FINAL REPORT

Water System Capital Improvement Plan Update

Prepared for:
Groveland Water and Sewer Department
Groveland, Massachusetts

August 2015

Environmental Partners GROUP
A partnership for engineering solutions

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. INTRODUCTION

The Town of Groveland Water and Sewer Department (GWSD) received a grant from the Massachusetts Department of Environmental Protection (MassDEP) to create a Capital Improvement Plan (CIP) in 2011. The 2011 CIP was focused on the distribution and water main replacement needs of the water system and also additional improvements relative to supply, storage and operations. This report serves as an update to the 2011 CIP based on completion of several capital improvement projects within the last 5 years and also provides updated costs and schedules for the GWSD.

1.1 2011 Capital Improvement Plan

The 2011 CIP was developed in accordance with the specific MassDEP grant requirements. In general, the requirements seek to ensure that public health requirements will be met over a 20-year time horizon by improving efficient delivery of drinking water, developing an accurate assessment of the funding required to implement improvements and establishing an annual investment amount into the budget process for performing capital improvements.

In accordance with MassDEP's scope for CIP preparation, the 2011 report created an inventory of the distribution system water mains and prioritized their replacement based on the asset characteristics discussed herein. The water main replacement program was combined with other capital projects identified by the GWSD to create a 5-year capital outlay program as well as a 20-year improvement plan.

1.2 Existing Water System

The original water system was constructed in 1925 and consisted of water supply from the City of Haverhill serving the Center Street and Main Street areas. The Town's Water and Sewer Department was established in 1965 in order to develop their own municipally-owned supply. Currently, there are 1,954 services connected to the system that distributes water to approximately 6,355 people. The water system includes the following:

- Three gravel packed wells
- Two water storage tanks
- One booster pump station
- Approximately 36.5 miles of water mains ranging in size from 4-inch to 12-inch

Supply Facilities - The Groveland water system supply consists of three active groundwater supplies. Each day, approximately 400,000 gallons of water are pumped from the three wells. Design parameters and physical properties of the wells are included in Table 1-1.

Table 1-1 Well Characteristics For Active Sources of Supply

Supply Facility	Year Constructed	Well Dimensions		Well Yield	
		Well Size (inches)	Depth (feet)	Safe Yield (gpm)	Typical Pumping Rate (gpm)
Well No. 1	1965	16x24	85	400[1]	400
Well No. 3	1979	36x24	57	500	400
Well No. 4	1997	12x18	45	215	200

1. Original yield of 600 gpm reduced to 400 gpm by MassDEP due to Contamination of Aquifer

Treatment - Raw water from the three wells is treated with sodium hydroxide for corrosion control, sodium fluoride for fluoridation, and calcium hypochlorite for disinfection before entering the distribution system.

Storage Facilities - Distribution storage is split between the 2-million gallon Perry Hill storage tank located off King Street and the 0.8 million gallon Town Forest Storage Tank located off Wood Street. The Perry Hill tank is a welded steel tank and the Town Forest tank is a pre-stressed concrete tank.

Table 1-2 Distribution Storage Facilities

Name	Nominal Volume (MG)	Year Installed	Diameter (ft)	Base Elevation (ft)	Overflow Elevation (ft)	Water Depth (ft)
Perry Hill Standpipe	2.0	1967	88	231	279	48
Town Forest Standpipe	0.8	2012	47	246	310	64

Booster Station - The town has two service zones, the Low Service Zone (east of King Street) and High Service Zone (west side of King Street). The Low Service Zone (LSZ) is supplied by the three wells and the hydraulic grade line (HGL) is set at 231.0 feet by the overflow of the Perry Hill Tank. The High Service Zone (HSZ) is supplied from the Main Street Booster Pumping Station located in front of the Town Hall with a hydraulic grade line of 310.0 feet set by the Town Forest Water Storage Tank.

Table 1-3 Booster Station

Name	Year Constructed	Number of Pumps	Typical Pumping Rate (GPM)
Main Street Booster Pump Station	2003	2	300 - 1,000

Transmission and Distribution Mains - The Groveland water distribution system consists of approximately 36.5 miles of piping ranging in diameter from 4-inch to 12-inch. Pipe includes original cast iron installed in 1920 to water main installed within the past year. A summary of the water distribution system piping is presented in Section 2. A detailed inventory is included in Appendix A and a water distribution map is included in Appendix B.

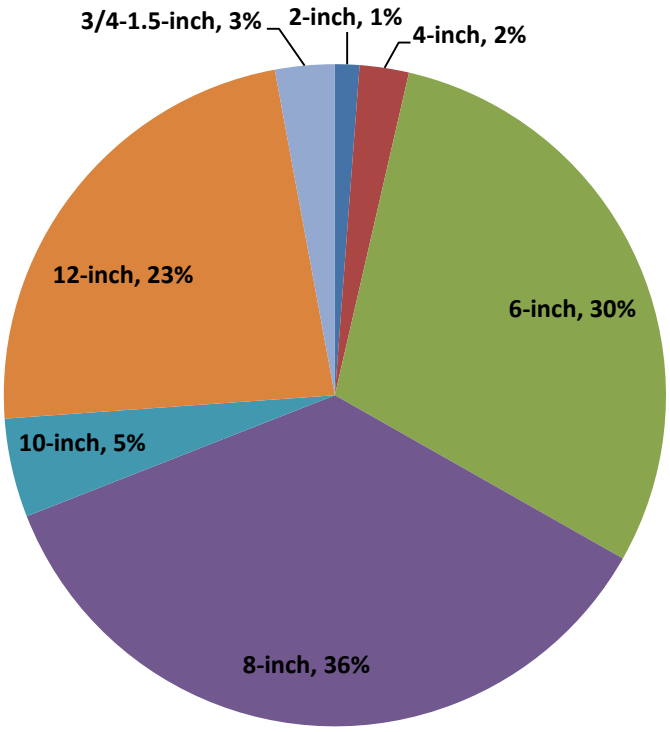
2. WATER MAIN INVENTORY

2.1 Distribution Mains Inventory

A street-by-street water main inventory with pipe length, diameter and C-Value was developed in 2011 from the Town Water System Map. The water main inventory was updated for this report based on information from 2011-2015 provided by Water Department staff including pipe material, year of installation, break history and water quality complaints. Static pressures obtained in 2011 by running an existing computer hydraulic model simulation of the water distribution system were assumed to be the same as the hydraulic gradelines of the system have not changed. The complete water main inventory and distribution system map can be found in the Appendix.

