvements are required to insure that the maximum benefit can be realized:
    - Addition of a new booster pumping station and storage to provide flows from the KKW transmission system to the BSWC distribution system is recommended. A new booster pumping station is needed to prevent low pressure and flow restrictions in the KKW transmission system.
    - Construction of an interconnection to the PWD distribution system along US Route 1 or Pine Point Road in Scarborough would provide needed supply redundancy.
    - Improvements or upgrades to the BSWC water treatment facility at the Saco River are anticipated at some point in the future because of the age of the facility. Any

upgrades to this facility should consider a mechanism for "Reserve Treatment Capacity" for future regional supply considerations. A methodology and costing scenario should be developed by the SMRWC membership if a decision by the BSWC is made to upgrade this critical treatment facility.

9.3.2.2 Kennebunk, Kennebunkport & Wells Water District

- The critical vulnerability in the KKW Water District would be loss of the Branch Brook supply during the peak summer demand months due to a contamination or catastrophic event. Cooperation from the YWD and the BSWC is essential to maintain service during an emergency event. However, under existing conditions, it is unlikely that the YWD can offer substantial assistance to the KKW other than limited areas in Ogunquit and Wells without large scale investment in distribution system infrastructure in the KKW system and expansion of York's water supply capacity. Similarly, while the existing infrastructure is hydraulically capable of transmitting up to 7.0 MGD from the BSWC system, the existing Arundel Booster Pumping Station is limited to a maximum flow of about 2.6 MGD.
- Construction of a new booster pumping station and storage along US Route 1 could provide emergency flows of up to 3 MGD to the BSWC system.
- Upgrading the Arundel Booster Pumping Station to reverse flows from the KKW distribution system into the BSWC system is not possible under existing conditions because of low service pressures in this area of the KKW transmission system. Improvements to pumping and storage along the US Route 1 transmission system near the Arundel Town line are needed to provide flow capacity to the BSWC. A plan detailing recommended improvements to interconnect the KKW and BSWC systems at this location is detailed in earlier Sections of this Report. As an alternative, KKW and the BSWC could consider realignment of the service area along Route 1 to transfer ownership to the BSWC which is better positioned to provide service in this area.
- A mechanism for funding the required improvements between the KKW and the BSWC must be established to fund needed improvements.

9.3.2.3 Kittery Water District

- The critical vulnerability in the Kittery Water District would be loss of the Boulter Pond/Bell Marsh branch of the Kittery Reservoir system during the summer months from a contamination or catastrophic event. This type of event would reduce the safe yield of the reservoirs to 1.2 MGD. Cooperation from the York Water District and the BSWC through KKW is essential to maintain service during an emergency event. The existing interconnection with the York Water District can provide 2.0 MGD by agreement which would meet the needs of Kittery on an average-day basis in the summer months.
- It is unlikely that the York Water District alone could provide sustained flows to the Kittery Water District during summer months without having flows wheeled through the York and KKW distribution systems because of demand needs in each of these systems during the critical summer period. Additional improvements to the Arundel Booster Pumping Station would be required so surplus water supply from the BSWC (Saco River) can be wheeled through the KKW and York distribution system into Kittery during a summer supply emergency scenario.
- Improvements or upgrades to the Kittery water treatment facility are anticipated at some point in the future because of the age of the facility. Any upgrades to this facility should consider a mechanism for "Reserve Treatment Capacity" for cooperation with the York Water District and for regional supply needs. A methodology and costing scenario should be developed by the SMRWC membership if a decision by the BSWC is made to upgrade this critical treatment facility.

9.3.2.4 Portland Water District

- The Portland Water District is presently evaluating its system-wide vulnerabilities. An interconnection with the BSWC along US Route 1 or Pine Point Road in the Scarborough area would provide emergency flows and reduce vulnerabilities in this area of the PWD distribution system.

- The following improvements in the PWD distribution system would allow a flow of up to 4.0 MGD to be introduced into the PWD system from the BSWC at this location without large increases in service pressure:
    - Replace 4,200 lineal feet of 8 and 12-inch mains between the terminus of the distribution system and Broadturn Road with 20-inch mains.
    - Flows above 4.0 MGD would require substantial main upgrades along US Route 1 to Gorham Road.
- A booster pumping station would be required between the BSWC and PWD systems to raise the hydraulic gradeline from the BSWC system (El. 206 feet) to the PWD system (El. 267 feet) if an interconnection is pursued at this location.
- The following improvements in the BSWC distribution system would allow a flow of up to 4.0 MGD to be pumped from the BSWC at this location without large decreases in service pressure from limited main sizes in the area:
    - Replace the existing 16-inch main from the end of Cascade Road to US Route 1 with a 20-inch main (approximately 650 feet).
    - Replace the existing 8-inch main along US Route 1 to the point of interconnection with a 20-inch replacement main (approximately 8,000 feet).
    - Improvements or upgrades to the Portland Water District Sebago Lake water treatment facility are anticipated at some point in the future for upgrades and expanded capacity to serve its own needs. Any upgrades to this facility should consider a mechanism for "Reserve Treatment Capacity" for future regional supply considerations. A methodology and costing scenario should be developed by the SMRWC membership if a decision by the PWD is made to upgrade this critical treatment facility.

