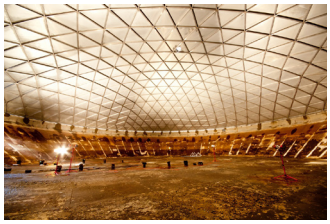



REVISED DRAFT

TASK 1 REPORT

April 2021

TOWN OF
Leicester
MASSACHUSETTS

Comprehensive Analysis of Current Conditions of Six Water & Sewer Districts, Leicester, Massachusetts

restore | enhance | sustain | maintain

Weston & Sampson℠

transform your environment

westonandsampson.com

427 Main Street, Suite 400
Worcester, MA 01608
tel: 508.762.1676




TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION / OVERVIEW

The Town of Leicester engaged the consulting team comprised of Weston & Sampson, Resilient Civil Engineering, Raftelis Financial Consultants, and the Collins Center to prepare a comprehensive study of the operational and fiscal condition of the seven water and sewer districts in the town and to evaluate potential consolidation alternatives for these districts. The following report documents our findings.

A detailed review of the current technical design and operational conditions of the water and sewer districts was conducted to provide a baseline for the evaluation of potential future organizational options available to the Town of Leicester and the water and sewer districts currently providing services within their respective District boundaries. Other sections of this report will discuss the legal and institutional organizations of each of the water and sewer districts. This section deals with the technical and operational aspects of each of the water and sewer districts as they are presently constituted and operated.

The three Water Districts currently operating within specified areas in Leicester include the Cherry Valley-Rochdale Water District (CV-RWD); the Leicester Water Supply District (LWSD) and the Hillcrest Water District (HWD). Figure 1 shows the approximate service areas of each water district.

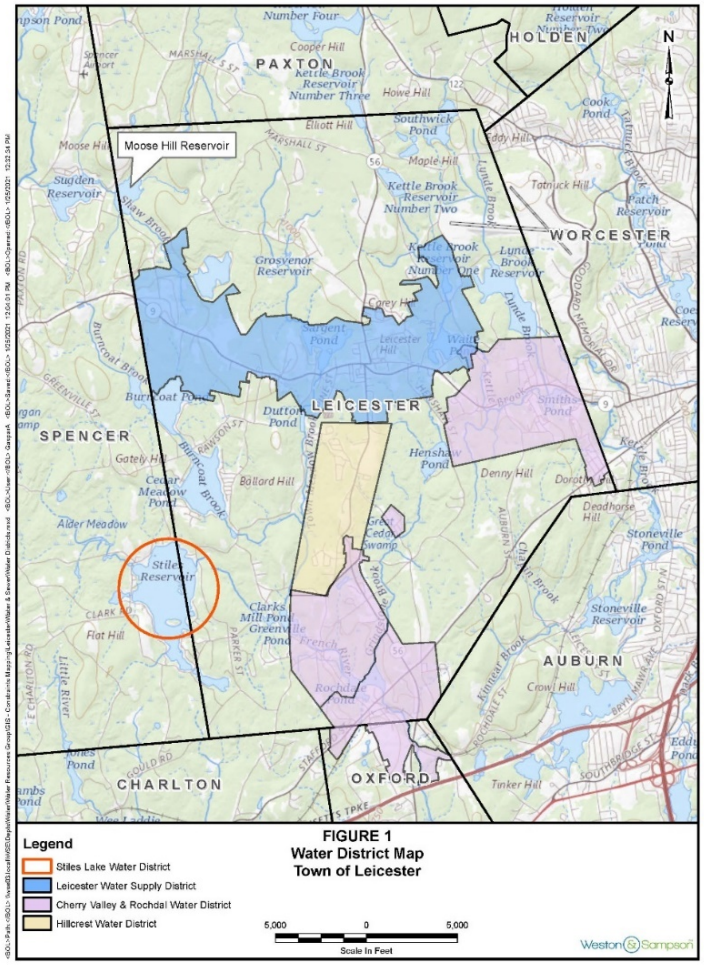


FIGURE 1
Water District Map
Town of Leicester

There are four sewer districts operating within designated service areas in Leicester including the Cherry Valley Sewer District (CVSD); the sewer district operated by the LWSD; the Hillcrest Sewer District and the Oxford-Rochdale Sewer District (ORSD). Figure 2 shows the approximate service areas of each sewer district.

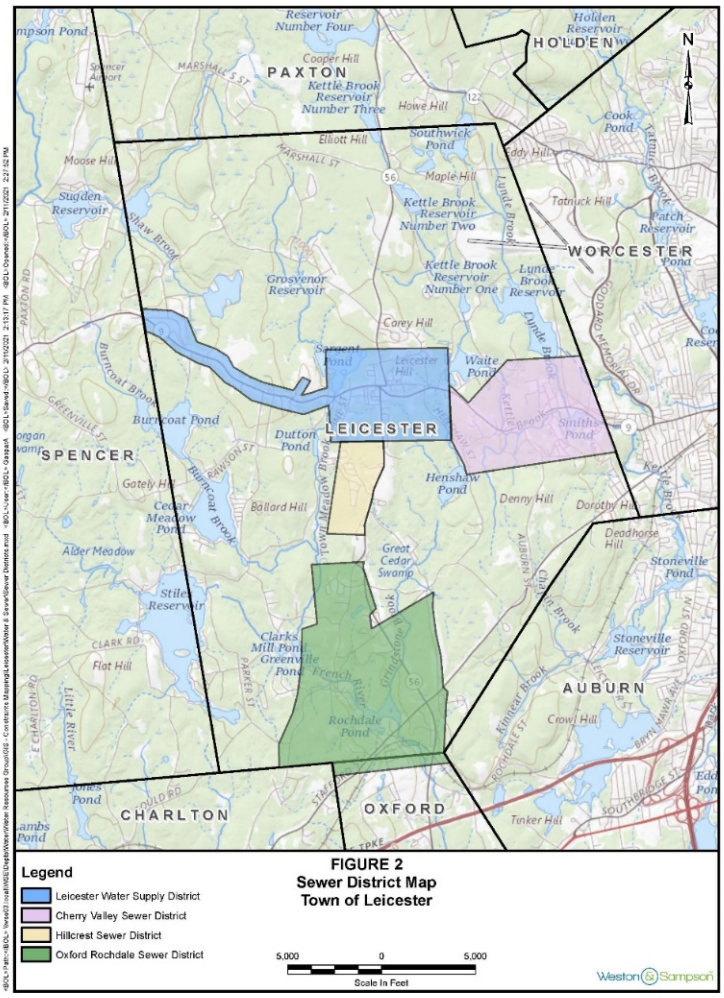


FIGURE 2
Sewer District Map
Town of Leicester

This section is further broken down into three subsections including:

- Water Districts
- Sewer Districts
- Moose Hill Reservoir – Potential for Development as a Public Water Supply

1.1 Assessment Process

A Request for Information was distributed to each district for response covering a wide range of information including technical data, historical demand and flow data, treatment operations, permitting status and compliance, past five years of Annual Statistical Reports (Water Districts) and Massachusetts

Department of Environmental Protection (MassDEP) Wastewater Reports called Discharge Monitoring Reports (DMRs) asset management reports, emergency response plans, capital improvement plans and overall financial information (O&M budgets, rates, debt service). Additional information was also requested for enabling legislation, governance, and related management operations which are discussed elsewhere in this report.

Based on the technical information received from each district, System Summaries were compiled and are presented for both Water and Sewer Systems in the following sections of this Technical Assessment. The following section provides a summary of the pertinent information common to each water district. This Summary section is intended to serve as a baseline from which combinations of districts can be evaluated under future organizational options. A similar summary section is also presented for the sewer districts in advance of the sewer system summaries.

In addition to the data and related information provided by the Districts in response to the Information Request, meetings were convened with members of the Project Team and the staff and officers of each respective District. Any apparent gaps in the information base were resolved through the meeting process and any follow-up that took place. Annual reports such as the Annual Statistical Report (ASR) required to be updated and submitted annually by all community water systems in Massachusetts were obtained from the MassDEP Central Regional Office (MassDEP CERO). Other MassDEP documents reviewed included the most recent Sanitary Surveys, Administrative Consent Orders (ACO's) or other Enforcement Actions currently on file and in effect through the MassDEP CERO.