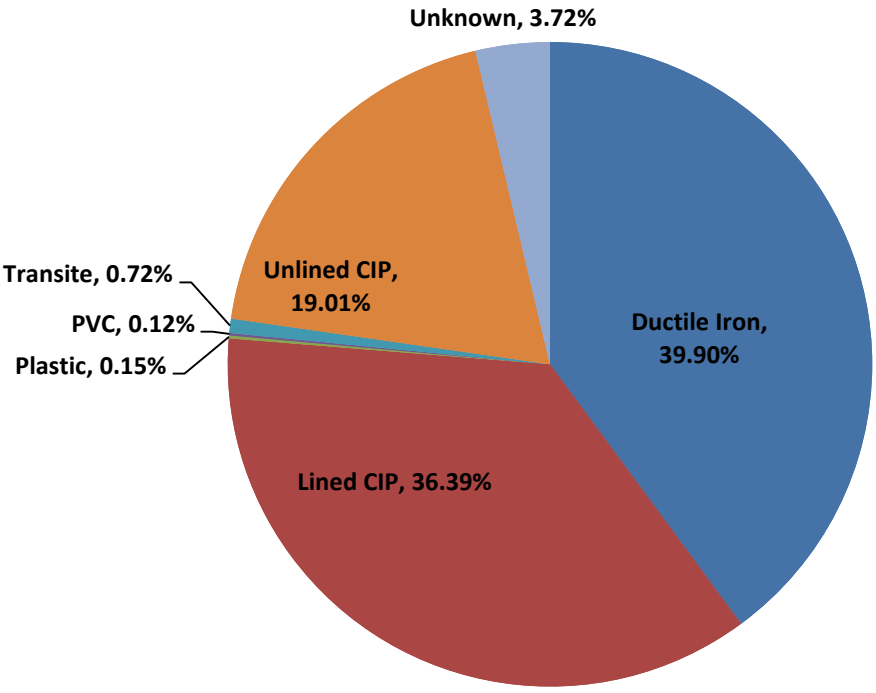
Based on the updated data for the water distribution system, the following graphs are presented to summarize the system's composition by diameter, material, and year of installation.

Figure 2-1 Water Main by Diameter



As shown in Figure 2-1, the majority of the water system is 6-inch and 8- inch diameter pipe (30% and 35% respectively). This is generally comparable to other communities of similar size and water usage. Twenty two percent (22%) of the distribution system is 12-inch diameter, and this corresponds to the water mains near the storage tank and the arterial roads in town. The remaining 13% of water main size is 4-inches and smaller or unknown diameters.

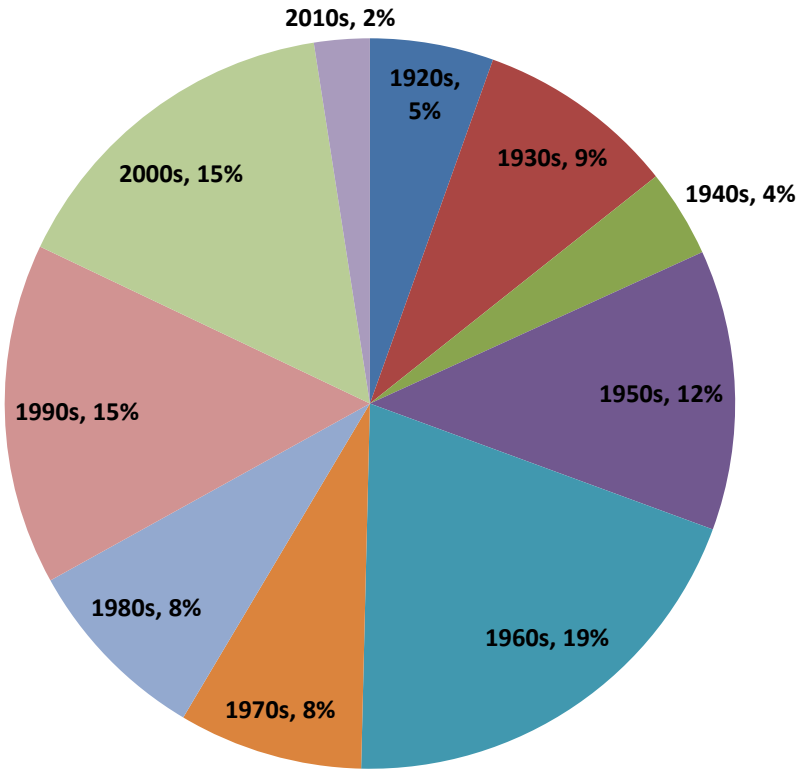
Figure 2-2 Water Main by Material



The water system is mainly comprised of cement-lined cast iron and ductile iron pipe (35% and 36% respectively) which are common water pipe materials having a useful life upwards of 100 years. Approximately 17% of the cast iron pipe remaining in the system is unlined. Unlined cast iron pipe is susceptible to internal corrosion and buildup of biofilm. This creates hydraulic restrictions, water quality problems and can weaken the pipes structural integrity. PVC/plastic and transite pipe account for just under 1% of the total water system pipe material.

There are also several streets with small diameter pipe (less than 2-inch diameter) where the material, age, and condition is unknown. The Water and Sewer Department Staff should continue to update the inventory as information is obtained.