9.3.2.5 Sanford Water District

- The Sanford Water District has adequate supply capacity to meets it's projected needs through the year 2050 with the loss of any one of its key well supplies from an unplanned mechanical failure, contamination or other catastrophic event.

- The groundwater supplies in Sanford are well dispersed and located in distinctly different zones of groundwater influence. Prudent vulnerability planning would suggest that an unforeseen groundwater contamination would result in loss of one of the SWD's well supplies.
- The SWD is not interconnected with other SMRWC utilities at this juncture and cooperation in the near future is not needed to meet demands or mutual aid needs.
- The District should continue its present practice of identifying and securing groundwater resources in the service area as dictated by needs within the SWD service territory.

9.3.2.6 South Berwick Water District

- Similar to the Sanford Water District, the South Berwick Water District has adequate supply capacity to meets its projected needs through the year 2050 with the loss of any one of its key well supplies from an unplanned mechanical failure, local or regional power failure contamination or other catastrophic event.
- The groundwater supplies in South Berwick are dispersed and located in four distinctly different zones of groundwater influence. Prudent vulnerability planning would suggest that an unforeseen groundwater contamination would result in loss of one of the SBWD's well supplies.
- Additional groundwater supplies should be protected and developed as demands increase and development occurs along the US Route 4 corridor.

9.3.2.7 York Water District

- The critical vulnerability in the York Water District would be loss of the Chase's Pond supply during the summer months from a contamination or other catastrophic event.
- The projected water supply needs in the York Water District during the critical summer demand period is projected to increase to 3.27 MGD during peak summer usage. Present interconnections with the Kittery Water District and KKW Water District can meet this need under current hydraulic conditions and in accordance with current mutual aid agreements. The Kittery interconnection can provide 2.0 MGD by agreement and the

KKW Water District can provide 2.5 MGD by agreement. Additional improvements within the KKW and Kittery distribution systems have been identified to optimize these existing interconnections.

- The York Water District distribution system has the hydraulic capacity to receive up to 3.0 MGD from the Kittery Water District and 3.0 MGD from the KKW Water District if piping improvements are made in both the KKW and Kittery distribution systems for emergency needs. Higher flows would require upgrades to the York and KKW booster pumping stations at this interconnection location.
- It is unlikely that the KKW Water District could provide sustained flows to the York Water District during summer months without additional improvements to the Arundel Booster Pumping Station as noted above. These improvements are needed so surplus water supply from the BSWC can be wheeled through the KKW distribution system into York during this emergency scenario in the summer months.
- Improvements or upgrades to the York water treatment facility are anticipated at some point in the future for upgrades and expanded capacity to serve its own needs. Any upgrades to this facility should consider a mechanism for "Reserve Treatment Capacity" for future regional supply considerations and cooperation with the KWD and KKW. A methodology and costing scenario should be developed by the SMRWC membership if a decision by the YWD is made to upgrade this critical treatment facility.

9.3.3 Service Plans for Primary Arterials and Highway Corridors

Extension of public water service along primary highways and growth corridors identified and studied in Southern Maine may occur in response to specific or regional development initiatives. In addition to mutual aid, regional cooperation in Southern Maine is likely to begin incrementally in this manner. Specific projects concept plans for these corridors are described below.

9.3.3.1 US Route 236 Highway Corridor - Eliot to South Berwick

- The US Route 236 corridor is a potential development and transportation corridor identified by regional planners.
- This location provides a logical point of cooperation in the future between the SBWD and the KWD.
- The KWD is the logical utility to supply flows to this corridor because of projected surplus supply capacity for the KWD in the future. The KWD can provide a flow of about 1.0 MGD from its distribution system in this location if an interconnection between the two utilities is pursued in the future.
- A conceptual service plan has been developed for this corridor which would be configured as follows:
    - Addition of a booster pumping station to elevate the hydraulic gradeline from the KWD gradeline (El. 189 feet) to the SBWD gradeline (El. 298 feet) near the Eliot-South Berwick town line.
    - Adequate service in the Town of Eliot east of the booster station can be provided by the KWD hydraulic gradeline.
    - Distribution storage facilities are likely needed along the interconnection pipeline route depending on land-use zoning, fire flow requirements and specific development needs.
    - A detailed hydraulic analysis should be undertaken before service is extended from either utility along US Route 236.
    - A service plan for this potential interconnection is included in the report.