2.0 STAKEHOLDER CHARACTERIZATIONS

Overview

Each district was established by a separate special act of the Massachusetts Legislature over a 118-year period beginning in 1888 with the creation of the Leicester Water Supply District.[1] See table 2.1 for a list of the primary enabling legislation for each district. All of the districts are governed in a manner similar to the open town meeting form of government in Massachusetts with an elected executive (i.e., Board of Commissioners) and legislative body that is open to all voters residing in the district. Initially, managing officers for most of the districts were elected by the annual meeting but recent changes to by-laws allow the appointment of clerk, treasurer, and superintendent by the Board of Commissioners. Some of the districts have executed inter-agency agreements providing for shared management and operation.

The Board of Commissioners convene an annual meeting. A Moderator selected by the voters present at that meeting presides over the annual meeting. Annual meetings are generally not well-attended, which is typical of water and sewer districts in Massachusetts. Membership on the boards of each district is characterized by low turn-over with little or no competition for positions and the same is true for most managing officers. None of the districts formally plan for succession of Commissioners or other officers.

Each district has adopted by-laws and rules and regulations. The most recently revised rules and regulations are 7 years old (ORSD); the most recently adopted by-laws are 6 years old (LWSD) By-laws are essential to the administration of the districts while rules and regulations are essential to the proper operation of the systems. Both should undergo periodic review to ensure consistency with law, regulation, and actual practice. See Table 2.2 for a list of bylaws and regulations by date of adoption[1]. Although there is no standard timeframe for review, rules and regulations should be reviewed every 5 years and anytime a significant regulation or permit condition is changed by federal or state authorities. By-laws are less likely to require revision and can be reviewed less often.

While the districts have taken steps towards professional management of their finances by appointing rather than electing treasurers, none appear to have job descriptions that adequately describe the necessary skills, education, experience, and work performance for these positions. Specifically, two districts (CV-RWSD and ORSD) have provided job descriptions. In the case of ORSD, there is no job description for Treasurer and the descriptions for operations personnel are 25 years old. CV-RWSD's Treasurers job description includes a fairly extensive list of duties, but lacks mention of educational and experiential qualifications, required training or certification, needed skills or abilities, and other factors such as the level of confidentiality that the job requires. Complete job descriptions are an important management tool as they set forth the standards for the job, the expectations of the organization and help meet legal requirements established in, for example, anti-discrimination and fair labor statutes.

Along with moving to appointed treasurers, many of the districts share Treasurers to improve efficiency. However, it is not clear what the recruitment and selection process has looked like in the past for these positions. The project team noted that although there is no certification process that is entirely applicable to district treasurers, certification, and professional development through the Massachusetts Collectors & Treasurers Association (MCTA) is likely relevant. Although there are portions of the program that are not relevant, e.g., Collectors, the MCTA Treasurer certification program covers many beneficial topics,

[1] See Appendix A for copies of by-laws and rules and regulations.

such as, cash control procedures, short and long term borrowing, municipal finance law, ethics, capital budgeting and financing, and procurement. The districts would likely benefit from further professionalization of these positions through job descriptions, a rigorous recruitment and selection process as vacancies occur, and more support for training and ongoing professional development of individuals holding the position.

In general, the districts have seen a great deal of longevity in leadership positions. The stability that comes from successfully retaining competent leadership should not be understated. All organizations will eventually experience turn-over in key positions. The loss of institutional knowledge when this turn-over occurs can be substantial. Having basic human resources (HR) and financial management structures in place will help ensure smooth transitions. For example, it appears that only one district has formal HR policies and another an employee handbook a third reports conducting employee performance evaluations. However, none appear to have formal, written financial policies and procedures and while this may be typical of similar water and sewer districts in Massachusetts, these are worthy endeavors. Additionally, some of the districts do not have a debt management plan or a robust capital planning process. The project team recognizes that many of these occur, but that they rely on individual knowledge and habit rather than being established or documented in the management structure.

Table 2.1: Primary Enabling Legislation

District	Enabling Legislation	Notes
Cherry Valley-Rochdale Water Supply	Chapter 105 of 1996	Replaces c.381 of 1910 and amended by c. 112 of 2006.
Cherry Valley Sewer	Chapter 33 of 1998	Replaces c.729 of 1963
Hillcrest Sewer District	Chapter 612 of 1954	
Hillcrest Water District	Chapter 358 Acts of 1950	
Leicester Water Supply	Chapter 171 Acts of 1888-water Chapter 181 of 1893-sewer	amended by c.230 of 1895.
Oxford-Rochdale Sewer	Chapter 250 acts of 1957	

Table 2.2: Date of Adoption of By-laws and Rules

District	By-laws	Rules and Regulations	Notes
Cherry Valley-Rochdale Water Supply	2014	1989	
Cherry Valley Sewer	Date Unknown	Date Unknown	By-laws refer to chapter 729 of the Acts of 1963 which was repealed in 1998.
Hillcrest Sewer District	2004	2003	
Hillcrest Water District	2000	2000	
Leicester Water Supply	2015	2001	
Oxford-Rochdale Sewer	1997	2014	

2.1 Water Districts

Table 1 presents a summary of the relevant technical measures of each of the three water districts operating within specified portions of the town of Leicester. The provision of the information for each district in this table provides a helpful reference for considering possible combinations of district systems in a variety of future organizational options.

For example, since a consolidation of the LWSD with the HWD is already in the process of a contemplated merger, based on the information summarized in Table 1, the merged district would serve 1100 service connections with a service population of 2,900 people. The combined water system would include about 31.65 miles of water mains.

Table 2.3. Water District Comparison Table

DESCRIPTION	CV-R WD	LEICESTER WSD	HILLCREST WD
# OF SERVICE CONNECTIONS	1244	707	393
% METERED	100	100	100
Sources of Supply	Worcester	6 wells, not all operational	1 well and LWSD to supplement
Available Design Supply Capacity with currently operating wells (MGD)		0.387	0.086
Available Supply Capacity with wells at current reduced pumping rates (MGD)		0.288	0.086
Available Supply with Largest Source off-line (MGD)		0.243	Get water from LWSD if well offline
Storage Capacity (MG)	1.02	1.2	0.37
Usable Storage (MG)	0.924	1.1	0.135
Miles of Water Main	19	25.15	6.5
Winter Population	N/R	3200	1500
Summer Population	N/R	2700	1250
Residential Service Connections	1167	608	387
Residential Institutional Service Connections	4	32	1
Commercial/Business Service Connections	60	59	2
Municipal Service Connections	10	8	3

Table 2.3. Water District Comparison Table			
Other Service Connections	3		
Total Service Connections	1244	707	393
Residential Gallons per Capita per Day	33	47	75 (est.)
Population Served	3,685	1,900	1,000
Unaccounted for Water in 2019	13.50%	3%	N/R
WMA Registered Volume (MGD)*	0.27	0.19	Below WMA threshold
WMA Permitted Volute (MGD)*	0	0	Below WMA threshold
WMA Authorized Volume (MGD)*	0.27	0.19	Below WMA threshold
*Note Registration is for wells in Blackstone Basin, District has additional wells in French Basin not large enough to trigger WMA thresholds			
Average Daily Use (MGD)	0.205	0.11	0.08
Maximum Day Demand (MGD)		0.27	0.097
Able to meet Maximum Day Demand with Largest Source Off-line (DEP requirement)	Yes, supplied by Worcester	No	No
Comments	100% of demand is supplied by connection with the City of Worcester	LWSD struggles to meet maximum day demand with available supply. LWSD is pursuing interconnection with Worcester to supplement wells and potentially replace wells located in Paxton.	HWD gets water from LWSD to supplement demand routinely.
Capital Projects Planned for next 5 Years	$3,000,000 - $6,000,000	$5,010,000 to $6,767,000	$884,000 to $1,122,000
Capital Projects Planned for the 6 to 20 Year Schedule	$2,500,000 - $5,000,000	$2,569,000 to $3,092,000	$1,505,000 to $1,835,000

The complete water system summaries for the Cherry Valley-Rochdale, Leicester Water Supply and Hillcrest Water Supply Districts are presented in the following sections.

2.1.1 Cherry Valley-Rochdale Water District

The Cherry Valley and Rochdale Water District (CV-RWD) is currently enabled by Chapter 105 of the Acts of 1996 as amended by Chapter 112 of the Acts of 2006 (the CV-RWD Act). The CV-RWD Act provides for a three-member Board of Water Commissioners to be elected at the annual meeting to three-year staggered terms. The Board is responsible for creating a warrant for the annual meeting and appointing a district clerk and district treasurer who hold office for one year or until a successor is chosen. The meeting Moderator is elected at the beginning of each annual meeting.