Figure 2-3 Water Main by Installation Year



The graph above provides a general overview of the water system's age distribution. Approximately 62% of the water mains were installed after 1960 (50 years or less of service). The oldest pipes in the system are over 80 years old. Cast iron and ductile iron pipe typically have a life span of 100 years or more, depending on soils, hydraulics and pressure class.

3. WATER MAIN IMPROVEMENT PRIORITIZATIONS

The pipe data from the water main inventory was evaluated and a ranking system of pipe replacement was developed with pipes that are older, unlined, cast iron and under high pressure given higher priority over newer, cement-lined, low pressure pipes.

3.1 Method of Analysis

In addition to the water main inventory data presented in Section 2, static pressure, water quality and water main break history data was updated in order to prioritize the main replacements.

The previously developed weighted ranking system for the data was used to prioritize the pipeline replacement needs. In general, each pipe was given a numerical value for each criterion discussed, with higher values corresponding to worse pipe condition. The criteria were then weighted relatively to each other to produce final scores for each pipe. The values and weighting factors determined for each of the criteria are presented below.

Diameter - In general, the smaller the diameter of the installed water main, the less likely it will be able to provide adequate supply under most circumstances. Six-inch water mains are recommended for short (500 feet or less) cross streets and dead ends. Eight-inch diameter water mains are recommended for lengths of not more than 1,000 feet without reinforcement and primary distribution piping should be 12-inches or larger. Accordingly, the corresponding criteria values for diameter were established as follows:

Table 3-1 Diameter Criteria Values

Diameter (inches)	Value
≤ 4	100
6	80
8	20
10	15
12	10
14	7
16	5

Diameter weighting factor = 15%.

Year Installed - The age of the pipe is also a critical component in establishing a replacement program. As discussed, cast and ductile iron pipe can have a service life of 100 years; however, pipe greater than 50 years old can be reaching the end of its useful life. In addition, older cast iron pipe may have manufacturing inconsistencies that result in breaks and leaks.

Table 3-2 Installation Date Criteria Values

Year	Value
Pre 1900	100
1900-1919	95
1920-1939	90
1940-1957	80
1958-1969	30
1970-1974	20
1975-1989	5
1990-1999	2
2000-2015	0

Installation date weighting factor = 20%.

Material of Construction - Typical water main materials of construction have a variety of differences based on their strength, corrosion resistance, flow characteristics, etc. that can be correlated to their useful life expectancy, reliability and water quality. However, it is noted that even the same materials (such as cast iron) have different life expectancies based on their period of manufacture. In general, materials like galvanized iron and transite (asbestos cement) pipe are the least desirable materials of construction within a distribution system while ductile iron, HDPE and PVC are more desirable. The following criteria values were selected as follows for the material of construction.

Table 3-3 Material Criteria Values

Material	Value
Unlined CIP	100
Transite (Asbestos Cement)	80
Cement Lined CI	30
PVC/Plastic	30
Ductile Iron	5

Pipe material weighting factor = 20%.

Static Pressure - Massachusetts Guidelines for Public Water Systems states that normal working pressure in the distribution system should be approximately 60 to 80 psi and not less than 35 psi. Standard water works practice generally allows a normal maximum system pressure of 80 to 100 psi. Although common in New England, high pressures can lead to increased water loss at leaks and more frequent breaks as water mains and their appurtenances approach the end of their useful life. Static pressures were determined during average conditions using the hydraulic model of the distribution system with the values established in Table 3-4.

Table 3-4 Pressure Criteria

Pressure (psi)	Value
> 125	100
101 to 125	80
80 to 100	60
< 80	0

Static pressure weighting factor = 20%.

Water Quality Issues - Water quality problems can result from a variety of issues but can be attributed to distribution system related items (e.g., unlined CI water mains, low flows, dead ends, etc.). The location of water quality complaints, based on information provided by the Groveland Water and Sewer Department were noted in the evaluation. As water quality issues can have immediate impacts to the customers, its criteria were rated highly as follows:

Table 3-5 Water Quality Criteria Values

Parameter	Value
Water Quality Problems	100
No Water Quality Problems	0

Water quality weighting factor = 5%

Break History - Historical water main break and leak records offer a direct indication of past and possibly future problem areas within a water distribution system. Water main leaks and breaks can be a regular occurrence within water distribution systems that disrupt service, potentially cause contamination and must be repaired immediately. There are various factors that contribute to breaks and leaks which can include pipe condition and strength, poor installation, shallow burial depths, corrosion, environmental factors, and many of the other criteria discussed. A detailed breakage analysis, number of breaks or leaks per foot of pipe per year (or other time period) provides a more qualitative analysis; however, this information was not available so a less detailed criteria was used in this analysis. Accordingly, the criteria value for break history was established as follows:

Table 3-6 Break History Criteria Values

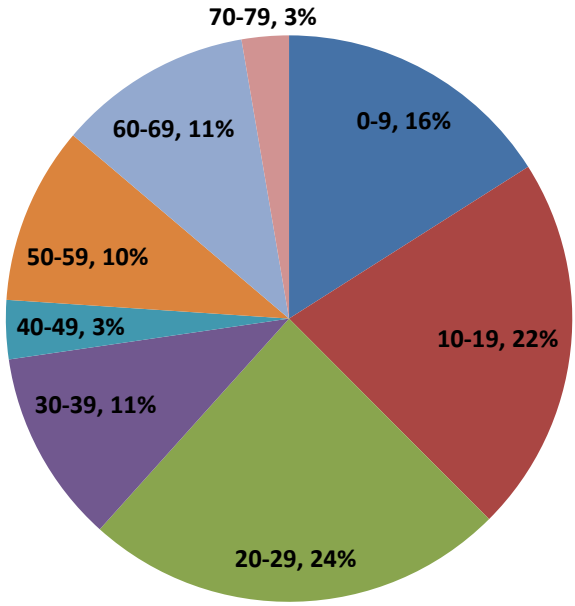
Breaks	Value
History of Breaks	100
No History of Breaks	0

Break history weighting factor = 20%

3.2 Evaluation Results

The established criteria values and weighting factors were input into the water main inventory spreadsheet and corresponding sums were calculated. The water main ratings of the Groveland distribution system ranged from 2.5 (excellent) to 76.5 (poor) out of a possible rating of 100. The current overall average system rating prorated by footage is 30. The percentage of pipe in each rating range is shown in Figure 3-1.

