Town of Hanover Sewer Collection System Preventive Maintenance and Sewer Overflow Response Plans

April 28, 2017

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1. COLLECTION SYSTEM MANAGEMENT

a. Goals

Hanover's preventive maintenance plan (PMP) covers the assets we manage in our wastewater collection system and is one component of our overall Capacity, Management, Operations and Maintenance (CMOM) Plan. The PMP combines preventive, predictive and corrective maintenance strategies with our best management practices. The CMOM Plan and PMP have been prepared to help Hanover effectively manage our wastewater collection system and achieve the following goals:

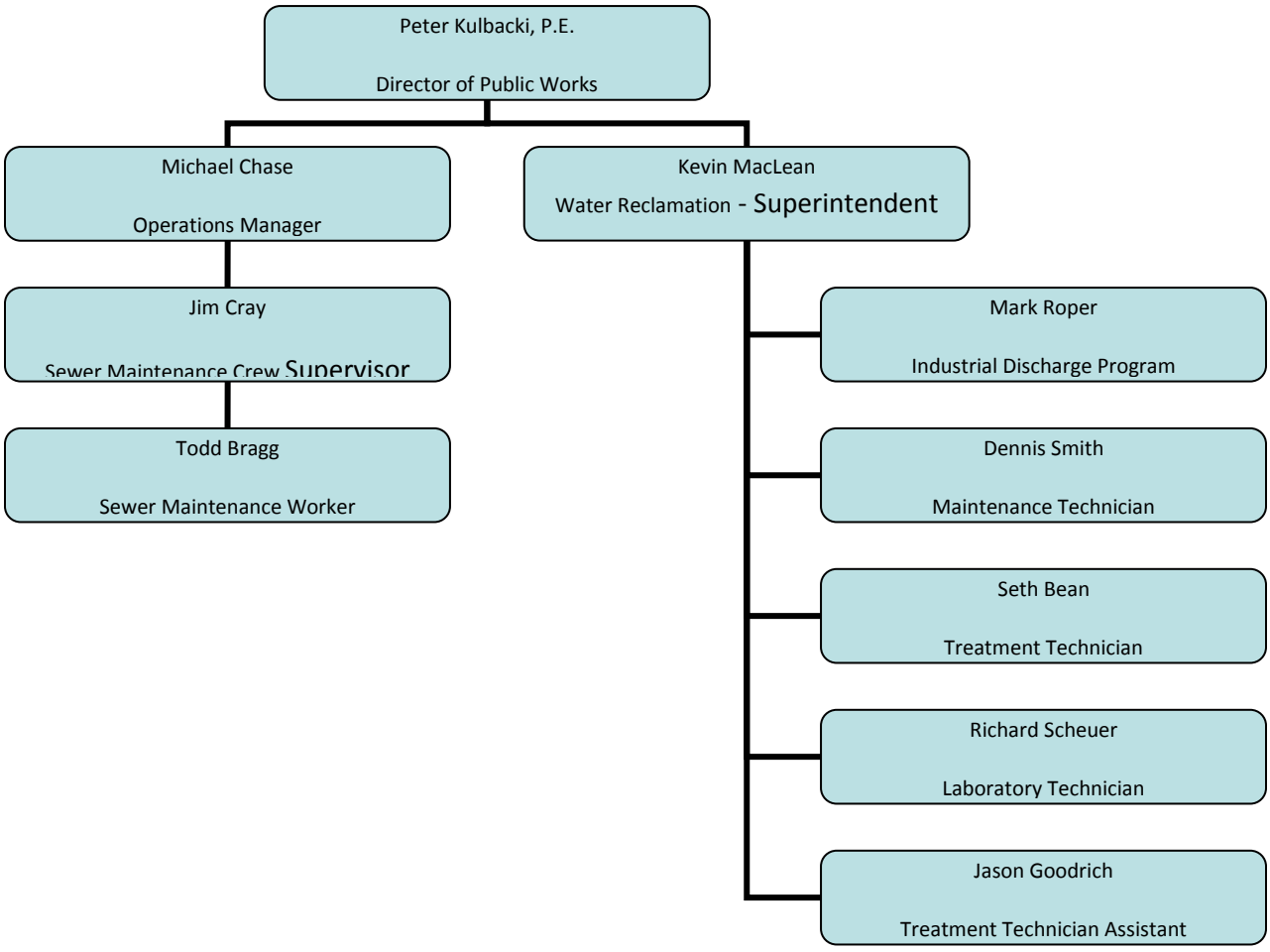
- Prevent public health hazards
- Protect the environment
- Comply with regulations
- Minimize the frequency of SSOs
- Mitigate the impact of SSOs
- Minimize disruptions in service
- Minimize complaints
- Provide quick response to any disruption in service that occurs
- Protect Hanover's large investment in the sewer collection system by maintaining maximum capacity and extending the useful life of the associated assets
- Prevent unnecessary damage to public/private property
- Efficiently use the funds available for the maintenance of the infrastructure and the operation of services
- Reduce expenditures for emergency maintenance
- Convey wastewater to the Town of Hanover's waste water treatment facility with a minimum of infiltration, inflow and exfiltration
- Provide adequate capacity to convey peak flow
- Provide immediate, responsive, and efficient service to all emergency calls
- Provide a safe work environment for employees, employers, and residents in Hanover

- Perform all operations in a safe manner to prevent personal injury
- Utilize evolving technology to increase our effectiveness and efficiency
- Provide reliable service now and into the future

b. Organization

Hanover's Line Maintenance and Construction (LMC) is a division within the Department of Public Works (DPW) and are responsible for the maintenance and upkeep of the gravity wastewater collection system. LMC has a staff of two full-time maintenance positions, which is sufficient to meet daily maintenance needs, but uses on-call contractor services as needed for specific maintenance activities and for emergency support. Pump stations, lift stations and the treatment facility are operated and maintained by the six full-time staff of the Wastewater Treatment Facility (WWTF) or Water Reclamation (WR) division. The chart below shows the organizational structure of the DPW.

Hanover's Line Organizational Chart:



Director of Public Works-Provides administrative and engineering oversight to all operations and activities of the Public Works Department. Plans, coordinates, directs, organizes and participates in the public works activities of the Town. Supervision is exercised over the work of all employees within the Public Works Department.

Operations Manager-Plans and directs operational exercises and activities. Leads staff and delegates responsibility, allocates resources, authorizes outside contractors to perform services, inspects on-going work efforts and may serve as public contact.

Line Maintenance Supervisor-Manages field operations and maintenance activities, provides relevant information to agency management, prepares and implements contingency plans, leads emergency response, inspects sewer assets as needed, investigates and reports SSOs, and trains field crews. Hanover's Line Maintenance Supervisor is required to have a Grade IV Operator's License.

Water Reclamation Superintendent-Manages the operations of the Water Reclamation Facility (WRF) or wastewater treatment plant including pump stations and force mains, ensures compliance with regulatory requirements of treatment and discharges. Plans and budgets for upcoming operational and compliance needs.

Field Crew-Conduct staff operations and preventive maintenance activities. Mobilizes and responds to notification of stoppages and SSOs, as well as address and clean-up of events as required. As the situation requires, additional man-power and assistance is available through on-call local contractors as well as other divisions (e.g. highway) that contains four members that are cross-trained to assist in tasks as needed.

Administrative/Public Relations-Support staff operations and preventive maintenance activities, assist with data entry, billing, dispatch, payroll, customer response, outreach, education and other support functions as needed.

Relation to Other Municipal Functions

The management, operations and maintenance of the wastewater collection and transmission system is the responsibility of the LMC and WRF divisions. The Water and Highway Divisions of the DPW support LMC & WRF. Cross-training and assistance creates interest, involvement and redundancy which are invaluable to the community. Conversely, LMC & WRF personnel are also utilized for the benefit of other DPW divisions and activities as appropriate.

- Collection system mapping is supported by the DPW's Administrative Coordinator/GIS Specialist. The position is responsible for the development, maintenance and updates to the town's GIS existing sewer infrastructure mapping system.

- Resources and budget are overseen by the Director of Public Works and the Director of Administrative Services.

- Contingency equipment and replacement inventories are managed and maintained by the respective divisions within Public Works and ultimately by the Director.

- Training for our maintenance team and department is provided through many regulatory, private and institutional groups, including but not limited to: New Hampshire Department of Environmental Services {NHDES}, New Hampshire Water Pollution Control Association {NHWPCA}, Granite State Rural Water Association {GSRWA}, United States Environmental Protection Agency {USEPA}, New England Interstate Water Pollution Control Commission {NEIWPCC}, North East Water Wastewater Training Associates {NEWWTA}, National Association of Sewer Service Companies {NASSCO}, and New Hampshire Department of Labor {NHDOL}.

- Outreach to plumbers and building contractors is largely done by the Town's Planning, Zoning and Codes Department, which issues Building Permits and performs inspections for code compliance on building projects in Town.

- Design and construction standards for installation, rehabilitation and repair are overseen and reviewed by the Director of Public Works or his designee which is either the Operations Manager or Line Maintenance Supervisor, depending on the situation.

- Standards for inspection and testing are developed by the Director of Public Works.

- Inspection of grease interceptors/separators is performed by the Industrial Discharge Program Coordinator.

- Outreach for Fats, Oils and Grease is performed jointly by the LMC personnel, Industrial Discharge Program Coordinator and Building Inspector.

- Personnel hiring and administration are performed by the Director of Public Works with support from the Human Resources Department.

- Procurement of non-routine equipment, services or supplies is authorized by the Director of Public Works.

- The Town Attorney provides legal advice, reviews and opines to the department for legal concerns, contracts and agreements, and is responsible for handling all claims against the Department and for prosecuting violations of all Sewer Use Ordinances.

- The Highway division coordinates paving services to LMC on all sewer repairs performed within public streets and works to coordinate street-paving schedules with sewer and other utility work.