The CV-RWD manages all "physical and administrative" aspects of the Cherry Valley Sewer District (CVSD) under an agreement last executed in 2015 which can be terminated only after a 2/3rds vote of both Boards. The districts' officers and staff are fully integrated; they share a Treasurer, Clerk, Superintendent, and operations staff. The CVRWD continues to operate independently in all other respects and holds an annual meeting to approve appropriations and take other action.

Originally to service the Cherry Valley and Rochdale villages within the Town of Leicester. The CV-RWD supplies water to approximately 1244 customers and 3685 residents.

The existing water system includes two permitted water sources including Henshaw Pond and the Grindstone Well. Due to water quality concerns, CV-RWD was ordered by the Massachusetts Department of Environmental Protection (MassDEP) to stop using the Henshaw Pond surface water supply. As of October 2016, CV-RWD stopped all operation of both sources and began purchasing water from the City of Worcester.

The water distribution system has three water storage facilities, one permanent interconnection with Worcester, two emergency interconnections, and includes approximately 19 miles of water mains ranging in diameter from 1 inch to 12-inch.

<u>Water Sources</u>

The CV-RWD owns two permitted sources, the Grindstone Well (bedrock well) and Henshaw Pond (surface water supply) neither of which are currently utilized as all water supply is purchased from the City of Worcester.

The Grindstone Well is an 8-inch diameter bedrock well-constructed to a depth of approximately 483 feet that is located adjacent to the western edge of Henshaw Pond. The well has a MassDEP approved pumping rate of 80 gallons per minute (gpm) or 0.11 mgd. The well was activated in June 2005 and is equipped with a 10 HP submersible pump capable of pumping 80 gpm. When in service, the well is pumped through the treatment facility for the removal of arsenic, uranium, and radon. Water quality from this well meets all other state and federal requirements with the exception of pH, which is adjusted prior to its entry into the distribution system. The Grindstone Well is currently an inactive source. CV-RWD is in the process of requesting approval from MassDEP to return the well to active status. CV-RWD would also need to review the operating and maintenance cost to produce and treat the water from this source to determine if it is cost effective to operate this well versus purchasing the 0.11 mgd from the City of Worcester.

Henshaw Pond had been the primary source of potable water for the CV-RWD since 1912. It has a storage capacity of 97 mg and a safe yield of 0.375 mgd. When in use, the reservoir was pumped through a slow sand filtration system prior to entering a 0.1 mg water storage clearwell. As stated, this

supply is currently not in service and the CV-RWD would have to construct a new water treatment facility to utilize the pond as a water supply source.

CV-RWD currently purchases all potable water from the City of Worcester through a metered interconnection. The water purchase agreement allows for a maximum of an annual average day of 270,000 gallons.

Treatment

The CV-RWD has two water treatment facilities. The Grindstone Well Treatment Plant (Grindstone WTP) and Henshaw Pond Treatment Plant (Henshaw WTP) are located adjacent to each other on the North side of Henshaw Pond.

Untreated water from the Grindstone Well was pumped to the treatment building through approximately 1,000 feet of 6-inch ductile iron transmission main. The treatment train consists of a granular ferric hydroxide ion exchange filter for the removal of arsenic, followed by an ion exchange filter for the removal of uranium, and a low-profile bubble aeration unit for radon reduction. Treated water was blended with treated water from Henshaw Pond.

When in service, a7.5 HP, 500 gpm low lift pump transferred water from Henshaw Pond through slow sand filter into a clearwell. High- and low-level sensors in both the sand filters and the clearwell control the pump. Chlorine dioxide was injected into the water prior to filtration to meet the contact time requirement of the Surface Water Treatment Rule by utilizing the designed detention time of the filtration process. The filter effluent flowed through under drains into the underground clearwell. The finished water from the Henshaw WTP was combined with the treated well water from the Grindstone WTP prior to high lift distribution pumps. The 30 HP, 500 gpm high lift pump would draw the combined water from the Henshaw WTP clearwell and the Grindstone WTP 6-inch pipe and deliver it to the distribution system through an 8-inch transmission main. The distribution water was treated with chemicals after the high lift pumps. The pH of the water was increased through the use of potassium hydroxide. Chlorine gas was added for disinfection, and corrosion control was provided through the use of zinc orthophosphate. The chemicals were housed in the existing pump house and were flow paced from the 500 gpm high lift pumps. The system was equipped with continuous pH and chlorine monitoring, high and low pH and chlorine alarms, and an interlock with the high lift pumps.

Storage

The CV-RWD has three water storage tanks including the Greenville Tank and two West Street Tanks. The Greenville Tank, located in the southwestern portion of the system off Pleasant Street in Rochdale, was constructed in 1971 and is a 0.5 MG concrete tank 60 feet diameter and about 24.5 feet high with an overflow elevation of approximately 911 feet. The West Street Tanks, located in the northeastern portion of the system off West Street in Cherry Valley, were constructed in 1994 and are 0.212 MG steel tanks each 42.5 feet diameter and 20 feet high with overflow elevations of approximately 911 feet.

Booster Pumping

A booster pumping system housed at the Henshaw Pond Treatment Plant boosts water from the West Street Tanks to the Greenville Tanks.

Worcester Interconnection

One hundred (100%) percent of the water system demands of the CV-RWD are currently met by the purchase of treated finished water from the City of Worcester. A number of improvements were necessary to enable CV-RWD to receive and distribute finished water from Worcester. Improvements included meter installation, pumping station improvements and water main installation.

Table 2.4. Cherry Valley Water District Finished Water Distribution 2015 – 2019 (MG)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2015	7.6	7.419	8.312	7.951	9.815	8.595	8.065	8.101	7.511	7.237	6.578	6.688	93.601
2016	6.956	7.128	7.889	7.951	9.43	9.745	9.378	9.103	8.732	8.893	6.635	8.554	100.344
2017	10.771	5.884	9.263	5.546	6.519	6.413	6.413	5.743	5.558	5.743	5.558	5.743	79.153
2018	6.045	6	6.045	5.85	6.045	5.85	6.045	6.045	5.85	6.229	6.631	6.627	73.263
2019	5.801	5.791	5.952	5.809	6.75	6.508	6.571	6.834	6.427	6.071	6.071	6.219	74.71

Staffing

The CV-RWD includes a Superintendent who serves as the operations head over both the Water and Sewer Districts. He meets the DEP requirements for a Grade 2T Treatment license and a 2D Distribution license.

In addition to the Superintendent there are two distribution operators who also hold 2D Operators licenses.

The operations staff divide their time between the water district and sewer districts with about 80% of their time devoted to water operations and the remaining 20% focused on sewer system operations.

It is important to note that there is a considerable commitment to mutual support shared by each of the districts in their respective day to day operations, even in the absence of formal mutual aid agreements. This has been a long-standing practice which the districts confirm remains firmly embedded in the informal established working relationships among the various Districts serving Leicester water and sewer customers.

The district staffing also includes a Treasurer and a Clerk both of whose time is also generally split in a similar division as the operations staff between the water district and the sewer district functions. The Clerk also serves as the Billing Clerk and Secretary to the District Boards of Directors.

The Directors are each paid a stipend.

Capital Improvement Plans

A "Water Distribution System Study" was prepared for the CV-RWD by Tata & Howard dated September 2018 which included recommendations for two phases of hydraulic system improvements. Phase 1

included seven specific recommended improvements with a total estimated cost of $6,742,000. Phase 2 included six action items with a total estimated cost of $3,421,000.

2.1.2 Hillcrest Water District

The Hillcrest Water District (HWD) is enabled by Chapter 358 of the Acts of 1950 (the HWD Act). The HWD Act provides for a three-member Board of Water Commissioners to be elected at the annual meeting to three-year staggered terms. The Board is responsible for creating a warrant for the annual meeting and appointing a district clerk and district treasurer who hold office until a successor is chosen. The meeting Moderator is elected at the beginning of each annual meeting.

The HWD is supplied water through an inter-agency agreement with the LWSD and has no operational staff of its own. The Board of Commissioners continues to meet and select a clerk and treasurer. Although it has elected the LWSD treasurer as its treasurer, there is no requirement that it do so.

For all intents and purposes, the HWD is managed and operated by the LWSD. The district pays the equivalent of 8 hours per week of the LWSD superintendent's salary for "monitoring of the system; response to after-hours emergencies; monthly, quarterly and annual reports to the Massachusetts Department of Environmental Protection (DEP). However, the agreement does not provide for maintenance and repair of the HWD distribution system. Therefore, our characterization of the adequacy of its staff and state of its management is as described for the LWSD.