Figure 3-1 Water Main Rating



3.3 Prioritization of Water Mains

Water mains continue to be identified as the largest component of drinking water systems requiring replacement. The 2011 Drinking Water Infrastructure Needs Survey Assessment (DWINSA) report by the EPA identified the transmission and distribution component to be 73% of the total need for the next twenty years in Massachusetts vs. 64% nationally. This corresponds to an amount of $5.64 billion dollars for Massachusetts.

Materials currently installed have expected useful lives of 50 to 100-years depending on installation, pipe material thickness class, soil conditions and other factors. Typical recommendations include the upgrade and/or replacement of between 1% and 2% of the entire system on an annual basis equating to an entire water distribution system replacement every 50 to 100 years.

The Groveland distribution system is in good condition and is primarily constructed of lined cast iron and ductile iron pipe. Approximately 62% of the water mains were installed after 1960 (50 years or less of service). Replacing 1% of water mains within the 20-year planning period would result in replacement of approximately 7.5 miles of water main or 2,000 feet per year. The water main scores for the highest priority mains totaling 7.5 miles range from 53 to 76.

3.4 Water Main Project Schedule and Cost

Table 3-7 contains the list of pipes representing an annual replacement of 1% of the pipes in the system that should be replaced within the 20-year period. Also included are the cost of each project and a total cost for all of the improvements.

Table 3-7 20 Year Distribution System Improvements

Street Name	Length	Pipe Diameter (in)	Location From	Location To	Proposed Diameter (in)	Cost/Ft	Total Cost
Main Street	3,100	10	Washington Street	Gardner Street	12	$250	$775,000
Main Street	950	6	Broad Street	Scotland Yard Ext	6	$180	$171,000
Main Street	650	6	Washington Street	Haverhill	12	$250	$162,500
Main Street	3,000	6	Elm Park	Gardner Street	12	$250	$750,000
Lanen Avenue	850	4	Salem Street	Washington Street	6	$180	$153,000
Grove Street	445	2	Elm Park	Chestnut Street	6	$180	$80,100
Chestnut Street	480	6	Gardner Street	Union Street	6	$180	$86,400
Main Street	1,350	8	Elm Park	King Street	8	$205	$276,750
King Street[1]	4,500	6	Garrison Street	Center Street	12	$250	$1,125,000
Washington Street[1]	1,500	6	Center Street	Salem Street	12	$250	$375,000
Washington Street[1]	3,000	6/10	Salem Street	Dead End	12	$250	$750,000
Rollins Street[1]	3,350	6	Garrison Street	Center Street	8	$205	$686,750
Seven Star Road[1]	2,400	6	Broad Street	Wood Street	8	$205	$492,000
Wood Street[1]	1,700	4	Seven Star Road	Nichols Way	8	$205	$348,500
Balch Avenue[1]	2,050	4	Main Street	Governor's Road	8	$205	$420,250
Merritt Ave[1]	900	2	School Street	Pinewood Lane	6	$180	$162,000
Union Street	1,100	6	Chestnut Street	King Street	6	$180	$198,000
Main Street	1,650	8	Riverpines Drive	Broad Street	8	$205	$338,250
Highland Avenue	750	6	School Street	Dead End	8	$205	$153,750
View Hill Road	250	6	School Street	View Hill Road	6	$180	$45,000
Gardner Street	1,825	8	Main Street	School Street	8	$205	$374,125
Anne Street	475	6	School Street	Anne Street Extension	6	$180	$85,500
Main Street	1,390	8	King Street	Riverpines Drive	8	$205	$284,950
Center Street	1,430	10	Salem Street	Washington Street	12	$250	$357,500
Alpha Avenue	1,000	8	Cannon Hill Road	Rollins Street	8	$205	$205,000
Yemma Road	1,375	8	Main Street	Dead End	8	$205	$281,875
						TOTAL	$9,138,200
						Years	20
						Cost/Year	$456,910

Notes: (1) Locations also identified as having deficient fire flow.

(2) Unit Costs include construction plus 20% for engineering and contingency.

Spending approximately $460,000 per year for 20 years on infrastructure improvements will sufficiently update the aging water distribution system. The specific locations and priorities of the projects should be reevaluated annually by the Town based on other infrastructure, roadway, traffic and related factors.

4. ADDITIONAL WATER SYSTEM CAPITAL IMPROVEMENTS

Additional water system capital improvements were identified and included in the Capital Improvement Plan. These improvements were developed based on the following:

- 2011 Capital Improvement Plan prepared by Wright-Pierce
- 11/15/12 Well No. 1 PS Alternatives Evaluation
- 4/25/13 Perry Hill Tank Inspection by Underwater Solutions
- 5/8/15 Tank Replacement Letter by DN Tanks
- 3/30/15 CIP meeting with Superintendent

4.1 Supply

The Town currently has three existing wells and the adequacy of these existing supplies are evaluated in Table 4-1 by comparing available supply to recent demands. The firm capacity assumes the typical operating rates of the existing supplies with the largest supply out of service (Well No. 3) and the remaining supplies (Well No. 1 and Well No. 4) must provide maximum day demands.