- The Town Clerk maintains copies of Resolutions and Hanover Ordinances passed by the Selectboard related to the operation of the Wastewater Collection and Treatment Systems.

c. Training/Safety

Hanover's training program provides mechanisms for educating employees and establishing their technical competence through a variety of organizations dedicated to supporting wastewater collection system operators and treatment facilities, including: NHWPCA, NHDES, NASSCO, GSRWA, NEIWPCC, NEWWTA, NHDOL, and USEPA. Hanover utilizes a combination of in-house skill training and the purchase of specialized training through state and national associations, the self-study technical wastewater training courses offered through California State University- Sacramento, conferences and vendor training programs to enhance skills for performing daily work duties and provide certified operators continuing education hours. Skills training for LMC employees include, but are not limited to:

- Routine Line Maintenance
- Heavy Equipment Operation
- Maintenance Equipment Operation
- Line Testing and Inspection
- Infrastructure Installation
- Closed Circuit Television of Lines
- Electrical and Instrumentation
- Emergency Response
- Public Relations
- Safety

Safety training is obtained from training agencies including New Hampshire HealthTrust. Hanover expects employee adherence to the following written safety policies and procedures:

- Confined-Space Entry
- Hard Hat Policy
- Vehicle Operation Policy
- Seat Belt Policy
- Excavation Safety Policy and Program
- Injury Reporting Policy
- Joint-Loss Management Committee
- Personal Protective Equipment (provided for the employee)
- First-Aid, CPR and AED (First-aid supplies are available in crew areas and vehicles)
- Flaggers
- Emergency Action Plan
- Defensive Driving Program

Training records are maintained for each employee at the Public Works office. The LMC and WRF divisions maintain appropriate safety equipment including: protective clothing, safety glasses, hard hats, gloves, harnesses, tripods, hoists, and fire extinguishers. The division also maintains and calibrates atmospheric testing equipment. Lights, barricades, signage and exhaust fans are also available at the Public Works facility and also on-board the Department service vehicle.

d. Customer Service

The Hanover Water Reclamation Facility {WRF} is open to public, private and institutional groups for tours. Annually the facility averages around 30 groups. Many are recurring groups that have built it into their curriculum activities. Informative text is provided in the annual budget as well as the annual Town report outlining current, past and future activities and planning. The WRF has also participated in “A Day Without Water”, NHWPCA “Clean Water Week”. Staff have also provided off-site informational training for residents and other wastewater professionals.

Hanover has established protocols for informing the public if/ when services will be affected. This is typically done through person-to-person contact, phone calls and web page notifications.

1. Complaint Management Program

Complaints and requests are received by various means. Phone calls, e-mails, other DPW divisions and in-person accounts are all typical for community and department communication. Regardless of the nature or means of receipt, all complaints and requests are relayed to the LMC division or the Operations Manager. An aggressive response, diagnosis and repair plan is initiated. The Town is in the process of developing an online work order system which will allow for all complaints to be assigned and tracked. The work order system will allow the detailed information to be tracked and work to be assigned to the appropriate staff.

Once a complaint is assigned, our field personnel perform an investigation. If the problem cannot be immediately resolved, DPW will generate a work order to take appropriate action for permanent correction of the problem. If the Town of Hanover is not responsible for correcting the problem, the DPW will provide the complainant with guidance on a recommended course of action. Once an investigation has been completed, the staff enters closeout information into the work order system.

2. Public Information and Education Program

Hanover uses a variety of outlets for providing information and education to residents/customers. The outlet(s) used to disseminate information is often based on the type of information and the targeted audience. Hanover routinely uses the outlets listed below to help provide its citizens with the most up-to-date information possible:

- Hanover website-ordinances, rates, notices and capital improvement information
- Hanover Annual Town Reports
- Public Hearings
- Personal Visits/Phone Calls
- Door Hangers
- Customer Mailings
- Neighborhood/Town Hall Meetings
- Hanover Selectboard

The Hanover community consists of an atypical population dynamic due to the presence of Dartmouth College (transient student population) and the region's largest hospital, Dartmouth-Hitchcock Medical Center. As such, the local populace is comprised of an educated and actively-involved public. Throughout the year, the Town has a number of facility field trips for school groups and various committees/groups in the community.

Additionally, a number of other sources of information and activities are available for the public and business-owners to utilize. Copies are generally available at the Water Reclamation Facility as well as Town Hall and the Public Works facility.

Outreach Information (source) and Activities:

- Town Building Permits contain questions as to how the water and wastewater needs of the project are being managed—based on the building information, the Town provides applicants with appropriate information.
- Sewer Use Ordinances
- Industry Pretreatment Requirements
- Sewer Use Rates
- Grease Handling and Disposal Information (NHDES)
- Service Connection Requirements

e. Information Management and Geographic Information Systems

The Town of Hanover is currently transitioning from an Excel-based spreadsheet to manage information on our collection system to an online Geographic Information System (GIS). Some of the data is being integrated into the Town's work order program as well. The table below shows some of the collection system information that is included in our GIS.

Collection System Map Information Included in Hanover's GIS:

Attribute Fields in Sewer Manhole Table:

TOH_ID	LOCATION	INVERT_MAT
FEAT_TYPE	INSTALLED	INSP_DATE
_ID Char	MATERIAL	INSP_TYPE
GRID_LOC	FRAME_SIZE_IN	COVER_COND
CC	RIM_ELV_FT	SHELF_COND
CLD_ID	INVERT_DEPTH_FT	FLOW_COND
OWNER	INVERT_ELV_FT	INFILTRATN

INL1_DIA_IN	INL3_DIA_IN	OUT1_DIA_IN
INL1_FR_DR	INL3_FR_DR	OUT1_TO_DR
INL1_FR_ID	INL3_FR_ID	OUT1_TO_ID
INL1_DROP_FT	INL3_DROP_FT	OUT2_DIA_IN
INL2_DIA_IN	INL4_DIA_IN	OUT2_TO_DR
INL2_FR_DR	INL4_FR_DR	OUT2_TO_ID
INL2_FR_ID	INL4_FR_ID	NOTES
INL2_DROP_FT	INL4_DROP_FT	SOURCE

Attribute Fields in Sewer Lines Table:

TOH_ID	TO_ID	FROM_ELEV_FT
FEAT_TYPE	INSTALLED	TO_ELEV_FT
_ID	DIAMETER_IN	LENGTH_FT
GRID_LOC	MATERIAL	AV_SLOPE
CC	SLIPLINED	NOTES
FLOW_TYPE	FLUSHED	SOURCE
FROM_ID	TO_DIR	

Attribute Fields in Sewer Pump Station Table:

TOH_ID	CLD_ID	TRANS_SMH
FEAT_TYPE	LOCATION	EM_GEN
_ID	ELEC_SERV	NOTES
GRID_LOC	PUMP_STATS	SOURCE
CC	POLE_NUMB	

Also links to All Pump Stations Specs.pdf and pump station schematics ex:PS#5 Sections.pdf

Attribute Fields in Sewer Syphon Table:

TOH_ID	INSP_DATE	OUT1_DIA_IN
FEAT_TYPE	INSP_TYPE	OUT1_TO_DR
_ID	COVER_COND	OUT1_TO_ID
GRID_LOC	SHELF_COND	OUT2_DIA_IN
CC	FLOW_COND	OUT2_TO_DR
CLD_ID	INFILTRATN	OUT2_TO_ID
OWNER	INL1_DIA_IN	NOTES
LOCATION	INL1_FR_DR	SOURCE
INSTALLED	INL1_FR_ID	
MATERIAL	INL1_DROP_FT	
RIM_ELV_FT	INL2_DIA_IN	
INVERT_DEPTH_FT	INL2_FR_DR	
INVERT_ELV_FT	INL2_FR_ID	
INVERT_MAT	INL2_DROP_FT	

Attribute Fields in Emergency Generator Table:

TOH_ID
FEAT_TYPE
_ID
GRID_LOC
CC
STRUCTURE_SERVED
LOCATION
OUTPUT_KW
FUEL_TYPE
TANK_CAP
GPH
RUN_TIME
MAKE
MODEL
SERIAL
INSTALLED
LAST_INSP
NOTES
SOURCE

Force Mains are not a separate layer. They are indicated in the "type" field in the Sewer Lines table.

Assets are managed using real-time online websites for GIS (currently Maps Online) and materials and equipment (Facilities Dude). The information includes:

General

- Parts Inventory
- Equipment and Tools

Collection System

- Collection System Mapping
- Collection System Inventory
- FOG Compliance
- Flow Monitoring
- SSO/Emergency Response

Maintenance Program

- Routine and Priority Planned Maintenance (cleaning, etc.)
- Inspection Scheduling and Tracking
    - Manhole
    - Pipeline [Closed Circuit Television (CCTV), camera]
    - Pump Station
- Work Orders
- Monitoring/Sampling Scheduling for FOG
- Vehicle Maintenance

Customer Service Program

- Complaints
- Customer Service Response

Any activity performed by department personnel is generated and tracked through the online work order and GIS system. The work order system produces daily digital work orders for the performance of routine maintenance as well as repairs and corrective actions in response to inspection findings or customer complaints. Upon completion of the task(s), data related to the work order is entered into the Maintenance Edge online work order software for tracking performance and historical information on pump station equipment, manhole servicing, interruptions and related collection system responses.

Our work order and online GIS programs are cloud-based. The systems are backed up daily and both are access-restricted. Passwords are provided to Town employees designated for access, at various levels. Administrators restrict ability to modify information, review critical details and share information.

f. Legal Authorities and Controls

1. Sewer Use Ordinance

Hanover has established and implemented regulations regarding the use of the wastewater collection system. Hanover has operated with a comprehensive sewer use ordinance, consistent with EPA's model ordinance, since 07/31/1987. As regulations and requirements have changed, Hanover has adopted additional ordinances to address the issues and needs. Ordinances (Appendix B Sewer Use Ordinance) are kept up-to-date and are available

electronically at http://www.hanovernh.org/sites/hanovernh/files/uploads/ordinance_14_-hanover_municipal_sewer_system.pdf.

The items addressed through our sewer ordinances include: sewer use and standards, access to pipelines and structures, FOG management, pretreatment requirements, service connections, hauled waste/septage, user rates, permitting of flows into the system, inflow/infiltration control, enforcement of proper design, installation, and testing standards, and inspection requirements for new and rehabilitated sewers. Hanover also has an Inter-municipal Agreement (IMA) (Appendix E) with the City of Lebanon, NH to accept sewer flows emanating from certain geographic areas in Lebanon. Hanover reviews the adequacy of user rates annually (see Ordinance #14, Appendix 3-Sewer Rental Rates and Charges pages 70-75).