The Hillcrest Water District (HWD) supplies water to 393 customers and approximately 1,000 residents. Since the system serves a population less than 3,300 people, it is defined as a Small System. Average day demand is approximately 67,000 gallons per day (gpd) and the maximum day demand is approximately 116,400 gpd.

The existing water system includes one active water supply well, one inactive water supply well, one water treatment facility, one water storage tank, an interconnection with Leicester Water Supply District (LWSD) and about 6.5 miles of water main ranging in size from 1-inch to 8-inches diameter.

<u>Water Sources</u>

The HWD has two ground water supply wells including Rock Well No. 1 (Well 01G) and Rock Well No. 2 (Well 02G). Rock Well No. 1 is the only well currently active. Any additional water supply is purchased from the LWSD via an interconnection.

Figure 3. Rock Well No. 1 Pump Station

Rock Well No. 1, located at Pleasant St. and Lehigh Road, supplies the majority of the drinking water to the HWD. Rock Well No. 1 is a bedrock well drilled to a total depth of 550 feet. It was originally constructed in 1955 to a depth of 400 feet and deepened in 1984 to its current depth. The well has an approved pumping volume of 86,000 gpd and is equipped with a submersible pump rated for 60 gpm. The Zone 1 radius for Rock Well No. 1 is 389 feet. The HWD does not currently have complete control over the Zone 1 area which includes portions of Rte. 56, local roads, residential areas, and parking areas.

Rock Well No. 2 is located just west of Rock Well No. 1 and has not been used as a source of supply since 2001 because it greatly impacts the available water in Well No. 1. Currently the submersible pump and steel column pipe have been removed from this well. Table 2.5 provides information on these two water supply sources.

Figure 4. Rock Well No. 2 Pump Station

Table 2-5. Water Supply Sources		
Source	**Rock Well #1**	**Rock Well #2**
DEP ID	2151002-01G	2151002-02G
Status	Active	Inactive*
Location	Leicester	Leicester
Basin	French	French
Type	Bedrock Well	Bedrock Well
Date Installed	1955	1975
Maximum Pump Rate	60 gpm	--
Approved Pumping Volume	86,000 GPD	--
Well Depth	550 ft	592 ft
Pump Setting Depth	504 ft	No pump
Pump Type	Submersible	
Pump Motor Size	20 HP	
VFD	Yes	

*Well has been offline since 2001 because it is interconnected with the aquifer that supplies water to Well No. 1.

Treatment

Figure 5. Water Treatment Facility

The HWD has one water treatment facility for treatment of the water pumped from Rock Well No. 1. The treatment Facility (2151002-01T) is located adjacent to the Rock Well No. 1 near the intersection of Pleasant Street and Lehigh Road. The treatment facility was approved for operation on March 13, 2009 and has a design capacity of 86,000 gallons per day (gpd). Treatment is provided for the removal of iron, manganese, arsenic, uranium, and hydrogen sulfide.

Figure 6. Treatment Systems

Flow is directed to the water treatment facility from Rock Well No. 1 through a 6-inch ductile iron pipe. Raw water is first filtered through a 50-micron Harmsco cartridge filter. Filtered water is then treated with sodium hypochlorite and directed through two Greensand Pressure Filters (SOM's) operated in parallel. Iron and manganese are removed by oxidation with sodium hypochlorite, filtration, and absorption to GreensandPlus media. The addition of sodium hypochlorite also oxidizes any Arsenic III in the raw water to the Arsenic V precipitated state which can then be co-precipitated and filtered out in further treatment processes. Filtered water then flows through two AIX treatment vessels. Each is operated in parallel. They contain Purolite A300E media, an anion exchange resin that is used to remove arsenic and uranium from the raw water. The A300E resin is periodically regenerated on-site with a supersaturated sodium chloride (salt) brine solution. Before discharging to a 3000-gallon precast concrete clearwell below the facility floor, treated water is polished by passing through a vessel with Purolite A33E media. The intent of the Purolite A33E media is to remove any traces of arsenic that might have made it past the previous processes. The A33E media is not backwashed and is regenerated off site at a Purolite facility in Philadelphia, PA. The facility finished water is disinfected with sodium hypochlorite before it flows by gravity into the clearwell. Water is withdrawn from the clearwell and routed to the distribution system using a vertical turbine High Lift Pump.

Storage

The HWD has one water storage tank located at the north end of Lehigh Road adjacent to the Leicester Memorial School. The original 1964 tank was a welded steel standpipe tank with a diameter of 24 feet and a sidewall height of 110 feet. This tank was replaced with a glass fused steel Aquastore tank in 2019. The tank is about 25 feet in diameter and 111 feet straight shell. Overflow elevation is approximately 1048 feet above Mean Sea Level (MSL).

Distribution

The HWD water system is operated as a single pressure zone with normal pressures generally ranging from 35 psi to 110 psi depending upon the specific geographical location. The distribution system is comprised of approximately 6.5 miles of water main ranging in size from 1-inch to 8-inches in diameter.

Interconnections

The HWD has one interconnection with the LWSD equipped with a meter and pressure reducing valve. They are located in a vault just off the pavement at the corner of Pleasant Street and Newfield Street. There is a 3-inch meter in the interconnection vault that is used for measuring LWSD water that is transferred to the HWD distribution system. The piping to and from the interconnection vault is 6-inch ductile iron pipe. The pressure reducing valve between the two systems is currently inoperable, therefore flows are directed to the HWD system by manually throttling a 6-inch gate valve just after the interconnection vault. Currently, the gate valve is opened or closed depending on water needs of the HWD.

The interconnection is only used seasonally to supplement water supplied by Rock Well No. 1.

Operations

The hydraulics of the HWD is primarily controlled by the water level in the storage tank. Levels typically fluctuate between 100 feet and 110 feet. The tank water level controls the operation of the well and the water treatment plant. The facilities are programmed to turn on when the water level in the tank reaches 103 feet and turn off when the water level reaches 108 feet to 110 feet.

Table 2.5. Hillcrest Water District Finished Water Distribution 2015 – 2019 (MG)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2015	1.773	1.755	1.921	1.745	1.882	1.757	2.121	2.772	2.49	2.132	2.008	2.122	24.481
2016	2.239	2.216	2.327	2.197	2.478	2.819	2.533	2.179	2.056	2.075	2.092	2.267	27.478
2017	2.413	2.284	2.557	2.405	2.532	2.61	2.413	2.43	2.304	2.347	2.209	2.295	28.801
2018	2.573	2.278	2.518	2.455	2.509	2.455	2.133	1.931	1.854	1.905	1.87	2.427	26.908
2019	2.517	2.348	2.618	2.375	2.421	2.511	2.565	2.309	2.457	2.33	2.325	2.581	29.357

Staffing

MassDEP allows the same operators that work for the LWSD to conduct operations of the HWD. MassDEP has classified LWSD as a 2T and 1D system and HW-D as a 1T and Very Small System (VSS) D system. Acknowledging that the LWSD operators maintain the HWD system, MassDEP allows a minimum of 2 full time drinking water licensed operators for treatment and distribution of both systems. The LWSD staff keep track of their hours worked on the HWD system to bill the HWD accordingly.

The HWD has a part-time treasurer and billing position that averages about 25 hours per month (note more hours during the billing months and less during non-billing months so 25 hours per month is an average). The HWD has a part-time clerk position that is a stipend position for recording meeting minutes. Additionally, HWD pays LWSD about $200 per month toward the LWSD for their clerk to answer phones, deposit checks, etc. for HWD. Finally, the HWD has three Commissioners, separate from the LWSD commissioners, which are also stipend positions.

2.1.3 Leicester Water Supply District

The Leicester Water Supply District (LWSD) provides both water and sewer service and is enabled by Chapter 171 of the Acts of 1888 and Chapter 181 of the Acts of 1893 (the LWSD Acts) for water and sewer, respectively. The LWSD Acts provide for a three-member Board of Commissioners to be elected at the annual meeting to three-year staggered terms. The LWSD Acts do not identify specific officers instead granting the Commissioners the power to appoint officers, as necessary. The District by-laws grant the Commissioners the responsibility for appointing "…The Treasurer; Assistant Treasurer; Clerk; Moderator and Auditor…" for a term not exceeding three years.