Table 4-1 Groveland Supply Capacity

Year	Firm Capacity (MGD)	Maximum Day Demand (MGD)	Supply Surplus/Deficit (MGD)
2014	0.86	0.85	+0.01

The maximum day demand of the water system is currently approximately equal to the firm capacity of existing supplies. Identifying a location for a new supply well for the Town is recommended to maintain reliability and redundancy for future water demands. The parcel north of Well No. 1 was recently acquired by the Town and previously identified as containing a potential new source location. A budget of $75,000 is recommended for sufficient testing including test well drilling and water quality testing. Testing and permitting associated with new source approval by MassDEP is also recommended within the 20 year planning period at an estimated cost of $300,000.

Well No. 3 and No. 4 currently pump below their safe yield levels due to under sizing of the pumps in the original installation. It is recommended that the pumps and motors be upgraded to increase their capacities. MassDEP allows pumps to be designed up to 150% of their safe yield capacity. The cost of these upgrades is estimated at $125,000.

4.2 Treatment

This project involves conversion of the existing GAC Building at the site of Well No. 1 into a new treatment and control building. The existing chemical treatment equipment is in need of modernization to increase operational efficiency and reliability. This is a high priority project as the Town needs this supply to meet demands. It is recommended that the test well program be performed prior to the design of the Well No. 1 building so that provisions for treatment of the new source can be made. A cost estimate for the Pumping Station is presented in Table 4-2 below.

Table 4-2 Well No.1 Pumping Station Cost Estimate

Project Component	Estimate
Mobilization / Bonds / Insurance	$ 50,000
Demolition	$ 20,000
Structural (Masonry/Concrete)	$ 150,000
Architectural (Carpentry/Roofing/Doors)	$ 110,000
Equipment (Chem Feed/Process Piping)	$ 115,000
Instrumentation / SCADA	$ 50,000
Plumbing/ Heat / Ventilation	$ 45,000
Electrical	$ 110,000
Construction Subtotal	$ 600,000
Engineering and Contingency (30%)	$ 180,000
Project Total	**$ 780,000**

Additionally, it is recommended that provisions to achieve contact time for 4-log removal of viruses be installed at all three well sites. This improvement involves installation of additional 16-inch water main piping at the well site to achieve the required chlorine contact time prior to the first customer. The estimated cost per well site for the piping modifications is $75,000.

4.3 Storage

The Perry Hill Storage Tank is the original system storage facility and was constructed in 1967. Recent inspections show that the tank requires recoating of all interior and exterior surfaces in order to prevent further corrosion of the steel and maintain structural integrity. A cost estimate for the tank rehabilitation is presented in Table 4-3 below.

Table 4-3 Perry Hill Reservoir Rehabilitation Cost Estimate

Item No.	Description	Units	Quantity	Unit Price	Extended Amount
1	Mobilization and Demobilization	ls	1	$10,000	$10,000
2	Exterior Coating System	sf	21,066	$13.75	$289,661
3	Interior Coating System	sf	27,148	$14.75	$400,439
4	Pit Filling & Repair	pits	200	$100	$20,000
6	Furnish and install safety rail	ls	1	$5,000	$5,000
7	Remove and reposition antenna mounts	ls	1	$2,500	$2,500
9	Tank Mixing System	ls	1	$60,000	$60,000
				Subtotal	**$797,600**
				Engineering & Contingency (25%)	**$159,520**
				Project Total (Rounded)	**$960,000**

4.4 Other Projects

4.4.1 Water Operations Center

The Water and Sewer Department currently operates out of an old facility on Washington Street, with inadequate space, access, storage and building infrastructure. Construction of a modern garage, operations and office facility is recommended to improve the operations and efficiency of the GWSD. This facility would include garage space, a maintenance shop, inventory storage, SCADA Center, Billing and customer service and offices and meeting rooms. The estimated cost for this facility is $300,000.

4.4.2 Pressure Reducing Valves

This project includes the installation of two pressure reducing valves at the boundary of the high-pressure/low-pressure zones. The first would be installed at the intersection of Gardner Street and King Street and could be scheduled at the same time as the water main replacement on King Street. The second would be installed on Center Street at the end of the new 12-inch pipe and end of the existing 8-inch pipe 200-feet South of Rollins Street. This valve would be installed at the same time as the new 12-inch pipe. The estimate cost for the two PRV vaults and piping modifications is $300,000.

The pressure reducing valves are required to be installed prior to maintenance of the Perry Hill Reservoir. This will allow the Town Forest Tank to provide storage for peak usage and fire protection to the MSZ while the Perry Hill Reservoir is offline.

4.5 5-Year Capital Improvement Plan

In order to implement the capital improvements in an affordable, phased program, a five-year improvement program has been outlined. We have not considered existing budgets and appropriations in the five-year plan. The Commissioners should review and adjust the plan as required to meet the Town priorities and rate structure. In addition, bonding of improvements over a specified period of time will decrease the annual outlay. Table 5-1 below includes the Capital Improvements outlined in this report and the anticipated costs over the five-year period. It should be noted that Item 5 is based on a 20-year plan.

Table 4-4 Water System 5-Year Capital Improvement Plan

Item	Project	Category	Priority	Total Cost	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
1	New Source Exploration & Approval	Source	High	$350,000	$25,000	$50,000	$300,000		
2	Wells No. 3 and No. 4 Upgrades	Source	High	$125,000		$125,000			
3	Well No.1 Pump Station Upgrade	Treatment	High	$780,000			$780,000		
4	Perry Hill Tank Painting	Storage	Medium	$975,000					$975,000
5	4-Log Removal Piping Modifications	Treatment	Medium	$225,000	$75,000	$75,000	$75,000		
6	Aging Infrastructure Improvements	Water Distribution	High/Medium	$9,138,200	$456,910	$456,910	$456,910	$456,910	$456,910
7	Water Operations Center	Other - Operations	Medium	$300,000					
8	Pressure Reducing Valves	Other - Valves	Medium	$300,000				$300,000	
Total					**$556,910**	**$706,910**	**$1,611,910**	**$756,910**	**$1,431,910**

5. CAPITAL IMPROVEMENT PLAN FUNDING OPTIONS

As presented in the previous sections, there are significant capital expenditures which will need to be made over the coming decades. This section covers the Groveland Water and Sewer Department's current rates and identifies other potential funding options that can be considered for implementation as necessary.