2. Joint Sewer System Agreement

Hanover has an Inter-municipal Agreement (IMA) that allows the conveyance of wastewater from sections of the City of Lebanon sewer collection system since 09/02/1969. The agreement was last amended on 10/09/2012. The main items in the agreement are described below:

- Hanover has authorized the City of Lebanon to discharge up to 0.65 million gallons per average day (MGD) of wastewater, and a peak daily flow from "Gile Tract Watershed" (Rte. 120) of 0.90 MGD and from Route 10 0.187 MDG (total of 1.087 MGD). In addition, Hanover has authorized up to 1,050 5-Day BOD pounds per day (lb/day) and 945 lb/day of TSS.

- The City of Lebanon retains ownership of sewers within their corporate limits as well as maintenance and repair responsibilities to designated manholes in Hanover.

- The City of Lebanon is assessed an annual sewer charge updated each May after Town Meeting is held. The sewer maintenance service charge includes: costs for sewer maintenance flow monitoring, inspection and maintenance, wastewater treatment, and contribution to the sewer reserve fund.

- The City of Lebanon is responsible for the maintenance and repairs for the sewer system within the Lebanon City limits, including any portion that conveys flow to the Hanover Water Reclamation Facility. Maintenance and repairs include routine inspection, rodding, unplugging or flushing, as well as CCTV inspection of their own collection system.

- Lebanon is responsible for determining the annual sewer maintenance service charge to Lebanon users. The sewer maintenance service charge includes: costs for sewer maintenance, wastewater treatment, and a sewer reserve fund.

- Lebanon is required to adopt, and from time to time revise, a Sewer Use Ordinance, local limits, and an Industrial Pretreatment Program as restrictive as Hanover's Ordinance.

- To date, Hanover has not encountered legal issues regarding wastewater flow from Lebanon.

2. GENERAL INFORMATION ABOUT THE HANOVER SANITARY SEWER SYSTEM

a. Wastewater Treatment and Collection System Description

Hanover's first formal wastewater collection system dates back to the 1800s with the first wastewater treatment facility being constructed in 1969. The collection system transports wastewater to the treatment facility (Water Reclamation Facility), located at 121 South Main Street, behind Pine Knolls Cemetery.

The oldest portion of the system is in the downtown (former Hanover Precinct), which includes the areas in the vicinity of North & South Main Streets, parts of East and West Wheelock and the small neighborhood to the southwest of South Main Street and West Wheelock. This area corresponds to the highest density of commercial customers as well. In 1969, Hanover constructed a primary treatment facility to treat wastewater. In 1986, Hanover upgraded the treatment facility to a 2.3 MGD activated sludge treatment facility that provides secondary wastewater treatment for both communities. The last major upgrade of the wastewater treatment facility was completed in 2013 and included anaerobic digestion rehabilitation, process pumps, methane collection and use, dewatering, SCADA, HVAC and electrical upgrades. The treated wastewater is discharged to the Connecticut River; NHDES designated Section [NHLAK801040402-03].

Hanover and the City of Lebanon each own and maintain the wastewater collection system within respective jurisdictions. Hanover's collection system includes 4 municipally-owned pump stations and approximately 45 miles of sewers, ranging in size from 6 inches to 20 inches in diameter. Hanover also has 1 private pump station at Kendal at Hanover that Hanover is responsible for maintaining. Additionally, there is a private pump station at the Storrs Pond Recreational Facility owned by the Hanover Improvement Society.

Hanover does not own or maintain any portion of the sewer laterals, mains or manholes that drain each privately owned parcel. However, Town crews assist property owners in the prevention of backups and spills on their properties.

LMC staff and contractors perform planned maintenance tasks at scheduled frequencies. Frequencies are established based on experience and collection system information to

minimize the risk of blockages or equipment failures that could lead to sewer overflows. Some portions of the wastewater collection system are maintained more frequently than others based upon past history of the effective operation of the wastewater collection system.

b. Collection System Details

- Service Area: 5.1 Square miles
- Population Served in primary community: 8,600
- Population in interconnected community: 800

System Inventory owned by Hanover:

Miles of Gravity Sewer	Miles of Force Main	Number of Manholes	Number of Pump Stations		Number of Siphons	Number of Air Relief Valves
			Public	Private		
41	3	1,244	4	1	4	0

- Number of Service Connections:
  - Residential: 1,733
  - Commercial: 174
  - Industrial:
  - Total: 1,907

WWTF Flow Characteristics in MGD—2016 data:

Annual Average Daily System Flow	Average Daily Dry Weather Flow	Peak Wet Weather Flow	Treatment Plant Design Capacity (MGD) 2.3	
1.235 MGD	1.101	3.794 MGD	Average: 2.3 MGD	Maximum Flow: 7.6 MGD {peak day}

c. Age Distribution of Collection System

Hanover conducts an ongoing program to assess the structural condition and maintenance needs of the collection system as a part of our Cleaning, Inspection and Assessment program described in Section 3 and our capital planning described in Appendix G. Hanover has categorized our sewer system by age and size.

The ages of the components of our wastewater collection system are as follows:

Age	Gravity Sewer Miles	Force Main Miles	Number of Pump Stations
Post-1990	13	4	4
1966-1990	6	1	
1941-1965	8		
Pre-1940	15		

d. Length of Pipe by Diameter:

Pipe Diameter	Material	Length
4”	AC	195’
4”	VC	85’
4”	DI	52’
4”	PVC	542’
6”	VC	21,017’
6”	DI	21,510’
6”	PVC	2,807’
8”	VC	90,854’
8”	AC	8,952’
8”	DI	13,691’
8”	PVC	37,433’
10”	VC	1,529’
10”	DI	5,365’
10”	PVC	1,359’
12”	VC	2,559’
12”	DI	5,170’

Pipe Diameter	Material	Length
12”	PVC	5,179’
15”	VC	5,777’
15”	DI	1,153’
15”	PVC	1,774’
16”	VC	412’
16”	DI	21,629’
18”	AC	201’
20”	DI	4,509’
2 FM	PVC	380’
6 FM	DI	3,191’
10 FM	DI	1,412’
12 FM	VC	960’
Total		**259,612’**

e. Sanitary Sewer Overflow History

Hanover has experienced 5 sanitary sewer overflows (SSOs) since 2011. Appendix K describes the overflow dates, locations, quantities and causes.

To assure sewer capacity, Hanover has developed programs to address capacity, inflow/infiltration, and condition of our collection system.

f. System Map

A map of the system is shown in the figure below. The map is a work-in-progress being updated constantly with releases of updated information at least semi-annually. Beginning in 2012, the Town of Hanover began developing and maintaining GIS data layers. In 2012, CLD was hired to GPS all sewer manholes. Town staff continues to collect and update collection system information and update GIS data. The data is added on a quarterly or less-frequent basis depending on the ability to collect information (weather and construction schedules related).

The map is also available on the web at: https://www.mapsonline.net/hanovernh/toh_basemap.html.

3. CLEANING, INSPECTION AND ASSESSMENT PROGRAM

In 2012, Hanover began development of a preventive maintenance plan (PMP). This includes a cleaning, inspection, and assessment program to assess the maintenance needs and structural condition of the entire collection system. The goal of this program is to complete the entire system assessment within 5 years.

The cleaning, inspection and assessment efforts are performed by LMC and/or private contractors, as needed. All data is entered into field logs or data collection sheets and then submitted for quality assurance and computerized data entry into the GIS system.

Hanover began the cleaning, inspection and assessment program with a focus on the known problem areas and the older sections of the system. Historic knowledge of the condition of the system has been used to adjust the cleaning schedule frequency for identified problem areas.

The cleaning, inspection and assessment program includes: sewer cleaning, CCTV inspection of piping, visual inspection and classification of manhole structures and flow channels, an evaluation of the condition of the pipes and manholes, and I & I investigations. Results from the assessment program are used to categorize the cleaning and inspection frequencies and possible repair or replacement of pipe for both the sub-areas and problem pipe sections (described in more detail below and in Gravity Line Preventive Maintenance, Section 4).

The cleaning and CCTV schedules are closely coordinated. Hanover's goal is to have a complete cleaning, inspection and system assessment every 5 years, approximately 5 percent of the system is reviewed by CCTV each year. Approximately 25 percent of the system is cleaned annually: the cleaning performed each year includes the priority cleaning plus 25 percent of the remaining parts of the collection system, factoring in the intermediate and long-term interval cleaning schedules. Most of the system cleaning is for gravity lines, as described in more detail in section b, below.

Information from cleaning and inspections (see Inspection section, below), including any findings, is entered into data collection sheets, and incorporated into an online maintenance program for scheduled maintenance and capital improvement. This information is also used to update this long term Preventive Maintenance Plan (PMP).

a. Cleaning

Our primary sewer maintenance activity is sewer line cleaning. The Hanover service area is divided into 5 sewershed areas as shown in the figure above.

The cleaning of sewer lines, manholes, siphons and other appurtenances is categorized as: priority (annual or more frequent cleaning); intermediate (2-5 year interval); or long term (6 or more year interval).

Cleaning Schedules—Priority Cleaning

Pipe sections on a priority cleaning frequency are identified based on known trouble spots and Critical Service Area lists. The trouble spots have a history of blockages or overflows as noted in the table below.