Chapter 171 of the Acts of 1888 contains provisions that are unique to the LWSD amongst all the Leicester districts. First, section 5 states that the LWSD *"…may make such contract with individuals, corporations, and the town of Leicester for supplying water as may be agreed upon, and (sic) may extend*

its pipes for that purpose subject to the direction of the selectmen of the town of Leicester, through the streets and highways of said town lying outside the corporate limits of said district." This seems to enable the LWSD, with the consent of the Leicester selectmen to expand to any other portion of the town.[3] Second, section 13 states, in part, *"The said town of Leicester **shall** (emphasis added) have the right at any time to take, by purchase or otherwise, the franchise, corporate property and all rights and privileges of said district on payment to said district of the total cost of its franchise, works and property of any kind…".* Section 13 goes on in some detail including a provision requiring approval by a 2/3rds vote of Town Meeting. Taken together and provided they withstand legal scrutiny these provisions indicate that the creation of a town-wide water district is contemplated by the Act and creates a path for doing so. It is unclear whether this provision extends to the sewer district created by chapter 181. This provision of the LWSD act will be explored further later in this report.

Both administrative and operational staff appears to be adequate, but as is the case in the Cherry Valley districts, Superintendent splits time between the office and the field which is standard practice for small and some medium size systems. However, it requires relying on members of the Board of Commissioners and consultants to assist with planning improvements to the system, financial planning, or organizational management. For example, a master plan and asset management plan have been completed and implemented. As discussed in Section 2.0, efforts should also be put toward organizational management needs that require attention from the district personnel or retained consultants. For example, LWSD would likely benefit from additional field personnel to free-up the superintendent to address unmet needs.

The LWSD supplies water to the Hillcrest Water District and provides wastewater treatment for a portion of the Hillcrest Sewer District. The details of these inter-agency agreements are discussed in subsequent sections of this report.

The Leicester Water Supply District (LWSD) was established in 1888 to service the central village of Leicester. Components of that early system, including Pierce Spring and the Jim Dandy Well. Sections of cast-iron water mains are still in service today. The system at that time was a gravity system with water flowing from the dug wells and springs in Paxton to an open reservoir (30 feet diameter and 40 feet high) located on Carey Hill just north of the central village of Leicester.

Today the LWSD supplies water to approximately 683 customers and 1,900 residents. Since the system serves a population less than 3,300 the system is defined as a Small System. Average day demands are about 0.23 mgd and maximum day demands are about 0.3 mgd. Note that the LWSD does not experience as much change from winter to summer demands as other systems since they provide water to Becker College, increasing their winter demands. Becker College's water use decreases in the summer when other customer's demand increases.

The existing water system includes six water supply wells, five MassDEP designated water treatment facilities, a transmission main booster pump station, two water storage tanks, one system booster pump station and about 25 miles of water main ranging in size from 2-inch to 16-inch diameter. The LWSD is classified as a Treatment T-2 and Distribution D-2 system.

Wells

The LWSD has six groundwater supply wells as listed in Table 2.6. The oldest sources (Jim Dandy Well and Pierce Spring) date to the time of the founding of the water system. The actively used sources include Paxton Wells No. 2 and 3 and Rawson Well.

Paxton Well No. 1 is located off of Grove Street in Paxton. This well can only be pumped in the summer since the well pump discharge exits the building above grade, is exposed for about five linear feet of pipe and then continues below grade to Pierce Spring. Currently, Paxton Well No. 1 is off-line since this well pumps directly to the Pierce Spring Reservoir, bypassing disinfection treatment.

Paxton Wells No. 2 and No. 3 are also located off of Grove Street in Paxton. Both wells receive treatment for the removal of arsenic.

Jim Dandy Well is located 550 feet north of Well 3. This well is a 9-foot hand dug well and is classified as groundwater under the direct influence (GWUDI) of surface water. It requires treatment in compliance with the Surface Water Treatment Rule (SWTR) and is currently off-line.

Whittemore Street Rock Well No. 4 is located off Whittemore Street in Leicester and is currently off-line due to elevated levels of arsenic, uranium, radium, and radon.

Rawson Rock Well No. 5 is located off Rawson Street in Leicester and receives treatment for the removal of manganese, arsenic, uranium, and radon.

Pierce Spring is located at the Grove Street well field. It acts as a water storage reservoir for the wells in Paxton. The spring is octagonal in shape, the walls are constructed of stone laid in cement and covered with a wooden structure and shingled roof. With a storage volume of approximately 60,000 gallons, the spring is about 30 ft diameter and 12 ft deep. Water from Paxton Well No. 1 discharges directly to the spring before flowing to the distribution system. Water from Paxton Wells No. 2, No. 3 and Jim Dandy Well each discharge to the 12-inch transmission main that routes water from the Paxton well fields to the water tanks in Leicester. The transmission main is also connected to Pierce Spring. Finished well water can either fill Pierce Spring or fill the water tanks at Carey Hill in Leicester.

The water level in Pierce Spring controls the operation of the Paxton Wells. The bottom of the spring is not watertight so in times of high groundwater, a small amount groundwater can flow into the spring, while in times of low groundwater, a small amount of water can be lost to the surrounding ground.

There are no standby power facilities at the Paxton well field. The LWSD uses a trailer mounted portable generator to service the well field if there is an extended power outage. The main power panel adjacent to Pierce Spring has a three-phase weatherproof receptacle to connect the stand-by generator to the power feed for the wells. The generator has been successfully used during several storm events. The most memorable time was the ice storm in 2012.

Table 2.6. Water Supply Sources							
Source	Paxton Rock Well No. 1	Paxton Rock Well No. 2	Paxton Rock Well No. 3	Jim Dandy Well	Whittemore Street Rock Well No. 4	Rawson Rock Well No. 5	Pierce Spring
DEP ID	2151000-01G	2151000-02G	2151000-03G	2151000-04G	2151000-05G	2151000-06G	2151000-07G
Status	Not currently pumped*	Active	Active	Not currently pumped*	Not currently pumped*	Active	Active
Location	Paxton	Paxton	Paxton	Paxton	Leicester	Leicester	Paxton
Basin	Blackstone	Blackstone	Blackstone	Blackstone	French	French	Blackstone
Type	Bedrock Well	Bedrock Well	Bedrock Well	Dug Well	Bedrock Well	Bedrock Well	Covered Stone Lined Reservoir
Date Installed	1908	1948	1955	1908	1961	1981	1888
Maximum Pump Rate	50 gpm	86 gpm	100 gpm	66 gpm	50 gpm	201 gpm	--
Safe Yield	0.072 MGD	0.10 MGD	0.072 MGD	0.104 MGD	0.072 MGD	0.274 MGD	0.023 MGD
Well Depth	127 ft	537 ft	700 ft	9 ft	1,000 ft	200 ft	--
Pump Setting Depth	120 ft	315 ft	315 ft	--	315	170 ft	--
Pump Type	Submersible	Submersible	Submersible	Centrifugal End Suction	Submersible	Submersible	--
Pump Motor Size	5 HP	5 HP	5 HP	7-1/2 HP	10 HP	20 HP	--
VFD	Yes	Yes	Yes	Yes	No	Yes	

*Wells not currently pumped for water quality purposes.

Treatment

The LWSD has five MassDEP identified treatment facilities. They range from simple chemical feed facilities to more complex treatment plants for removal of arsenic, uranium, and radon.

Treatment Facility 01T is located at the Paxton Street Booster Station which is located adjacent to water storage tanks on Carey Hill. At this location polyphosphate is added to assist in achieving corrosion control. Sodium hypochlorite is added for disinfection coupled with a 4-log disinfection pipe loop at the end of the Paxton Well transmission main before the water enters the storage tanks.

Treatment Facility 02T is located at the Whittemore Street Rock Well Pump Station. Previously, this facility housed chemical feed equipment for the addition of polyphosphate for corrosion control. At present, the chemical feed equipment has been removed and this facility is off-line.