5.1 Current Rates

The Groveland Water and Sewer Department has a minimum quarterly charge with a block structure as follows:

0-1,200 cubic feet	$50.58	Minimum
1,200-3,000 cubic ft	$4.61	per 100 cf
Over 3,000 - Residential	$8.63	per 100 cf
Over 3,000 - Commercial	$6.98	per 100 cf

5.2 Funding Options

Implementation of the Capital Improvement Plan (CIP) presented within the previous sections will have a significant impact on water user rates, depending on the phasing of improvements, municipal bond rates and terms and other sources of funding. Some potential means of funding an increased Capital Improvement Plan (CIP) include the following:

- Rate Increase - A water rate increase is the primary method available for funding capital improvements. A preliminary rate impact analysis was developed to give an "order of magnitude" of water rate increases. However, a detailed rate study should be performed that would take the increased budget, debt retirement, non-rate revenue and other funding into account.
- Capital Improvement Fee - Some water systems implement a specific fee or charge for funding a specific capital improvement. This provides a constant source of revenue and can be eliminated when the capital improvement is paid for. This method can be more equitable, spreading the cost of the improvement to the entire user base.
- Bonding - In general, bonding of improvements over a specified period of time will decrease the annual outlay so that more improvements can be completed annually. Bonding caps should also be

considered so that repayment is limited to the available budget (this would also allow new debt to be taken on as older debt is paid off).

- Loans - Other available funding options for larger capital projects (e.g., $1.0 million or more) include the low interest Drinking Water State Revolving Fund (DWSRF) program offered by the MassDEP.

In general, there are many financing opportunities that should be taken into consideration. Ultimately, Groveland's Commissioners will need to review and adjust the CIP plan as required to meet the Town priorities and desired rate structure.

It should also be noted that other funding opportunities are being discussed by the Water Infrastructure Finance Commission (WIFC) to help water departments with funding for needed improvements, but are likely years away from implementation. The WIFC was established by Act of Legislature pursuant to Section 145 of Chapter 27 of the Acts of 2009 and is charged with developing a comprehensive, long-range water infrastructure finance plan for the commonwealth and its municipalities.

5.3 Rate Impact

The Groveland Water and Sewer Department rate table was used to determine the approximate order of magnitude that the CIP implementation will have on the water rates. Based on an annual billed water usage of 120 MG and assuming that:

- Current Water Department debt is not reduced
- Revenue is only from rates
- Rate structure is flat
- Bonding at 5% for 20 years

Order of magnitude rate increases that are required to implement the CIP are shown in Table 5-1.

Table 5-1 Approximate Water Rates for CIP Implementation

Item	Total Cost	Annualized Cost	Rate Increase per 100 CF	% Increase over Existing Min. Rate ($4.61)
New Source Exploration & Approval	$350,000	$29,000	$0.18	3.9%
Wells No. 3 and No. 4 Upgrades	$125,000	$10,000	$0.06	1.3%
Well No.1 Pump Station Upgrade	$780,000	$64,000	$0.40	8.7%
Perry Hill Tank Painting	$975,000	$80,000	$0.50	10.8%
4-Log Removal Piping Modifications	$225,000	$18,000	$0.11	2.4%
Aging Infrastructure Improvements	$9,138,200	$724,000	$4.51	97.8%
Water Operations Center	$300,000	$24,000	$0.15	3.3%
Pressure Reducing Valves	$300,000	$24,000	$0.15	3.3%
TOTAL	$12,193,200	$973,000	$6.06	131.5%