Collection System Inventory of Trouble Spots and Schedule for Priority Monthly Cleaning:

Tax Map #	Location	SMH#	to	SMH#	Distance	Problem
22	West Street (sidewalk)	523		524	160’	Flat pipe/low cleansing velocity
23	Brockway Road	377a	Upstream		100’	Roots
23	Currier Street	173		173A	112’	FOG
23	Currier Street	173	Upstream		375’	FOG
33	Allen Street	156		157	280’	FOG
33	North Main	417		418	220’	Roots/debris
33	School Street	157	Thru 158	159	210’	Grease
33	School Street	159		159A	340’	Grease
33	School Street	159		Thru	161	Grease
34	East Wheelock	482		483+	290’	Roots and debris
34	South Main/ CVS	191A	Thru 192	193	470’	Grease
34	South Main Street/Molly’s	193		193A	255’	Grease
34	South Main Street	193	Thru 194	195	480’	Grease
34	Lebanon Street/Loading dock	473	Thru 474	475	289	FOG
37	Choate Rd	328		329	272’	Roots and debris
37	Occom Ridge	531		532	227’	Roots and debris
39	Valley Rd	502		601	217’	Flat pipe
22	Weatherby Rd	265		265A	250’	Low cleansing velocity
46	Fletcher Circle	827		827	243’	Flat pipe/low cleansing velocity
46	Fletcher Circle	814		815	345’	Flat invert in SMH 814

The Critical Service Areas listed below, locations where sewer malfunctions would lead to major disruption, are inspected and maintained at greater frequency due to the importance of their function. Inverted siphons of all diameters are typically treated as trouble spots and receive higher frequency care due to potential grease build up and/or debris settling.

Collection System Critical Service Areas:

Component	Location	Description	Cleaning Schedule	Contact #
Critical Facilities Served				
DHMC hospital, Elderly housing, nursing homes and retirement communities	Lebanon Street, Park Street, Lyme Rd	FOG, continuous high flow	SA/A	DHMC 603-650-5000 603-643-2222 (Hanover Dispatch)
Hanover High School, Richmond Middle School, Bernice A Ray Elementary School	Lebanon Street, Reservoir Rd, Lyme Rd	Continuous high flow	SA/A	603-643-2222 (Hanover Dispatch)
Restaurants and cafes	Mostly in the downtown area	FOG and debris	M/Q	603-643-2222 (Hanover Dispatch)
Dartmouth College	Throughout the town	FOG, roots and debris	M/Q	603-643-2222 (Hanover Dispatch)

Cleaning—Gravity Lines Routine Cleaning

This section details schedules for the routine cleaning of each sub-area of the collection system.

During the first cycle of the Cleaning, Inspection and Assessment program, each pipe and manhole is evaluated to determine cleaning frequency. Our push camera and visual

inspection is used to evaluate each sewer line to determine the need for cleaning and/or a CCTV structural inspection. A pipe section that has not been cleaned in over 5 years, but has been evaluated using the push camera and shown that cleaning is not warranted, is assigned to the long-term cleaning frequency (5+ years). If the camera evaluation indicates a need for cleaning, the pipe section is put on the intermediate cleaning frequency. The cleaning schedules for other pipe sections in the sub-area will determine whether the cleaning frequency will be closer to 2 years or 5 years.

The priority cleaning schedule (described above) includes approximately 5,200 linear feet of sewer; the intermediate schedule changes frequently based on findings of our routine inspections, and the long term schedule is the remaining lines that have shown no issues or are newer additions to the system. Hanover's sewershed areas consist of two basic areas. The first is the gravity segment that flows to pump station 5 and the second segment is the section that flows via gravity to the treatment plant.

The sewershed that runs directly to the treatment plant has the highest percentage of sewers on the priority cleaning schedule due to the number of restaurants and potential for grease blockages. In other sections of our gravity sewer, the routine cleaning schedule is listed in our database and revised as necessary based on findings and as reported by the crews to the supervisor.

Sewershed Area Name	**Pipe Diam. (in)**	**Length of Segment (lf)**	**Pipe Material**	**Notes**
Sewershed Area 1				
Upper Lyme Rd, Dresden area, Rip Rd, Grasse Rd developments, Hemlock, Ledge, Pine and Heneage Roads	6",8"and 10"	Approximately 95,000	VC, PVC, AC, DI	Suspected minor I & I in these areas. One of our routine monthly flushing segments is in this shed area
Low, Haskins, Rayton, Kingsford, Valley Rd areas	6",8"and 10"	42,000	VC, PVC, AC, DI	Root intrusion issues and flat pipe runs are apparent in these areas. One of our routine monthly flushing segments is in this area.

Sewershed Area 2				
Dartmouth College, DHMC Hospital, all of North and South Main St, South and South East parts of town	6",8", 10, 12" 16"	110,000	CI, VC, PVC, DI, CI	A few suspected areas of root intrusion. FROG issues are repeatedly apparent.

All cleaning records are kept in a database that tracks the following:

- date, time and location of cleaning activity;
- specific lines cleaned;
- Identify any problems or concerns

Each line segment cleaned is identified by an upstream and downstream manhole number. A data sheet is submitted at the end of each week of any work or changes completed. Support from contractors such as Stearns Septic is also used for cleaning and repairs, as well as for emergencies during non-business hours.

Manhole deficiencies are also noted in cleaning logs and data collection sheets (see Section b, below). Information about manholes requiring attention is provided to the Director of Operations and either a repair work order is issued or it is added to the capital repair schedule. Manhole condition is assessed by our maintenance crew along with how soon repairs are needed.

b. Pipe and Manhole Inspection

Planned manhole and pipe inspections are coordinated with the cleaning program and generally follow the cleaning schedule. The cleaning, inspection and assessment program goal is to inspect and clean the entire collection system within 5 years. Prior to cleaning, Hanover uses its own Snake Push Camera to screen a pipe section to determine the cleaning frequency and whether a full CCTV screening is necessary to assess the pipe for structural or other deficiencies to document:

- the structural condition of the pipe
- root intrusion
- grease

- protruding taps
- evidence of inflow and infiltration (I/I) or surcharging
- buried manholes, and
- other deficiencies that factor into condition assessment

In the event an obstruction is encountered, the blockage is immediately removed and service is reinstated. After the obstruction is removed the line is evaluated with the push camera again to determine if an inspection with a CCTV crawler is needed to assess the condition of the pipe.

All newly-constructed sewer lines are required to be CCTV inspected by the contractor or developer to verify as-built drawings and ensure the line has no construction defects. Additionally, all new pipes are pressure-tested and manholes are vacuum tested to ensure tightness and prevent release of sewer odors and future infiltration of storm and ground waters. This inspection and testing process must be completed prior to backfilling and before Hanover will accept the infrastructure. In addition, new construction is required to submit an as-built plan documenting the construction effort prior to final acceptance of the work. Once the as-built drawing is received a field GPS survey is conducted and the infrastructure in added to our GIS.

The following table lists the schedule for the types of cleaning and inspections that are performed.

Combined Routine Cleaning and Inspection Schedule:

Description	Priority	Information on Asset	Monthly	Semi-Annual	Annual	2-5 Year	>5 Year
See monthly flushing schedule	H	Past blockages and root intrusion	C & A				
See root cutting schedule	H	Root intrusion causing past overflows			RC		

Description	Priority	Information on Asset	Monthly	Semi-Annual	Annual	2-5 Year	>5 Year
Sewershed area 1	NC	Suspected I & I, Roots, Older barrel block constructed manholes		I/I, G	G, S, L	C & A	
Sewershed area 2		FOG, high flow, roots, old pipe, old brick manholes			S, L, G	C & A	

Table Legend:

Priority: High (**H**); Non-critical (**NC**)

Work Codes: Clean and Assess (**C & A**); Rodding (**R**); Jetting (**J**); Root Cutting (**RC**)

Visual Inspections: Inspect General condition and overflow evidence (**G**); Inspect for surcharging evidence (**S**); Inspect for loose bricks/mortar (**L**); Inspect for evidence of I & I (**I/I**)

Manhole inspections help keep our asset inventory up-to-date and are used not only to update collection system maps, but to determine structural condition. During manhole inspections, field crews take a complete inventory of each manhole including construction materials, ring size, depth to invert, flow conditions and evidence of problems according to the checklist in Appendix C—Forms. Information is recorded on data sheets and then transferred to our database and used to schedule maintenance and repairs.

Manhole inspection results are reviewed for condition rating. Manholes receiving a high priority rating are repaired immediately, and routine repairs are coordinated with re-paving work (see Section 5). When repairs are recommended, as described below, work orders are created and entered into.

Hanover's LMC division is responsible for completing structural repairs to manholes. Repairs include invert work, frame and cover grade adjustments and replacements, as well as rehabilitating manhole cones and risers. More comprehensive repairs, such as complete relining of the manhole structure, are performed by qualified contractors. Hanover maintains

an inventory of frames and covers. Work is completed based on priority as noted on work orders which are tracked and completed in our work order database.

c. Assessment

While routine cleaning and visual inspection are used to assess the condition of manholes and surface facilities, CCTV video inspections are the primary method used to assess the condition of the sewer pipes. All records are entered into our asset management system.

The results from routine inspection and monitoring are used to prioritize areas needing CCTV inspections to assess pipe condition such as manholes with evidence of slow flow or surcharging. The assessment is logged into GIS and the online facilities program.

Pipe condition information is used to determine short- and long-term maintenance strategies including increased cleaning, root treatment, sewer line repair, or replacement. The condition assessment helps establish the cleaning frequency and inform Hanover's capital planning. As more condition assessment information becomes available, the priority of capital projects may change. Sewer line repair or replacement projects are also coordinated with re-paving schedules (see Section 5).

Condition assessments document the following details and deficiencies:

- Characteristics including pipe diameter, and age and type of material
- Dips in line
- Grease build-up
- Root intrusion
- Sediment accumulation and encrustation
- Structural condition, including cracks, corrosion and erosion
- Joint alignment and movement
- Reverse slope
- Obstructions
- Deformations in line

Hanover's web-based GIS system includes a defect assessment where each asset (pipe, manhole, pump, etc.) is rated for specific criteria (e.g., roots, grease, sedimentation, cracks, etc.). Based on the criteria ratings, the staff assigns an overall priority of repair or replacement for each asset.

d. Staffing and Equipment

Hanover has four (4) staff that are trained for cleaning, inspection and assessment. The staff is deployed in 2-3 person crews year-round for cleaning. Inspection work is coordinated with general cleaning and data collection.

The crew will select an area of interest based on the scheduled maintenance needs as described above. The crew will clean and inspect the system (or, in the case of preliminary evaluation, determining if cleaning is needed) within the assigned area within the specified time-frame. Crews receive training on use of equipment and how to address problems that might be encountered while cleaning the collection system (roots, fats, oils and grease, and blockages), including recognizing when outside contractor services are warranted.