9.3.3.2 US Route 91 - York to South Berwick

- Development along US Route 91 is being discouraged by local planners despite the highways potential value to interconnect the KWD and SDWD distribution systems.
- The topography along this potential interconnection would make provisions for water service challenging.
- The service plan would include a booster pumping station and creation of a high service zone at a gradeline of El. 330 feet between the two distribution systems.
- A service plan for this corridor is included in the report.

9.3.3.3 US Route 4 Corridor

- The US Route 4 corridor has been identified as a development zone within the town of Berwick portion of the South Berwick service territory.
- The South Berwick, North Berwick and Sanford Water Districts have similar water qualities. In addition, the three distribution systems are closer in proximity than the Kittery, KKW or York Water District distribution systems along the Maine coast, located primarily east of Interstate 95 making cooperation along the US Route 4 corridor more practical and technically feasible.
- Further cooperation along the US Route 4 corridor will require inclusion of the North Berwick Water District as a partner in the SMRWC.
- Existing cooperation for emergency or mutual aid purposes is not needed to satisfy vulnerabilities of these three cooperating utilities. Mutual cooperation along this corridor will be a result of serving development needs.
- Interconnection between the North Berwick Water District and the Sanford Water District would require a booster pumping station to transfer flows from the NBWD to the SWD. A pressure reducing valve is required to transfer flows from the SWD (hydraulic gradeline - El 514 feet) to the NBWD (hydraulic gradeline - El. 297 feet).

9.3.3.4 US Route 99 and US Route 109 Corridor

- The US Route 109 highway corridor is being studied for improvement as a transportation corridor between the Maine coast and the Town of Sanford. This route serves as a potential interconnection route between the KKW and Sanford Water Districts.
- The US Route 99 corridor would require approximately 5.5 miles of water mains to interconnect the KKW and Sanford Water Districts. The US Route 109 corridor would require approximately 7.5 miles of water mains to interconnect the two distribution systems. Both projects provide no mutual aid benefits to the utilities but provide an opportunity to extend service to future development along this route if requested.
- Blending of the KKW and Sanford Water District supplies would be difficult and would require reconsideration of disinfection and corrosion controls strategies in both water systems.
- A booster pumping station would be required to raise the hydraulic gradeline from El. 265 feet in the KKW system to El. 514 feet in the Sanford distribution system.
- Exchange of flows ranging from 1.0 - 1.5 MGD between the KKW and SWD systems will not create large increases or decreases in pressure in either system.
- The interconnection would exacerbate somewhat high static pressures in south Sanford. Addition of a new storage tank in this area of the distribution system would reduce pressure increases in Sanford if either water main route was constructed.

9.4 OTHER RECOMMENDATIONS

9.4.1 Establish New Areas for Mutual Cooperation (non-technical)

9.4.1.1 Shared Staffing and Services

- Consider a more developing a more robust system of sharing qualified staff and operators to meet staffing needs.
- Consider a more integrated model for sharing on-call services for weekend coverage and other overtime or special situations.

- Consider joint agreements for acquiring services for watershed surveillence, land and forest management to reduce labor costs and for professional services to oversee these critical components of the system.
- Consider joint agreements for professional and specialized services (legal, engineering, financial, laboratory services, testing, surveying, rate analysis, etc.).

9.4.1.2 GIS Cooperation

- Consider leveraging existing GIS and mapping efforts through shared resources such as GIS staff for the upkeep and enhancement of systems.
- Consider acquiring specialized equipment for sharing between member systems including GPS equipment.

9.4.1.3 SCADA Cooperation

- Consider use of a common regional system integrator for SCADA programming and maintenance.
- Consider hiring an internal SCADA resource that is shared between SMRWC utilities
- Consider a central monitoring entity and SCADA node for system surveillance and mutual support.
- Consider leverage buying power and purchasing software licenses as a group including report generation software, SCADA software and other intellectual property.

9.4.1.4 Integrated Emergency Response Planning

- Consider shared purchase and use of portable generators for smaller electrical loads such as booster pumping stations which may not warrant investment of permanent equipment at specific locations.
- Consider centralized dispatching and coordination with York EMA during emergency declarations.

9.4.1.5 Additional Equipment Standardization

- Identify areas where materials can be standardized to leverage buying power (valves, piping, other).
- Consider more integrated Asset Management and inventory planning including:
    - Laboratory equipment and certification.
    - Instrumentation and controls.
    - Valve exercising equipment.
    - Meter standardization and testing.

WRIGHT-PIERCE
Engineering a Better Environment

Biddeford & Saco Water Company

Sanford Water District

Kennebunk, Kennebunkport and Wells Water District
Serving coastal York County since 1895

South Berwick Water District

Kittery Water District
Incorporated 1907

York Water District
York, Maine

Portland Water District
Portland, Maine