Treatment Facility 03T is the Rawson Street Water Treatment Facility located adjacent to the Rawson Street Rock Well Pump Station. This facility provides treatment for the removal of manganese, arsenic, uranium, and radon along with disinfection. The following treatment processes are in use at this facility:

- Chemical feed systems are provided for addition of sodium hypochlorite ahead of the greensand filters and for post treatment disinfection. Polyphosphate is also added for corrosion control.
- Manganese is removed using pressure filtration with manganese oxide coated media, (GreensandPlus by Inversand). Three filters are provided, each rated for 67 gpm. All three filters operate in parallel. Raw well water flows are automatically reduced to less than 140 gpm when a filter is backwashing.
- Uranium and arsenic are removed using Purolite's A300E resin, a strongly basic gel anion exchange resin designed for the removal of alkalinity, uranium, arsenic, and nitrate. This resin is regenerated on-site with a sodium chloride (salt) brine solution. Two 4-ft diameter x 6-ft side wall vessels are provided. There are two treatment trains each with a rated capacity of 100 gpm.
- Each A300E vessel is followed by vessels containing A33E resin. A33E resin is a highly porous hybrid anion ion exchange resin infused with iron oxide, making the media selective for arsenic. Since there is almost no arsenic that leaves the A300E vessels, it is anticipated that the A33E media will last over 10 years before it will need to be removed for regeneration offsite. Vessels containing A33E media are 4-ft diameter with a 6 ft side wall. There are two vessels: one for each 100-gpm treatment train.
- Radon is removed at the WTP through aeration using the Lowry Fine Bubble Aeration Unit. Outside air is used for aeration of the finished water and radon gases are also exhausted outside the north side of the WTP building.
- Disinfection is achieved through the addition of sodium hypochlorite just after the Lowry aerator. Finished water is stored in a below grade 6,000 gallon clearwell at the treatment facility.
- Finished water from the clearwell is pumped into the distribution system via a 200-gpm vertical turbine water pump operating at 250 feet of total dynamic head.
- The operation of the Rawson facilities are controlled by the level of the water in the water tanks at Carey hill.

Treatment Facility 04T is the Jim Dandy Water Treatment Facility located at the Jim Dandy Pump Station. In 2002, cartridge filters and sodium hypochlorite feed equipment were installed since the source is designated as GWUDI of surface water. Three cartridge filters are provided in series to provide filtration from 5-micron, 1 micron to 0.35-micron pore sizes. When in operation, sodium hypochlorite was injected before the filters. A turbidimeter and residual chlorine analyzer are also provided for this facility. The turbidimeter is physically located at the Paxton Rock Well No. 3 Pump Station. This source and treatment facility are currently off-line.

Treatment Facility 05T is the Grove Street Water Treatment Facility. The WTP treats water from Paxton Rock Wells No. 2 and No. 3. This facility is located as an addition to the Paxton Rock Well No. 3 Pump Station. This facility provides treatment for the removal of arsenic along with disinfection. The following treatment processes are in use at this facility:

- Arsenic is removed using Purolite's FerriX A33E resin which is a highly porous hybrid anion ion exchange resin infused with iron oxide, making the media selective for arsenic. There are two sets of vessels that service each well. Each vessel is 42-inches in diameter with a 6'-0" sidewall. The vessels operate in a lead lag fashion. Arsenic water quality is monitored between the lead and lag vessels. When the treated water arsenic levels after the lead vessel reach 8 ug/l, the media in the lead vessel is removed and sent off site for regeneration. If Wells 2 & 3 continue to be used on an 18 hour per day basis, media regeneration is required for each lead vessel once per year. Piping at the facility allows for interchanging which vessel is in the lead position. Therefore, when media is sent out for regeneration, the lag vessel can act as the lead and the wells can continue to operate until the media is reinstalled.
- Disinfection is achieved through the addition of sodium hypochlorite. The finished water from both treatment trains are routed to the transmission main just before they leave the building. Sodium hypochlorite is added at this point using a peristaltic chemical metering pump.

Storage

The LWSD has two water storage tanks located on Carey Hill off of Paxton Street (Route 56), just north of the Leicester High School. These tanks are welded steel standpipes. Tank 1 (north tank) was constructed in 1940 and Tank 2 (south tank) was constructed in 1961. More information about each tank is presented in Table 2.7.

Table 2.7. Water Storage Tank Characteristics

Characteristic	Tank 1 (North Tank)	Tank 2 (South Tank)
Date Constructed	1940	1961
Manufacturer	CBI	PDM
Type	Welded Steel Standpipe	Welded Steel Standpipe
Capacity	600,000 gallons	600,000 gallons
Diameter	50 feet	51 feet
Height	40 feet	40 feet
Base Elevation	El. 1074 feet	El. 1074 feet
Overflow	El. 1114 feet	El. 1114 feet
Typical Operating Levels	37.5-39.0 feet	37.5-39.0 feet
Mixing	None	None
Altitude Valve	None	None

Water flows directly from the Paxton wells and Pierce Spring to these tanks through an 8-inch and 12-inch diameter cast iron water main together approximately 5 miles in length. Water District records indicate the transmission main was installed in 1886. There are no customers connected to the transmission main.

Paxton Street Booster Station

Adjacent to the water storage tanks is the Paxton Street Booster Station constructed in the 1960s. This facility houses the booster pumps that are used to increase transmission main flows to 130 gpm to assist in keeping the water tanks full. Two constant speed end suction centrifugal pumps are provided. Each pump is a Goulds Model 3656 pump with 3 HP WEG motor. Only one pump operates at a time. Finished Paxton well water flows through either of the booster pumps when on. When the pumps are off, water flows through a silent check valve and by-pass piping to the booster pump discharge piping and on to the water tanks at a flow of approximately 40 gpm, depending on the water level in Pierce Spring. The booster pumps operate on a lead and stand-by basis.

The Booster Station houses a residual chlorine analyzer to monitor the chlorine residual in the water from Pierce Spring and Paxton Rock Wells after the water has traveled through the 8 & 12-inch diameter water transmission main and disinfection pipe loop. The water from Paxton is treated with sodium hypochlorite at the Paxton Water Booster Station. In 2016 a new water main loop line was constructed at the water storage tanks just before the Booster Station. The loop line is 500 linear feet and constructed of 12-inch diameter Class 52 cement lined ductile iron pipe. The purpose of the loop is to provide 4-log disinfection for viruses for the water from the Paxton wells prior to entry into the distribution system.

Disinfection 4-log certification monitoring and alarm requirements are achieved through use of residual chlorine analyzers and SCADA programming. Residual chlorine analyzers continuously monitor chlorine to verify levels remain above the minimum needed to achieve 4-log compliance (greater than 0.3 mg/L) and below high levels that would indicate an overfeed event. The chemical feed pump rates are paced by the Paxton Booster Station flow meter. Should the residual chlorine level decrease below 0.3 mg/L, the chemical pump rate would be increased by the operator. Note that the current low-level alarm is set for 0.5 mg/L. High level alarms are also provided to notify operators of a potential overfeed event; a high high-level alarm will trigger an alarm and shut down the facility.

Chemical feed equipment is also provided for the addition of polyphosphate for corrosion control.

The Hyland Booster Pump skid is in a room adjacent to the main booster pump room. The booster pump provides domestic water to the Carey Hill Estates Subdivision. This booster pump skid has four vertically oriented centrifugal pumps. Two pumps are variable speed with 2 HP motors and two pumps are variable speed with 15 HP motors. This system can pump from 0 to 290 gpm. Flows from the booster station are controlled by discharge system pressure. Insufficient pressure is alarmed by the SCADA system.

The Booster Station also houses an emergency generator and transfer switch. The generator is capable of supplying emergency power for operation of both booster pump systems.

Mount Pleasant Booster Station

The Mount Pleasant Booster Station is located at 1350 Main Street (Rte. 9) just east of Tractor Supply Co. Constructed in 2004, this station has three pumps, two for domestic flows and one for fire flows. These pumps boost water pressure to the west end of the system to keep pressures between 60 to 100 psi. The domestic pumps are Grundfos CR 16 Model vertical multi-stage pumps capable of approximately 85 gpm at 112 feet of head. They have 5 HP motors and variable frequency drives (VFDs). The pumps operate lead-lag, with the lead pump starting when the pressure decreases to 50 psi and

the lag pump starting if the pressure cannot be maintained at 50 psi. The fire pump is an end suction centrifugal pump with a 25 HP WEG motor. Two Wessels Model FXA-800L hydropneumatic (bladder) tanks are provided. Each tank has a volume of 211 gallons, which equates to about 80 gallons usable storage. This facility is also equipped with an emergency generator.

Distribution System

The LWSD water system is operated under one pressure zone with normal pressures generally ranging from 35 psi to 110 psi depending upon the specific geographical location. The distribution system is comprised of approximately 25 miles of water mains ranging in size from 2-inch to 16-inch diameter. The distribution mains range in age and material. The oldest main is cast iron installed at the creation of the water system in 1888, such as the 5 mile long 8-inch & 12-inch diameter transmission main from Pierce Spring to the Paxton Street Water Storage Tanks.