Crews report back on a daily basis on progress and problems including any inconsistencies between the information contained within the GIS system and the actual sewer system. Data corrections are noted and submitted with the crew's log to the GIS personnel for data entry. As the crews perform cleaning and evaluation, the long term cleaning schedule for the entire sub-area is reviewed to determine if any lines designated for long term cleaning need to be cleaned before the crew moves to a new area.

Cleaning crews also perform manhole inspections during cleaning. This practice results in nearly one third (1/3) of the system's manholes being inspected in a typical year. On average, the LMC crew is adequate for any routine maintenance needs. Occasionally, workload warrants the need for an extra person(s). Cross-trained highway division personnel assist when necessary.

The following equipment, which are both capable of cutting roots are available for pipe line cleaning:

- High-pressure jet equipment with an assortment of attachments is used for most cleaning.
- A power rodder is used in the event of a blockage that the high pressure jet is unable to dislodge.

4. GRAVITY LINE PREVENTIVE MAINTENANCE

a. Fats, Oils and Grease (FOG)

Grease and grease-like products can significantly increase the likelihood of sewer overflows by causing blockages aggravating blockage conditions due to roots or structural deficiencies. Restaurants, cafeterias and other food service facilities, as well as industrial facilities, can

discharge grease as part of their normal sanitary flows that can, over time, lead to blockages, backups and overflows.

The discharge of fats, oils and grease (FOG) is regulated through our Industrial Pretreatment Program; however, backups can sometimes occur. Areas of the collection system with known grease problems are recognized, monitored and cleaned on a regular cleaning schedule.

Hanover began assessing FOG in the collection system in 2008, and found that most blockages occurred in the downtown area which is where most food services and dining areas are located. Although commercial facilities account for a high percentage of the FOG-related blockages, they are not the only contributors of grease to the collection system. Residences also contribute grease to the system. In 2008, the Public Works Department developed a FOG program. The purpose of the program was to minimize the introduction of fats, oils, and grease into Hanover's wastewater collection system. The FOG program includes education for commercial/industrial facilities and residences, annual inspection and periodic sewer cleaning. Details of our FOG program are found in Appendix B.

The existing sewer use ordinance grants authority to the Department of Public Works to regulate discharges to the sewer system, including grease. Hanover's sewer use ordinance prohibits discharges to the collection system containing more than 100 ppm of FOG, or at levels that interfere with the operation of the system. The ordinance also authorizes inspection and enforcement of facilities contributing flow to the sewer system. To date, the FOG program has been effective in reducing blockages due to grease.

The Town issues Industrial Discharge Permits (IDP) to all commercial and industrial grease generating facilities and requires the installation and maintenance of grease interceptors and/or automatic grease removal devices, as well as requires records of their maintenance and operation. The policy also provides for periodic inspections by the Industrial Pretreatment Program Coordinator (IPPC). In addition, the Fire Department and Health Officer inspect commercial kitchens and alert the IDPC of any potential issues. If the grease interceptor has not been maintained (with documented removal of accumulated grease and cleaning), has been bypassed, or if significant grease is discovered within the service connection, the Town has the authority to discontinue a discharge as well as provide a fine and a billing surcharge for non-compliance.

b. Root Control

Hanover currently uses mechanical means, as well as high-pressure water, to clear root intrusions. As warranted, the severity of the problem is reviewed and as necessary, the pipe section is placed on the list for priority cleaning. Cutting a tree's roots actually stimulates root growth, requiring that the treatment must be repeated every year or two. This frequency is factored into the cleaning schedules.

c. Installation and Repairs of Service Laterals to be Done in Accordance with Town Specifications

Hanover does not maintain service laterals from buildings to the sewer main (portions in the public right-of-way). Service laterals from the building to the sewer main are the property owner's responsibility. Hanover does not repair laterals that are located in the public right-of-way when responding to service complaints. If a complaint is received and the LMC field crew determines that the problem is limited to the lateral between the building and the main the owner is brought aware of this and recommended to contact private contractors for repair or cleaning.

Hanover continues to evaluate flow monitoring data to determine the amount of infiltration from laterals and will consider funding lateral rehabilitation if it proves to be cost effective.

5. EASEMENTS AND PAVING: MAINTENANCE AND ACCESS

a. Maintenance of Right-of-Way and Easements

Easements give Hanover the right to install and maintain municipal utilities on property not owned by the Town. Easements in Hanover are typically 20 feet in width, but can be substantial in length. Hanover has several sewer access easements. These easements are recorded at the Grafton County Registry of Deeds, but copies are typically available at Town Hall or the Department of Public Works. The Inventory of Sewer System Easements listed below lists the easements for the sewer collection system.

Inventory of Sewer System Easements:

Location	**Assoc. Manhole ID # *(eg GIS #)***	**Owner of Property**	**Comments**	**Type of Maintenance, Frequency, and Responsible Party**
Great Hollow to Greensboro	909 to 914	Conservation & Hypertherm		Manhole inspections. Brush and regrowth control when needed
Greensboro to Route 120	65 to 98	private		Brush control, mowing yearly
Route 120 to Brook Rd	60 to23	Conservation & private		Yearly mowing, brush cutting

Location	Assoc. Manhole ID # *(eg GIS #)*	Owner of Property	Comments	Type of Maintenance, Frequency, and Responsible Party
Low Rd to Haskins	576 to 578	private		Yearly inspection and brush cutting when needed
Haskins to Rayton	608 to 606	private		Yearly inspection, brush cutting and mowing when needed
Rayton to Kingsford	603 to 605	private		Yearly inspection and brush cutting when needed
Kingsford to Valley	586 to 588	private		Yearly inspection and brush cutting when needed
Rope Ferry to Hilton Field Lane	516 to 513	private		Yearly inspection
West Wheelock to Maple	517 to 261	private		Yearly inspection and mowing, Brush cutting if needed
South Main to treatment plant	23 to 001	Conservation		Yearly mowing brush cutting if needed
Lebanon Street to PS #3	64 to 202	School		Yearly inspection, mowing and brush cutting as needed

Easements are important for our ability to operate and maintain our collection system. Hanover's goal is that all easements remain clear of any fences, buildings, gardens, trees, shrubs and extensive landscaping, to allow equipment access for inspection, maintenance and repairs as needed. Crews are instructed to work cooperatively with the property owner to the extent possible.

Maintenance of easements is accomplished in various ways. Easements on privately-owned parcels are often maintained by the owner. The Town's Building Inspector refers construction questions to LMC as they arise. Easements on public land are maintained by the entity responsible for property upkeep, as indicated in the Inventory of Sewer System Easements

table below. All manholes are located using GIS which allows for field crews to locate them particularly within easements. Manholes in easements are inspected as part of our ongoing preventive maintenance program.

Hanover intends to begin a program to identify and improve easement access where needed.

Collection System Easements with Limited Access:

Location	**Manhole IDs *(eg GIS #)***	**Owner of Property**	**Description of Access Problem**	**Plans to Improve Access**
Buck Rd syphon		State of New Hampshire	Wet area, brush and over growth	Add gravel, cut and trim brush
Lower Esker Circle	234, 234A, 234B	Terry Hall	Over growth, wet	Cut brush, establish a road, add gravel

Hanover has a number of manholes that have been paved over, or are on plans but have not been field-located. The following list includes suspected manhole locations and the schedule for locating and uncovering them.

List of Suspected Manhole Locations to be Cleared:

Physical Location of Manhole	**Manhole IDs *(eg GIS #)***	**Description of Suspected Problem**	**Schedule for Manhole Access**	**Date for Manhole Access**
Huntley Rd	#172A	Paved over because of curbing location	Manhole scheduled for inspection and cleaning in the summer of 2016	Spring of 2016
Morrison Rd	#767	Paved over because of plow damage	Inspection needed in spring of 2016	Spring of 2016
East Wheelock	#574	Paved over	Inspection needed	Spring of 2016

b. Street Paving Coordination

Hanover's Highway department is responsible for coordinating street resurfacing and ensuring that all utilities are aware of scheduled resurfacing. A prioritized list of streets to be paved is developed on an annual basis each budget year. This list is distributed and shared with other Town departments to facilitate coordination of all underground work. Each department assesses the condition of their associated infrastructure to determine where repairs may be necessary, and notifies Public Works as to which streets need underground infrastructure work completed prior to resurfacing.

When the LMC crew obtains the resurfacing list, the streets are reviewed for the presence of sewer lines. If a street does not have a sewer line under the pavement, no further action is taken. The remaining streets are cross-checked against the results of the Cleaning, Inspection and Assessment program to identify sewer lines that may need repair or replacement prior to the paving effort. Additionally, predictable problems that are likely to develop within the lifetime of the paving treatment being proposed are assessed.

As sewer lines are inspected and assessed (see Section 3), repairs are scheduled in conjunction with the repaving schedule whenever possible. Sometimes work is performed on a priority basis so that repairs are completed on the highest priority street, working in coordination with the paving schedule. In this case, the Cleaning and Inspection schedules are adjusted to coordinate with the other relevant schedules of the divisions of Public Works. Upon completion of the sewer repairs for an individual street, it is released for resurfacing.

During paving work, LMC prepares manholes prior to the re-paving of any street with sewer lines. The manhole is first inventoried to determine if repairs are necessary. Then the frame and cover are removed, lowered and covered with a steel plate so that the milling and or paving process can continue. Once the surface work is done the manhole cover and frame are raised to grade and concreted in place.

6. PUMP STATION/FORCE MAIN MAINTENANCE

Hanover owns and operates four (4) wastewater pump stations listed in the following table.

Pump Station Locations:

Pump Station Location	Description	Inspection Frequencies
West Wheelock/Ledyard Bridge LAT:43.7045 LON: -72.298566	PS#2	Daily
114 S. Main/Brook Rd LAT:43.6937 LON: -72.290006	PS#3-upgraded in 2007	Daily
Lyme Rd adjacent to CRREL LAT:43.7266 LON: -72.273576	PS#4	Daily
16-18 Lyme Rd/Girl Brook LAT:43.7104 LON: -72.279649	PS#5-upgraded in 2009	Daily
Kendal at Hanover LAT:43.7301 LON: -72.270687	Kendal PS	Daily

The collection system also includes one private pump station. The pump stations owned and operated by Hanover are routinely checked by trained personnel. The maintenance for the one private pump station {Kendal} is the responsibility of Hanover. However, Kendal is expecting to add additional units in the coming years, at which point the pump station maintenance will either be turned back to the owner or it will be eliminated with flows being routed to pump station #4. This is expected to occur within the next five (5) years.