APPENDIX A
WATER MAIN INVENTORY

GROVELAND WATER AND SEWER DEPARTMENT
WATER MAIN INVENTORY
AUGUST 2015

#	Street Name	Pipe Segment Length (ft)	Pipe Diameter (in)	Year Installed	Pipe Material	Rating (0-100)
1	Main Street	3100	10	1925	Unlined CIP	76.25
3	Balch Avenue	2050	4	1940	Unlined CIP	71
4	Main Street	950	6	1955	Unlined CIP	68
5	Seven Star Road	2400	6	1945	Unlined CIP	68
6	Main Street	650	6	1925	Unlined CIP	66
7	Main Street	400	6	1925	Unlined CIP	66
8	Main Street	530	6	1925	Unlined CIP	66
9	Main Street	2150	6	1925	Unlined CIP	66
10	Lanen Avenue	850	4	1930	Unlined CIP	65
11	Rollins Street	1900	6	1950	Unlined CIP	64
12	Wood Street	1700	4	1945	Unlined CIP	63
13	Chestnut Street	480	6	1935	Unlined CIP	62
14	Main Street	1350	8	1935	Unlined CIP	62
15	Union Street	1100	6	1935	Unlined CIP	62
16	Washington Street	1500	6	1935	Unlined CIP	62
17	Gardner Street	1740	6	1935	Unlined CIP	62
18	King Street	920	6	1935	Unlined CIP	62
19	Main Street	1650	8	1935	Unlined CIP	61
21	Highland Avenue	750	6	1945	Unlined CIP	60
22	View Hill Road	250	6	1955	Unlined CIP	60
23	Gardner Street	1825	8	1925	Unlined CIP	57
24	Anne Street	475	6	1965	Lined CIP	56
25	King Street	3200	6	1935	Unlined CIP	55
26	Cranton Avenue	1475	6	1956	Lined CIP	*54*
27	Dwinnell Street	1125	6	1956	Lined CIP	*54*
28	Fairview Circle	2250	6	1950	Lined CIP	54
29	Main Street	1390	8	1935	Unlined CIP	53
30	Center Street	1430	10	1925	Unlined CIP	52.25
31	Alpha Avenue	1000	8	1968	Lined CIP	51
32	Yemma Road	1375	8	1950	Transite	51
33	Seven Star Road	2188	6	1955	Lined CIP	*50*
34	Washington Street	1682	6	1935	Unlined CIP	50
35	Abbot Circle	248	6	1945	Lined CIP	46
36	Murray Avenue	870	6	1955	Lined CIP	46
37	Ashcroft Terrace	1050	6	1965	Lined CIP	44
38	Ashcroft Terrace	870	6	1965	Lined CIP	44
39	Benham Street	230	6	1960	PVC	44
40	Balch Avenue	563	6	1960	Lined CIP	40
41	Rollins Street	2015	6	1960	Lined CIP	40
42	Slvvan Street	595	6	1965	Lined CIP	40
43	King Street	1000	6	1955	Lined CIP	39
44	Center Street	445	8	1955	Lined CIP	37
45	Center Street	2518	8	1955	Lined CIP	37
46	Baldwin Terrace	1440	6	1958	Lined CIP	36
47	Georgia Street	510	6	1965	Lined CIP	36
48	Pandora Drive	1644	6	1965	Lined CIP	36
49	Cannon Hill Avenue	1030	6	1975	Lined CIP	35
50	Cannon Hill Road	1000	6	1975	Lined CIP	35
51	Coleman Road	996	8	1965	Lined CIP	35
52	Grove Street	445	2	1935	Unlined CIP	35
53	Briscoe Road	1280	8	1968	Lined CIP	31
54	Crosscountry	375	8	1965	Lined CIP	31
55	Manor Drive	1755	6	1975	Lined CIP	31
56	Muriel Road	500	8	1968	Lined CIP	31
57	Wharf Drive	625	8	1968	Lined CIP	31
58	Wharf Lane	186	8	1968	Lined CIP	31
59	Pump Sta #1	622	8	1965	Lined CIP	31
60	Washington Street	1517	10	1965	Lined CIP	30.25
61	Washington Street	854	10	1965	Lined CIP	30.25
62	Dartmouth Street	320	8	1965	Lined CIP	27
63	Dartmouth Street	320	8	1965	Lined CIP	27

GROVELAND WATER AND SEWER DEPARTMENT
WATER MAIN INVENTORY
AUGUST 2015

64	Harvard Street	1160	8	1965	Lined CIP	27
65	Murray Ct	806	8	1965	Lined CIP	27
66	Yale Street	1310	8	1965	Lined CIP	27
67	Washington Street	*500*	10	1965	Lined CIP	26.25
68	Crosscountrv	438	8	1975	Lined CIP	26
69	Gardner Street	295	12	1964	Lined CIP	25.5
70	Gardner Street	1740	12	1964	Lined CIP	25.5
71	King Street	920	12	1960	Lined CIP	25.5
72	River Pines Drive	400	6	1995	Ductile Iron	25.4
73	River Pines Drive	400	6	1995	Ductile Iron	25.4
74	Marjorie Street	1150	8	1995	Ductile Iron	24.4
75	Benham Street	500	8	1995	Ductile Iron	24.4
76	Abbott Street	260	6	1958	Lined CIP	24
77	Ashcroft Circle	800	6	1965	Lined CIP	24
78	Birchwood Terrace	953	6	1958	Lined CIP	24
79	Blueberrv Hill	937	6	1958	Lined CIP	24
80	Burke Street	787	6	1963	Lined CIP	24
81	Carlida Road	231	6	1963	Lined CIP	24
82	Carlida Road	275	6	1963	Lined CIP	24
83	Carlida Road	1056	6	1963	Lined CIP	24
84	Oark Road	830	6	1963	Lined CIP	24
85	Deer Run	186	6	1958	Lined CIP	24
86	Doris Street	610	6	1958	Lined CIP	24
87	Juoiter Terrace	297	6	1965	Lined CIP	24
88	Merritt Avenue	240	6	1958	Lined CIP	24
89	Outlook Drive	563	6	1965	Lined CIP	24
90	Pandora Drive	254	6	1965	Lined CIP	24
91	Parker Road	240	6	1963	Lined CIP	24
92	Parker Road	810	6	1963	Lined CIP	24
93	Pike Drive	551	6	1965	Lined CIP	24
94	Pinewood Lane	1300	6	1958	Lined CIP	24
95	Wilbert Avenue	590	6	1958	Lined CIP	24
96	Broad Street	1005	12	2008	Ductile Iron	22.5
97	Main Street	1652	12	2004	Ductile Iron	22.5
98	Nichols Way	4150	12	2008	Ductile Iron	22.5
99	Center Street	1250	8	1975	Ductile Iron	21
100	Park Street	395	8	1988	Ductile Iron	21
101	Pleasant Street	900	8	1988	Ductile Iron	21
102	School Street	662	8	1988	Ductile Iron	21
103	School Street	352	8	1988	Ductile Iron	21
104	Serine. Street	280	2	1980	Plastic	21
105	Center Street	5818	12	1975	Lined CIP	20.5
106	Bear Hill Road	1250	8	1995	Ductile Iron	20.4
107	Francis Avenue	646	8	1995	Ductile Iron	20.4
108	Madison Street	780	8	1995	Ductile Iron	20.4
109	Center Street	1500	8	2003	Ductile Iron	20
110	Dewhurst Street	570	8	2003	Ductile Iron	20
111	Garrison Streel	770	8	2006	Ductile Iron	20
112	Garrison Street	1245	8	2006	Ductile Iron	20
113	Seven Star Road	563	8	2003	Ductile Iron	20
114	Wyka Lane	375	8	2006	Ductile Iron	20
115	Elm Park Bypass	955	12	1989	Ductile Iron	19.5
116	River Pines Drive	990	12	1975	Ductile Iron	19.5
117	Main Street	3566	12	2008	Ductile Iron	18.5
118	Hillview	1480	8	1985	Ductile Iron	17
119	Summer Street	440	8	1975	Ductile Iron	17
120	Town Hall	563	8	1975	Ductile Iron	17
121	Cherry Tree Lane	534	8	1995	Ductile Iron	16.4