Interconnections

The LWSD has interconnections with the neighboring Paxton Water Department, Cherry Valley & Rochdale Water District and Hillcrest Water District. Currently the LWSD supplies water to the Hillcrest Water District (HWD) through a metered interconnection with pressure reducing valve located in a vault just off Pleasant Street at Newfield Street. This supply is used by HWD to supplement its own single source water supply. The LWSD operators operate the Hillcrest system. The LWSD controls the amount of water supplied to the Hillcrest Water District, based on HWD water demands & the ability of LWSD to keep their water tanks full. There is a 3-inch meter in the interconnection vault that is used for measuring HWD system use. The piping to and from the interconnection vault is 6-inch ductile iron pipe. Since the pressure reducing valve between the two systems is currently inoperable, flows are directed to the HWD system by throttling a 6-inch valve just after the interconnection vault.

Emergency hydrant to hydrant connections are available to connect Leicester's system to the Paxton water system and the Cherry Valley Rochdale system. The Paxton interconnection is located on Route 56 at the intersection with Asnebumskit Road. The Cherry Valley interconnection is located on Route 9 on the east end of the District. At each location, the respective systems have hydrants at the location that can be connected using 2-inch diameter fire hose. Water from the Paxton system must be reduced in pressure before connecting to the LWSD transmission main. Water from Cherry Valley must be pumped to the LWSD system at the interconnection.

The LWSD is currently pursuing a permanent interconnection with the City of Worcester to provide supplemental water supply. The intent is to have this facility operational by 2023. Additional details regarding the interconnection project include the following:

- Waters from the Paxton Wells (currently on-line) and Jim Dandy Well (currently off-line) are piped to the District's water system through a 5-mile-long transmission main that was constructed in 1888. The Massachusetts Department of Environmental Protection (MassDEP) is requiring water treatment improvements to continue using the wells located in Paxton. Additionally, there are significant questions and concerns about the integrity and condition of the transmission main. The size and scope of infrastructure improvements required to continue using these supplies makes the purchase of water from the City of Worcester a viable alternative to help maintain the fiscal sustainability of the District.
- When the District was formed in 1888, the enabling Act (Chapter 171, Acts of 1888) allowed the District to take and hold the waters of Rawson Brook and the waters of Kettle Brook in the Town of Paxton, provided the water taken from Kettle Brook not exceed an average daily quantity of

200,000 gallons per day (gpd) or 0.2 million gallons per day (mgd). Note that the District currently holds a water withdrawal registration amount of 0.19 mgd for the supplies located in Paxton.

- Subsequently, c. 230 of the Acts of 1895 authorized the District to take and hold the waters of Asnebumskit Pond in the Town of Paxton and water sources connected therewith, subject to the conditions and restrictions named in the enabling, c. 171, Acts of 1888.
- In a July 19, 2019 letter to the Office of Water Resources, Department of Conservation and Recreation (DCR), a request was made for a streamlined and expedited permitting process for the proposed purchase of water from the City of Worcester. On September 9, 2019, Ms. Michele Drury confirmed that the DCR legal counsel had reviewed the July 19, 2019 request and the supporting documents and concluded that there would be no increase in the interbasin transfer so that an interbasin transfer permit application would not be required. Additionally, legal counsel had determined that based on the enabling acts the District had rights to 0.2 mgd from the Blackstone Basin and no restrictions on the amount from the Nashua Basin.
- The District's request was formally presented and discussed at the October 10, 2019 Water Resources Commission (WRC) meeting. The WRC determined that the Interbasin Transfer Act does not apply to the proposed water purchase from the City of Worcester since there is no increase in the present rate of interbasin transfer. These findings were documented by DCR in a letter dated October 16, 2019.
- The District is in communications with the City of Worcester to purchase 0.3 mgd from the City. The District proposes to convey treated water from the City's water system to the District's water system through the construction of an interconnection at Bailey Street/Mulberry Street with a metered booster pumping station and approximately 2 miles of 8 or 12-inch diameter water main. This infrastructure would be installed within existing disturbed areas (i.e., along/within paved roadways).
- The District's intent is for the interconnection to serve as a supplemental source with flow rates similar to those obtained from the Paxton Wells. The interconnection supply and Rawson Wells will be used to fill the water storage tanks. The water from the storage tanks will be used for domestic, fire and emergency demands.
- A flow test was conducted by the City on their system at Bailey Road near Fox Meadow Drive using hydrants located near 92 Bailey Road and 126 Bailey Road. The results of the flow test indicate that flows of approximately 600 – 650 gallons per minute (gpm) have a pressure drop of 0 – 2 pounds per square inch (psi), a negligible pressure drop that would not impact the pressure within the City's system.
- Once the interconnection is operational, the District will remove the Paxton Wells from its operations. The interconnection supply Rawson Well and Whittemore Well (currently off-line well) will be used to fill the District's water storage tanks. The water from the storage tanks will be used for domestic, fire and emergency demands. Conceptually, the booster pumping system will be designed to withdraw flows in the range of 100 – 600 gpm from the City's system which would have no impact on the City's water pressures on the suction side of the pump. The design flow rates will be determined during the conceptual design process including evaluation of the number of pumps and if a fire pump should be included.
- The District is proceeding with the design of the proposed interconnection as described concurrently to efforts with the City to formalize a water purchase agreement during 2021.

System Operations

The LWSD water system is equipped with a Supervisory Control and Data Acquisition (SCADA) system. The main SCADA computer is located at the LWSD Wastewater Treatment Plant. Communications with remote sites are through a radio telemetry system with the exception of the Rawson Well and Treatment Facility which are connected to the SCADA system via fiber optic cables. For the Paxton well field, the radio antenna is located on the Jim Dandy Well Pump Station. Fiber optic cables connect the Jim Dandy Well Pump Station with the Rock Wells and Pierce Spring. On occasion, the SCADA system experiences communications failures. However, all facilities except those at Rawson Street will operate on their own without the supervision of the SCADA system.

The operation of the Paxton Rock Wells are controlled by the water level in the Pierce Spring by a pressure transducer. Pierce Spring is typically maintained between 8 ft to 10 ft. Water levels can drop to 3 feet if system demands require additional water at the water tanks in Leicester. The SCADA system alarms if the level in the spring falls below 3 feet. Historically, the Paxton Rock Wells No. 1 and No. 2 were not operated simultaneously since pumping Well No. 1 will cause the water level in Well No. 2 to decrease. Therefore, Well No. 1 is only operated alone or with Well No. 3. Well No. 1 is presently off-line, so current operations call for Well No. 2 and Well No. 3 to operate concurrently depending on system demands.

Rawson Rock Well No. 5 and Treatment Facility operate based on the water level in the Paxton Street Tanks. The well pump is activated when the water level drops to 37.6 feet and stops when the water level reaches 39.0 feet. When the Rawson Street facilities are called to operate, the well pump initially pumps to waste for about 90 seconds and then water is directed to the WTP and operations there start. The treatment facility finished water pump is activated based on the water level in the clearwell. This pump starts at 3.8 feet and stops at 3.0 feet. The controls at the water plant regulate the speed of the finish water pump to maintain 3.5 feet of water in the clearwell.

The Paxton Street Booster Pump Station pumps normally operate based on the water level in the Paxton Street Tanks. They can be manually started or stopped by an operator if system conditions require this condition. When in automatic, the booster pumps will start when the water level in the water tanks is at 37.5 feet and stop when the water level reaches 39.0 feet.

The operators have the ability to operate the system in Hand Mode. This allows them to over-ride the automatic triggers if needed. For example, when the water level in Pierce Spring is low (less than 4 feet), the operators normally would turn the tank booster pumps off, until the water level in the spring recovers to greater than 5 feet. Often times the operators override the SCADA controls and place the Paxton Booster Pump(s) in Hand in an effort to maintain 0.2 mg/l residual chlorine levels in the water coming from Paxton. The thought is that higher flows from Paxton (135 gpm) mean the Paxton well pumps (Wells No. 2 and No. 3) and Paxton Water Treatment Facility are operational feeding chlorine into the transmission main, which helps maintain chlorine levels at the water tanks.

Table 2.8. Leicester District Finished Water Distribution 2015 – 2019 (MG)													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2015	5.710	5.595	6.292	6.094	6.801	6.084	6.093	6.195	6.271	5.824	5.284	5.234	71.478
2016	5.501	5.473	5.600	5.616	5.714	5.287	5.149	5.214	5.192	5.290	4.915	4.776	63.727
2017	4.832	4.671	5.073	5.152	4.914	4.778	4.772	4.844	4.726	5.031	4.786	4.502	58.082
2018	4.668	4.072	4.511	4.712	4.986	5.002	4.749	4.619	4.476	4.537	4.240	4.300	54.873
2019	4.400	4.035	4.278	4.300	4.768	4.437	4.510	4.671	4.340	4.570	4.262	4.093	52.662

Staffing

District required to have a minimum of 4 fully licensed operators (2 wastewater and 2 drinking water) for both the LWSD and HWSD. The licensed operators are cross trained to cover for water/wastewater in an emergency. Refer to the MassDEP letter dated August 26, 2015 for the minimum requirements.