The performance of the Hanover pump stations is monitored through daily inspections and pump stations #3 and #5 are also connected to the WRF Supervisory Control and Data Acquisition (SCADA) system. During these inspections, a Treatment Technician or other assigned staff reviews the pump run hours, total flow, wet well levels and alarms. Back-up generators are exercised weekly. On an annual schedule, a private contractor such as Hartigan Vactor Services pumps the wet wells to allow for inspection and remove grease and other build-up.

Inspection, maintenance and repairs are recorded on checklists, logbooks at each station and logged into WRF laboratory computer which is backed-up by the Public Works server. If a problem or maintenance issue is encountered, personnel must also report it immediately directly to the Superintendent. A Computerized Maintenance & Management System {CMMS} is currently being configured and is being run through a trial phase.

The Hanover SCADA system located at our water reclamation facility (WRF) also includes the monitoring and control ability for two of the pump stations. The SCADA system has the

capability to remotely control and monitor pump station operations, as well as issue alarms to the on-call pager in the event of a malfunction or emergency. The SCADA system records most activities at connected pump stations and provides the ability for a hard-copy printout for backup documentation for select parameters. The SCADA provides continuous status of pump station operations and some user-defined fields for the following items:

- Number of pumps in operation
- Status of pumps, including operational alarms
- Current discharge pumping flow rate
- Historic discharge flow rate—totalized 24-hr flow
- Pump start/stop cycles
- Power status, including power failure alarms
- Wet well conditions: depth, lead/lag elevations
- Personnel status: entry/exit alarm exists at PS#3 only

The SCADA allows for remote monitoring of the pump stations and reduces the need for daily physical inspections at two of the pump stations. The two non-SCADA compatible stations are inspected daily as is the private station at Kendal.

Manufacturer's Operation and Maintenance (O&M) manuals for equipment are located in the WRF office.

Pump stations pump rebuilding, motor rewinds, the majority of impeller, seal and motor replacements as well as HVAC repairs are contracted to various vendors. Repairs to motor control centers, flow meters, remote monitoring equipment, valve, and macerators are typically repaired by WRF personnel. In general, any replacement parts that are difficult to acquire are kept in stock by the WRF; other parts are obtained from local vendors or the manufacturer's service center. As pumps and parts are replaced, the WRF staff is working toward standardizing pump station equipment, to the extent practical. In general, any equipment repairs required to be completed by others are returned to the OEM or authorized service center.

All service/repairs are planned to be recorded in the Town's work order system once the CMMS is established.

a. Mechanical and Electrical Maintenance

The size of the pump station and its related equipment determine its specific mechanical and electrical maintenance needs. The Maintenance Technician is responsible for incorporating the routine maintenance of each pump station into the routine operations. The Maintenance

Technician uses manufacturers' Operation and Maintenance manuals to establish action items for pump station equipment. A general description of weekly and bi-annual maintenance performed on pump stations by the Maintenance Technician and all assigned staff is listed as follows:

Mechanical Maintenance/Inspections	Electrical Maintenance/Inspections
Daily	
Review pump run hours	Ensure all breakers are on
Review totalized flow	Ensure that all switches and controls are in the correct position
Check wet well levels, check for debris, turbulence or unusual noise	Check chart recorder
Check alarms	Check Motor Control Centers (MCC)
Ensure that all switches, controls and valves are in the correct position	Check level controllers
Pick up litter, general housekeeping	Check electrical service feed
Record findings in log book	Check remote monitoring equipment
Log pump hours	Check indicator and alarm lamps
Check hydraulic levels	Check general electrical items (lighting, etc.)
Operate each pump	Check and release intrusion alarm
Check drive belt	Check lighting and HVAC
Check bearings and packing	
Check for pump vibrations, unusual noise, and excessive heat	
Check pump and pump base connections	
Check chart recorder for routine pump performance	
Check valve operations and signs of leakage	
Lube and grease equipment (as required by manufacturer)	

Check, clean and maintain property Check backup generator, exercise stand by power Check sump pump operation	
Weekly	
Pump down wet wells for inspection, cleaning Test alarming systems	
Bi-Annually	
Replace hydraulic fluids and oils (as required by manufacturer) Inspect pumps (oil levels, seals, packing, bearings, etc.) Replace packing Inspect pump impellers and clearances Inspect discharge piping Check outflow pressure Check for corrosion problems Exercise check valves Check air release valves Check floats (clean and/or replace) Inspect building and grounds Check operation of building heat and fans Inspect HVAC equipment Check building security	Inspect internal Motor Control Center components Inspect & grease electrical contacts Inspect electrical pump cables Inspect electrical breakers Perform amperage readings on equipment Check MCC for proper operations Check Generator: oil level water level [*if a level gauge is installed]* fuel level inspect hoses and belts check piping for leaks check battery condition
Annually	
Service and calibrate flow meters	Alternate Power Sources checked

Capacity and discharge head in the pump stations are reviewed annually, following confirmation that the pumps are in good working order. Changes in capacity and discharge

head are evaluated to determine whether cleaning of the force main is warranted. All mechanical and electrical maintenance activities are recorded on a log sheet, entered and tracked by the pump station logbooks.

b. Force Main Maintenance

Hanover currently has four (4) force mains in the collection system with a combined length of approximately 7,800 feet (1.5 miles). The South Main Street force main is not long enough to warrant air release valve. All air release valves and valve vaults are inspected for signs of corrosion, connection point leakage or improper operating characteristics.

The pressure on the discharge side of the pump is used to determine the need for force main cleaning. If the backpressure is more than 25 percent greater than the expected total operating head, the discharge pipe will be cleaned. Pressure gauges are calibrated during the annual inspection.

c. Private Pump Stations

Hanover currently has 2 private pump stations at Kendal and at Storrs Pond. The following table lists the private pump stations, owners and locations in Hanover.

Private Pump Stations:

Pump Station Name	Location	Owner	Owner/Operator Contact Information
Kendal	80 Lyme Rd	Kendall Retirement home	Owner – Kendal at Hanover, 603-643-8900 Operator - Town of Hanover WRF, 121S. Main St. Hanover, NH 03755. 603-643-2362
Storrs Pond	49-59 Oak Hill Drive	Hanover Improvement Society	603-643-2408

Kendal discharges an average of 53,000 gallons per day to the collection system. This privately-owned and operated pump station is maintained by Hanover staff as required. Kendal staff manage losses of power, utility costs and is responsible to notify Hanover staff of any issues in a timely fashion. Kendal staff is required to notify Hanover when the station is scheduled to have grease removed from the wet well.

The Kendal private pump station has a history of coordination and communication issues among staff representatives. At this time a record of such instances are not officially recorded.

The Storrs Pond is a minor seasonal pump station. The pump station serves a campground and related activities that are open between May and September with an average daily use less than 600 gallons.

d. Corrosion Control

The dissolved oxygen content of the wastewater is often depleted in the wet well of pumping stations. This wastewater passing through the force main not only lacks oxygen, but often contains sulfides. These sulfides have led to corrosion in manholes. Frequent cleaning and inspection of these areas is required to prevent solids and grease buildup and minimize corrosion due to the high concentration of sulfides.

7. REACTIVE MAINTENANCE

This chapter outlines the process used by Hanover to respond to non-overflow, unplanned maintenance needs in our collection system. It also provides an overview of responsibilities for emergency events. While Chapter 3 outlines Hanover's preventive maintenance program, maintenance events that don't result in overflows or backups of sewage into basements are incorporated into the regular inspection and maintenance of the collection system.

Sewer Overflow Response is always a priority. Details are provided in Hanover's Sewer Overflow Response Plan (see Appendix A). Responsibilities for reactive maintenance are assigned by the Operations Manager or Wastewater Superintendent based on level of priority for response and the locations.

a. Corrective Maintenance

Most repair needs are identified while conducting routine maintenance, inspections and assessments. Because there is such a wide range of potential unexpected events that it is not possible to prescribe the appropriate repair for every possible scenario, Hanover has established a prioritization scheme for determining the timing of repairs outlined in the table below. This is based on the types of problems that have occurred in the collection system in the past or could occur in the future. While this contingency analysis focuses on system upsets that would not result in immediate sewer overflow, the response timing is based on the potential for a resulting sanitary sewer overflow. Overflow response is covered in Appendix A.

Low-risk items, such as light bulbs or broken hand tools, and small non-critical valves, are planned for run-to-failure, and as such, are not part of the PM Program. These items are replaced when they fail. When assets critical to the process fail, they are scheduled for

corrective maintenance either on an urgent or routine schedule. Some of these repairs are handled under the operations and maintenance account, and some must be put in as capital improvements as part of our asset management activities depending on asset cost and life expectancy. Assets valued at greater than $10,000 and with a useful life of greater than 3 years are included in the capital budget.

Corrective maintenance repairs include (but are not limited to):

- cleaning to eliminate flow problems that are noted during inspections
- spot repair or replacement of a pipe that shows signs of deterioration
- replacing a rattling or failed manhole cover
- repairing or replacing a pump that is becoming clogged or has been damaged by debris
- responding to, investigating and mitigating customer complaints (see the SORP, Appendix A, for response to complaints of sewer overflows)
- repairing system parts subject to vandalism

b. Scheduling

Scheduling of repairs runs the range from repairing components found to be in substandard condition during inspection, immediate repairs to pump stations that are malfunctioning, to major, capital-intensive repair projects, such as a manhole-to-manhole pipe replacement or rehabilitation (see Appendix A for manhole to manhole pumping on an emergency overflow). An emergency, however, always supersedes scheduled maintenance. Timing of other repairs is done by annual assessment and prioritization based on effect of possible failures. Major replacement or rehab has been integrated into our capital replacement plan as part of the Town's capital improvement program (CIP).