GROVELAND WATER AND SEWER DEPARTMENT
WATER MAIN INVENTORY
AUGUST 2015

122	Groveland Commons Way	410	8	1995	Ductile Iron	16.4
123	Parking Lot	250	8	1995	Ductile Iron	16.4
124	Stonebridge Road	2636	8	1995	Ductile Iron	16.4
125	Alyssa Drive	1730	8	2002	Ductile Iron	16
126	Anne Street Extension	100	8	2002	Ductile Iron	16
127	Clara Court	250	8	2006	Ductile Iron	16
128	Diane Circle	750	8	2002	Ductile Iron	16
129	Matthew Drive	585	8	2002	Ductile Iron	16
130	Philbrick Street	470	8	2003	Ductile Iron	16
131	Pineau Avenue	750	8	2007	Ductile Iron	16
132	Pond Street	688	8	2004	Ductile Iron	16
133	River Pines Drive	560	12	1975	Ductile Iron	15.5
134	School Street	1585	12	1988	Ductile Iron	15.5
135	School Street	5900	12	1988	Ductile Iron	15.5
136	Carleton Road	282	8	1965	Lined CIP	15
137	Lee Road	313	8	1965	Lined CIP	15
138	Salem Street	3000	8	1968	Lined CIP	15
139	Shaunton Road	330	8	1965	Lined CIP	15
140	Salem Street	1130	12	1995	Ductile Iron	14.9
141	Salem Street	1850	12	1995	Ductile Iron	14.9
142	Salem Street	2150	12	1995	Ductile Iron	14.9
143	Salem Street	810	12	1995	Ductile Iron	14.9
144	Main Street	1390	12	2004	Ductile Iron	14.5
145	Wood Street	1000	12	2005	Ductile Iron	14.5
146	Washington Street	1844	10	1965	Lined CIP	14.25
147	PumpSta#3 to Well	1188	6	1979	Ductile Iron	14
148	Perry Hill Reservoir	719	12	1964	Lined CIP	13.5
2	Governors Road	1200	8	2014	Ductile Iron	13
20	Governors Road	1200	8	2014	Ductile Iron	13
149	Evergreen Lane	2688	8	1995	Lined CIP	9.4
150	Hemlock Lane	750	8	1995	Lined CIP	9.4
151	King Street	1000	8	1995	Ductile Iron	9.4
152	King Street	563	8	1990	Lined CIP	9.4
153	Rocky Woods Road	750	8	1995	Lined CIP	9.4
154	Abbott Street	989	8	1985	Ductile Iron	*5*
155	Coleman Road	780	8	1985	Ductile Iron	*5*
156	Pinewood Lane	520	8	1985	Ductile Iron	*5*
157	Apple Blossom Way	400	8	1995	Ductile Iron	4.4
158	Apple Blossom Wav	1037	8	1995	Ductile Iron	4.4
159	Crosscountry	1313	8	1995	Ductile Iron	4.4
160	Parker Circle	225	8	1995	Ductile Iron	4.4
161	Pheasant Lane	1063	8	1995	Ductile Iron	4.4
162	Salem Street	1250	8	1993	Ductile Iron	4.4
163	Center Street	1500	8	2006	Ductile Iron	4
164	Crosscountry	720	8	2006	Ductile Iron	4
165	Federal Way	715	8	2003	Ductile Iron	4
166	Lindsay Wav	425	8	2006	Ductile Iron	4
167	Pike Drive Extension	551	8	2006	Ductile Iron	4
168	School Street	710	12	1988	Ductile Iron	3.5
169	Salem Street	1920	12	1995	Ductile Iron	2.9
170	Nichols Way	1505	12	2008	Ductile Iron	2.5
187	Wood Street	180	12	2012	Ductile Iron	2.5
188	Tank Access Road	1950	12	2012	Ductile Iron	2.5
171	Arrowhead Lane	813	3/4 - 1.5 Service			0
172	Hales Ct	256	2			0
173	Knox Avenue	460	3/4 - 1.5 Service			0
174	Marjorie Street	250	3/4 - 1.5 Service			0

GROVELAND WATER AND SEWER DEPARTMENT
WATER MAIN INVENTORY
AUGUST 2015

175	Merrit Avenue	633	3/4 - 1.5 Service			0
176	Mill Street	162	3/4 - 1.5 Service			0
177	Nelson Street	250	3/4 - 1.5 Service			0
178	Pond Street	500	2			0
179	Pond Street	625	3/4 - 1.5 Service			0
180	Scotland Yard Ext	450	2			0
181	Sewall	445	3/4 - 1.5 Service			0
182	Stevenson's Way	350	2			0
183	Stocker Avenue	572	3/4 - 1.5 Service			0
184	Uptack Street	560	3/4 - 1.5 Service			0
185	View Hill Road	407	3/4 - 1.5 Service			0
186	Zachary Path	390	3/4 - 1.5 Service			0

APPENDIX B

DISTRIBUTION SYSTEM MAP

Water Distribution System

Groveland Water & Sewer Department

Groveland, Ma

Date: September 2008

REVISED: JUNE 30, 2014

Legend

- 2" WATER MAIN
- 4" WATER MAIN
- 6" WATER MAIN
- 8" WATER MAIN
- 10" WATER MAIN
- 12" WATER MAIN
- 3/4" TO 1 1/2" SERVICE
- DISCONTINUED WATER MAIN
- VALVE
- HYDRANT

TOTAL LENGTH OF DISTRIBUTION SYSTEM: 36.5 MILES

SCALE: 1"=500'

500 250 0 500 1000 1500 FEET

150 100 50 0 100 200 300 400 METERS

K:\Proj\P\2007\07049\dwg\07049SP.dwg