Collection System Non-Emergency Response and Repair Priority:

Problem	Response Time	Action	Repair Time Goal
Pump failure at a pump station	Within one (1) hour of initial alarm.	For SCADA linked stations—log in upon receipt of alarm and confirm lag pump operation. Review existing conditions to evaluate if site visit is required. For non SCADA stations—a site visit is required.	Within one working day.
Pipe integrity failures, pipe separations	Within one hour of initial report if exfiltration is suspected. Within one day otherwise.	Repair with our own equipment and supplies unless the situation is deemed beyond our abilities. Then a contractor will be hired.	Within one day if exfiltration is suspected. Within one week otherwise.
Manhole cover collapse or failure in manhole integrity	Within one day.	Repair or replace anything that may create a SSO in the near future.	Within one day.
Failure of backup generator	Such a failure is critical and will be addressed immediately.	Hanover Fleet services shall be notified and repair will be handled internally or by authorized service contractor.	Within one week.
Rattling, loose or broken manhole covers	Within one day.	Repair or replace.	Within one day.

c. Tracking and Recording Repairs

Line Maintenance personnel document corrective maintenance needs in the data collection program when completed and then sheets at the time of the event. Corrective maintenance tasks are recorded and entered into our GIS system. CCTV or other failure analysis may also be

done by staff as a corrective maintenance task after a problem occurs when routinely inspecting pipe and manholes or if there is a backup complaint to diagnose the cause of the problem and recommend repairs and schedule changes if needed. Findings may lead to a spot repair of the pipe, root cutting, root foaming with an herbicide, re-cleaning for grease or debris removal on a periodic preventive basis, and if so, these tasks are included in an update of our schedule as described in Section 3, Cleaning, Inspection and Assessment.

d. Complaint Response

Collection System and Service Complaints

The LMC crew is responsible for responding to sewer service complaints. Complaints are generally related to sewer stoppages, overflows, or odors. Response is performed by the LMC crew at all hours. We have our 2 full-time crew members and a well-qualified contingency of 4 from the highway department to assist the line crew in emergencies, after hour calls or routine issues that may arise. The normal business hours are 7:00 AM to 3:30PM, Monday through Friday. Complaint response includes both assessing the complaint and resolving the problem. The majority of our complaints are related to odors and lateral blockages. During work hours, a cleaning crew is diverted to remove stoppages. During non-work hours, the 24 hour Hanover Dispatch Center alerts the Operations Manager of a complaint, who in turn will assign a crew to respond to the issue.

Pump Station Complaints

The WRF crew is responsible for pump station issues. Complaints are received from the Hanover Dispatch as well as from alerts by our SCADA and alarming systems. Hanover has 6 full-time Treatment Facility operators. A similar process is employed outside of normal business hours. During work hours, 1-2 WRF operators are dispatched by the Superintendent or his designee. During non-work hours, the on-call operator responds directly to the location. In the event in which a pump station has SCADA, the operator is able to diagnose the issue prior to responding. In an event in which a pump station doesn't have SCADA, alarms are sent directly to Hanover's 24 hour Dispatch Center. The emergency or complaint is relayed to the on-call operator by the Dispatch Center.

e. Reactive Response Summary

Response information—refer to Appendix A.

8. EQUIPMENT AND TOOL INVENTORY

a. Essential Day-to-Day Items

Hanover provides operations and maintenance crews with the essential work-related items they use on a day-to-day routine basis. When new or replacement equipment or tools are necessary, the Crew Leader notifies the Operations Manager or in the event of a pump station-related need the operator notifies the Wastewater Superintendent. The Operations Manager or the Wastewater Superintendent, depending on the area, will issue the crew leader stocked items. For non-stocked items, the supervisor will advise the operator or crew leader of a pre-established vendor. The operator or crew leader will then procure the requested items through the local vendor in an "in-stock" format.

b. Spare Equipment and Tools

Hanover keeps a limited supply of spare equipment and tools for personnel. In lieu of maintaining a full supply of spare equipment and tools for personnel, Hanover arranges with select vendors for essential common equipment and tools. Non-bid equipment and tools can be purchased in amounts up to five thousand dollars ($5,000.00) with approval of the Operations Manager in the case of collection system-related items or the Wastewater Superintendent in the case of pump station-related items.

The large equipment and tools needed for certain tasks such as deep manhole replacement are obtained through current rental contracts or purchased through the Finance Department with approval of the Director of Public Works.

An inventory of the equipment, tools and materials used by Hanover to maintain the wastewater collection system is maintained in our online work order and maintenance software. Specialized attachments are often used with these tools to perform specialized maintenance tasks such as root cutting and jetting heads. A list of current equipment and tools is available in Appendix L.

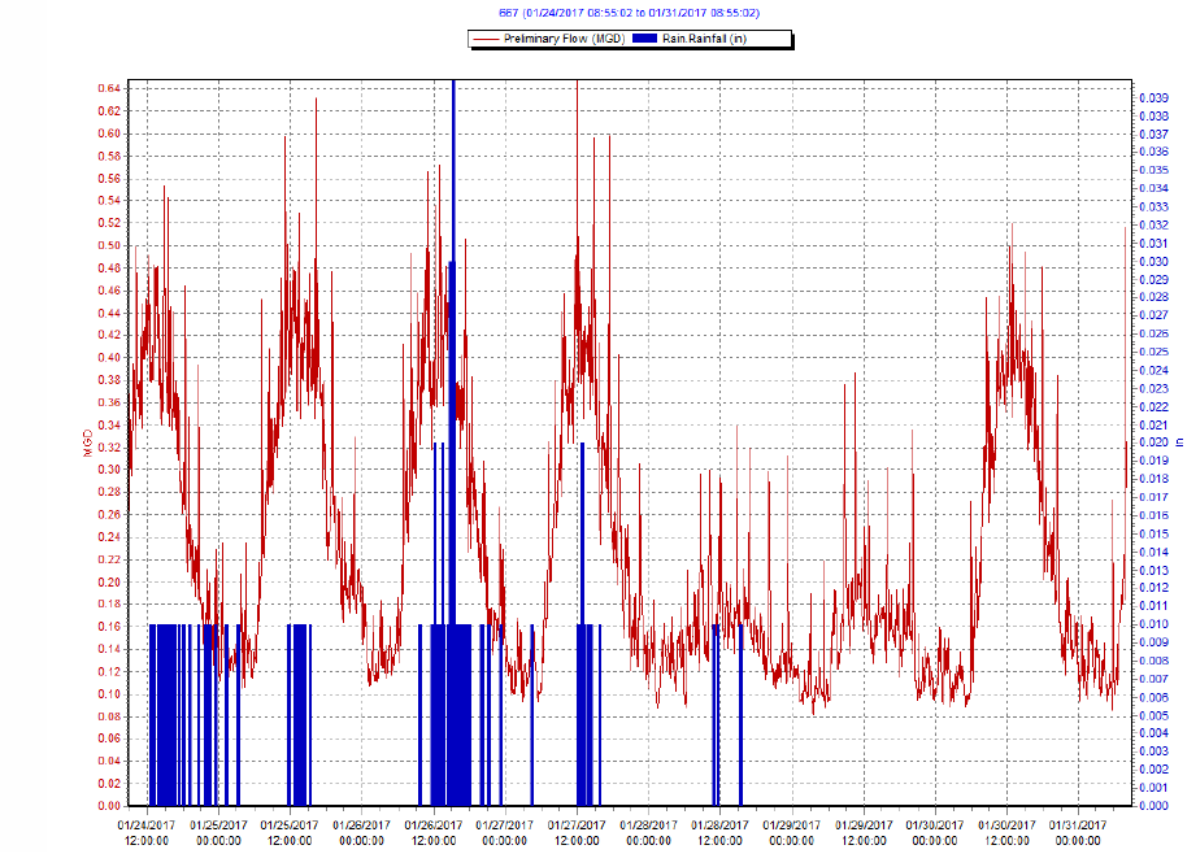
9. CAPACITY MANAGEMENT

a. Capacity Background

Hanover's collection system has not exceeded design capacity to contain wastewater flows from the town. While there have been historic inflow issues is sections of the City of Lebanon Route 10, recent modifications appear to have rectified this issue. Real-time flow and rainfall monitoring was installed in 2016. Flow monitoring occurs at all Lebanon connections to the Hanover System. There are inflow issues that are being investigated in the Pump Station #5

catchment area that we continue to investigate. The following tables and discussion summarize the state of our system capacity to carry and contain flows.

Example of flow monitoring:



Hanover is in the process of developing a list of collection system and building overflows/backups to assess the collection system capacity.

Hanover has implemented the following measures to remedy and/or alleviate potential overflows:

- Structural rehabilitation measures, i.e. elimination of pipe restrictions; elimination of storm sewer--sanitary sewer cross connections; storm sewer catch basin redirection; manhole, sewer, and private lateral replacement; pump station expansions; etc.
- Implementation of private extraneous flow incentive or disincentive programs
- Increased cleaning to maintain collection system capacity
- Implementation of Fats, Oils & Grease programs {2008}

- Quarterly review of flows received from satellite communities
- Implementation of sewer/DPW reviews of building permits

b. Sewer Capacity Certification/Connection Policy

Sewer Capacity Certification is a process where any new development requiring the connection of its sanitary sewer service to the Hanover sewer system is reviewed to determine whether adequate sewer system capacity exists to convey the new wastewater flow from the proposed development to our wastewater treatment facility. A capacity certification analysis by a professional engineer is required for all developments greater than 5,000 gallons per day. In addition, Hanover requires applicants of multi-family, commercial or institutional discharges to assess the downstream collection system to determine potential capacity restrictions. If restrictions or limitations are identified applicants are required to provide necessary improvements that will enable new or substantially modified flows to be accommodated.

The connection fee for newly-constructed homes and renovated and newly-constructed businesses are required to pay a sewer capacity charge based on the value of capital assets divided by the Water Reclamation Facility capacity. Hanover staff is in the process of a collection system analysis to determine the necessary capital improvements required in the collection system. The analysis is expected to be completed by the fall of 2018.

c. Lateral Inflow Elimination

Hanover has 44 miles of sewer mains and 20-25 miles of private service laterals. All substantial building renovations or replacement require service to be videoed and if necessary replaced to eliminate infiltration and inflow (I/I). The Hanover Sewer Ordinance prohibits non-sanitary connections to the sanitary system.

10. RESOURCES AND BUDGET

a. Budget Process

Hanover's LMC and WRF budgets are developed for adoption in the Hanover municipal budget cycle, which requires that the annual budget be completed on or about March 1st of each year. The process begins in the late fall at the department level and is submitted to the Town Manager for review in the middle-to-late December. The Town Manager reviews and makes modifications to meet the Select Board's budget target levels and submits to the Board in February.

The Selectboard holds a series of public hearings where the budget is reviewed and input is accepted from the public. As part of the process, capital items are reviewed as part of the

Capital Improvement Plan appropriations and expenditures. At the end of February to early-March the Selectboard votes on a final budget which is posted in the Town Meeting warrant and voted on during a public meeting held on the second Tuesday in May. Upon adoption by Town Meeting, the budget becomes effective on July 1 of any given year. The fiscal year runs from July 1 to June 30.

b. Rate Setting, Budgetary Policies and Financial History

The Town of Hanover's rate-setting policies are based on the following principles:

1. Rates and fees will be based on the actual cost to deliver each service.
2. Current rates must be sufficient to cover current costs and to meet all bond covenants.
3. Rates will include funding for Capital Improvement Plan projects included in an annually-updated five-year capital financial plan.
4. Contributions to and usage of fund balances are appropriated as needed. Each year, after reviewing operating costs and any other non-recurring financing uses of excess fund balance, the annual rate is determined. The Select Board's policy is retain 10-15 percent of the operating costs as fund balance. This policy is reviewed annually to ensure adequate reserves and protections as well as rate-setting is achieved.

Hanover's Wastewater Fund operates as an enterprise fund with no funds raised through taxation. The Wastewater fund's revenue is generated from user fees, connection fees from new customers, pretreatment permits, fines, engineering review and inspections, interest earnings, and other miscellaneous income.

The quarterly user charge has two components: a base charge which covers fixed costs an and a volume charge based on metered flows. The metered flow also includes a strength component charge. The entirety of the charges cover operating expenses including operation and maintenance, debt service, and capital reserve fund replenishment.

c. Historical Rate Review

Our current sewer rate structure is based on meter water usage. Customers are billed quarterly for wastewater services based on 100 percent of the metered water use. In addition to flow charges, customers are also assessed a base charge to recover fixed costs, based on meter peak capacity.

The current Preventive Maintenance program will result in minor increases in the sewer user rates. Once a comprehensive Sewer Improvement Plan has been completed a budget will be developed.

Sewer rates over the last three (3) years is available in Appendix F.

d. Operating and Maintenance Expense

The operating expenses for the LMC division are back charge to the WRF budget for labor, materials, equipment and vendors used in the maintenance of the wastewater collection system.

Operating and maintenance expenses include:

- Employee salary and compensation
- Operating supplies
- Utilities
- Repair and maintenance
- Professional services
- Routine capital outlay
- Debt service expenses for repair and replacement

Professional Services include planning and engineering studies for replacement projects.

Contractor Services include contractual work for cleaning sewer lines, pumping wet wells and manholes, CCTV, manhole rim adjustments related to paving, and Capacity Assessments of the collection system.

Routine Capital Outlay include items that are considered capital assets and are purchased from annual operating revenue rather than through bonds or the capital reserve fund. Routine items include: specialized maintenance equipment, pumps, motors, office equipment and other smaller items with a cost less than $10,000.

Collection System Construction & Maintenance

The operational budget includes funding for slip lining and repairs to identified sections of the collection system which have structural or infiltration issues as well as ongoing capacity assessments. In general, repairs are limited to sewer manhole replacement, short sections of main replacements, slip lining and sewer rerouting. Capacity assessments include: flow monitoring, smoke and dye testing, and videoing. Refer to Appendix D for the annual budget amount.

Debt service is the annual principal and interest payments for bonds, loans and other fiduciary instruments owed by the Town of Hanover. The debt service supports capital improvement projects.

e. Capital Improvement Program Overview

The Capital Improvement Plan (CIP) is part of the long-term CMOM planning. Once the collection system analysis has been completed, projected needs for maintaining the integrity of the collection system and expanding sewer capacity to accommodate growth will be incorporated into the CIP.

Currently, Hanover has 67 assets in the Wastewater Equipment and Capital replacement plan including pump station upgrades. Hanover develops a long-range CIP program covering a 10-year period that is updated annually. The CIP describes each proposed project, the budgeted cost for the project and the financing source(s). The CIP was primarily SRF loans and funds from the capital reserve fund.

The capital reserve funds appropriations are based on the equipment replacement and infrastructure improvements schedule. The capital reserve fund also accounts for inflation based on a 10-year average of the Municipal Cost Index (MCI) developed by the American City and County organization. The available reserve funds generally range from $300,000 to $600,000. The amount varies based on the proposed capital outlay.

f. Capital Improvement Plan

Appendix G shows the proposed CIP adopted by Town of Hanover. The CIP shows both funded and un-funded projects. The un-funded projects are included for tracking purposes and to allow for changes in the priority of the projects and as funding levels change.

The total 10-year CIP exceeds the available funds by $1,952,000. It is anticipated that as existing bonds are paid off, the bonding capacity will be available to complete the unfunded projects in future years.

Hanover currently has three (3) outstanding State Revolving Loans (SRF) with a combined principal and interest payment of approximately $642,000 which are due to be repaid by 2027.

1. Population Growth

Hanover has been growing steadily for a number of years. In the 2000 census, the population was 10,850. In 2016, the population had grown to 11,260, an average growth of 0.3 percent per year. The long-range population growth for Hanover is expected to continue at a similar rate due to the current zoning through the year 2025, reaching a population of 11,500.

2. Capacity and Fees

The service and treatment of capacity meets the needs of the current service area and provides for additional capacity to accommodate projected residential growth through the

year 2025. This service capacity includes current average sewer demands of 1.4 MGD and growth-related reserves of 0.9 MGD for a total sewer capacity for the 2.3 MGD Collection System and Wastewater Treatment Plant of 2.3 MGD. 0.65 MGD of the total Treatment Facility capacity has been allocated to properties in Lebanon as part of an Inter-municipal Agreement (IMA).

Connection fees are used to fund planned capital improvements and are set based on those plans. The current capital program identifies $10,289,750 in capital projects to meet the projected future needs. Growth over the next 20 years expected to be very modest, with the exception of increased development in Lebanon. Based on these assumptions and known capital needs the current level of $136,930 will need to increase by 176 percent to meet future capital needs of $377,400 annually. However, much of these capital needs will likely be funded through bonding utilizing the current bonding capacity within the budget.

3. Capital Facilities Projects and Financing

The total cost of the planned 67 capital and equipment projects during the 2019-2056 period is $10,298,750. Two (2) of the projects are classified as capacity projects: Pump Station #2 replacement, at a cost of $850,000 and Pump Station #4, at a cost of $800,000. Non-capacity related projects are estimated to be $8,600,000 (See Appendix G).

4. **Operating Impact of Service Capital Improvements**

The cost of operating the proposed capital improvement projects during the next five-year period is estimated at $1,560,000 (See Appendix G.).

11. SEWER SYSTEM PREVENTIVE MAINTENANCE PLAN UPDATES

a. Plan Update Process

Hanover will complete annual reviews of our Preventive Maintenance program in the month of July and this plan beginning in 2017. The review will consider the progress that has been made in developing and implementing our Preventive Maintenance Program, the results of our monitoring program described in Section b, below, and will incorporate updates to this Plan including:

- Changes to organizational structure, information management, contacts, and system maps
- Changes to information on the collection system, such as the size and age of pipes, to incorporate information on repairs completed during the year

- Incorporation of successful cleaning, inspection and assessment program improvements during the past year
- Changes to our Sewer Use Ordinance and Fats, Oils and Grease programs
- Updates to our pump station inspection and maintenance program,
- Updates as we evaluate our collection system capacity
- Budget and Capital Planning updates

As the sewer inspection history of any segment of pipe is retrievable electronically and the data is used to develop condition ratings, this will aid in the prioritization of future sewer rehabilitation projects, maintenance activities, and updating this plan.

b. Monitoring, Measurement, and Program Modifications

As noted in Chapter 1, Hanover currently maintains complaint and blockage records in a paper log and online work order software database. Hanover maintains records of cleaning and other preventive maintenance activities, and records problems (e.g., excessive debris, observed manhole defects) identified through regular sewer maintenance activities in a paper log as well as the GIS database.

The sewer inventory, mapping and maintenance database is currently under development, discussed in Chapter 1. Hanover tracks and utilizes records related to any sewer segment in our system. Using a log and the GIS system, complaints and service are recorded and linked to preventive and reactive maintenance activities.

The information available in the GIS and the SSO reporting system will be used to help measure the effectiveness of our program by tracking various parameters related to service calls and our maintenance and inspection activities. We also measure our effectiveness by comparing SSO trends from previous years and identifying system components that continually contribute to system failures. We are developing our strategy to track the following parameters with which to measure the effectiveness of this Plan and its effectiveness in reducing SSOs and meeting the goals we set (described in Chapter 1):

- Number of SSOs per year
- Volume of SSOs per year
- Number of dry weather SSOs per year
- Number of SSOs per year by cause (e.g., roots, grease, pipe failure, I/I, pump failure or other deficiency, etc.)

- Response time to SSOs and other service calls (time from call received to first responder arriving on site)
- Length of gravity sewers cleaned annually
- Actual versus scheduled cleaning dates for gravity sewers
- Length of gravity sewers CCTV inspected annually
- Record of pump station maintenance work orders completed annually
- Percent of system rehabilitated (repaired or upgraded) each year
- Number of FOG inspections and compliance with FOG requirements
- Improvements in capacity due to reductions in I/I
- Safety history/incidents
- Ratio of funds spent on preventive maintenance versus reactive and emergency response

This information will be assessed and reported in the annual Town report as well as on the Town LMC website to continue to inform citizens of our infrastructure condition. Changes to this Preventive Maintenance Plan will address issues identified through this monitoring program and during our annual update and review.