The LWSD has one full-time Superintendent who manages both water and wastewater operations and holds operator licenses that are higher grades of the other operator licenses since this position has responsible charge of operations. The Superintendent divides time between water and wastewater to support both since 4 operators is the minimum required. The Superintendent spends more time supporting wastewater operators than drinking water operators due to the complexity of the WWTP. The LWSD has two full-time licensed wastewater operators and two full-time licensed drinking water operators (one handles treatment and the other distribution) and both service the LWSD and HWD systems.

The LWSD employs a part-time treasurer and billing position with duties averaging about 21.5 hours per week. Currently the treasurer is at the LWSD office from 9:30 am to 2 pm Monday through Thursday and 9:30 am to 1 pm on Friday. The LWSD employs a clerk position with duties averaging about 24 hours per week. The LWSD also has three Commissioners which are stipend positions.

2.2 Sewer Districts

Information common to all four sewer districts is presented in Table 2.9. Table 2.10 provides a summary of the monthly and annual sewage flows reported for each sewer district from 2016 thru 2019. Note that the monthly data for the CVSD is reported in terms of Total Flow in Million Gallons (MG). The annual totals for the CVSD were divided by 365 to derive the daily flow in Million Gallons Per Day (MGD) for demonstrating the comparative information across all district flow reporting.

Presenting the information for each district provides a helpful reference for considering possible combinations of systems in any of a variety of future organizational options. Average daily flows for example can be added to estimate the total flows from any proposed combination of sewer districts that might be considered under alternative district or town consolidation options.

Table 2.9. Sewer District Summary Table				
	LWSD - Sewer	HSD	ORSD	CVSD
Number of Customers	683	260	1021	437
Wastewater discharge point	LWSD WWTF	LWSD and ORSD	ORSD WWTF	Worcester/Upper Blackstone
WWTF Construction Date	1900	(system constructed in 2003)	1971	NA
WWTF Major Upgrade Date	1988	NA	1996, 2010	NA
WWTF design capacity (MGD)	0.35	NA	0.5	NA
WWTF Discharge point	Town Meadow Brook	NA	French River	NA
NPDES Permit issued	2005	NA	2005	NA
NPDES Permit number	MA0101796	NA	MA0100170	NA
Gravity main (miles)	15	4.5	15	9.8
Force main (miles)	3.2	0.25	1.7	
Number of pump stations	8	3	4	5
Dry weather flows (MGD)	0.14	*	0.32	0.1
Estimated I/I	42%			
Capital projects planned	WWTF upgrade required but waiting for renewed NPDES to properly design facility	Planning to dissolve HSD into LWSD and ORSD	WWTF upgrade required but waiting for renewed NPDES to properly design facility	
Additional comments	CWMP recommended WWTF upgrade to 0.732 MGD	Flows split b/w LWSD * ORSD		

Table 2.10. Comparison of Sewer District Flows 2016 - 2019 (mgd)			
YEAR	Leicester Sewer District	Oxford-Rochdale Sewer District	Cherry Valley Sewer District
2016	0.119	0.224	0.095
2017	0.126	0.27	0.152
2018	0.15	0.346	0.142
2019	0.138	0.319	0.089

The complete sewer system summaries for the Cherry Valley, Leicester, Hillcrest and Oxford-Rochdale Sewer District are presented in the following sections.

2.2.1 Cherry Valley Sewer District

The Cherry Valley Sewer District (CVSD) is currently enabled by Chapter 33 of the Acts of 1998 (the CVSD Act). The CVSD Act provides for a three-member Board of Sewer Commissioners to be elected at the annual meeting to three-year staggered terms. The Board is responsible for creating a warrant for the annual meeting and appointing a district clerk and district treasurer who hold office until a successor is chosen. The meeting Moderator is elected at the beginning of each annual meeting.

The by-laws for the district are out of date as they refer to enabling legislation that was repealed by the CVSD Act, however the Board has adopted a comprehensive set of rules and regulations.

The CVSD is managed in all "physical and administrative" aspects by the CVRWD under an agreement last executed in 2015 which can be terminated only after a 2/3rds vote of both Boards. The districts' officers and staff are fully integrated; they share a Treasurer, Clerk, Superintendent, and operations staff. The CVSD continues to operate independently in all other respects and holds an annual meeting to approve appropriations and take other action.

The Superintendent indicated that the administrative staff is adequate, but that the operations are understaffed. The project team concurs but points out that the Superintendent splits time between the office and the field leaving little time for planning improvements to the system, financial planning, or organizational management. For example, there is little in the way of capital planning, financial policies, or written job descriptions.

The Cherry Valley Sewer District (CVSD) was officially formed in 1963 through Chapter 729 of the Acts of 1963. In 1995, as part of the reconstruction of Route 9, the Commissioners obtained funding for the Route 9 Interceptor Sewer which would anchor the full build-out of the sewer system. In 1998 the District successfully amended chapter 729 as amended and was replaced by Chapter 33 of the Acts of 1998.

The main provision of chapter 729 was the revision of the District boundaries which led to the reduction in the size of the District to its current configuration. In 1999 the District was successful in securing USDA-RD for the funding of the full build-out of the District. The build-out would include three Phases spanning from 2000 through 2004.

In Phase I, the project included the design and construction of sanitary sewer service to 573 dwelling units connecting this system to the existing Route 9 Interceptor Sewer.

In Phase II, the project included the design and construction of the McCarthy Avenue pump station, Redfield Road Pump Station, and the connection of the associated streets in the McCarthy Avenue neighborhood.

In Phase III, the project included the design and construction of the following pump stations: McCarthy Avenue, Church Street and Willow Hill Road and the connection of the remainder of the streets within the Cherry Valley Sewer District.

Currently the District has 5 pump stations and 9.8 miles of collection pipe. The District currently services 437 homes.

Sewage is discharged to the City of Worcester sewer system and transported to the Upper Blackstone Water Pollution Abatement District (UBWPAD) for treatment. Treated wastewater is discharged to the Blackstone River.

The District headquarters are located at 148 Henshaw Street, Leicester, MA 01524.

Table 2.11. Cherry Valley Sewer District - Sewage Flow Summary Table (MG)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Avg Monthly Flow (mg)	Total Annual Flow (mg)	Avg Daily Flow (mgd)
2016	2.28	3.02	3.645	3.154	2.335	1.926	1.579	1.596	2.308	3.811	4.047	4.99	2.891	34.691	0.095
2017	5.417	5.143	5.239	6.239	5.494	4.978	3.047	3.398	3.472	3.971	4.2	4.774	4.614	55.372	0.152
2018	5.157	5.773	6.609	6.619	5.026	3.091	1.826	2.317	2.547	2.968	5.509	4.817	4.355	52.259	0.143
2019	4.381	3.022	3.389	4.3	3.258	1.812	1.841	1.581	1.375	1.923	2.331	3.347	2.713	32.560	0.089
2020	3.094	2.703	3.039	4.131	4.256	1.949							3.195	38.344	0.105
AVG	**4.066**	**3.932**	**4.384**	**4.889**	**4.074**	**2.751**	**2.073**	**2.223**	**2.426**	**3.168**	**4.022**	**4.482**	**3.541**	**42.490**	**0.116**

Staffing

Refer to discussion of Staffing in Section 2.1.1. The same staff also operate the sewer system. The Superintendent estimates that about 80% of staff time is spent on Water System operations while the remaining 20% of staff time is devoted to sewer system operations.

2.2.2 Leicester Water Supply District – Sewer District

The Leicester Water Supply District (LWSD) provides both water and sewer service and is enabled by Chapter 171 of the Acts of 1888 and Chapter 181 of the Acts of 1893 (the LWSD Acts) for water and sewer, respectively. The LWSD Acts provide for a three-member Board of Commissioners to be elected at the annual meeting to three-year staggered terms. The LWSD Acts do not identify specific officers instead granting the Commissioners the power to appoint officers, as necessary. The District by-laws grant the Commissioners the responsibility for appointing "…The Treasurer; Assistant Treasurer; Clerk; Moderator and Auditor…" for a term not exceeding three years.

Chapter 171 of the Acts of 1888 contains provisions that are unique to the LWSD amongst all the Leicester districts. First, section 5 states that the LWSD *"…may make such contract with individuals, corporations, and the town of Leicester for supplying water as may be agreed upon and may extend its pipes for that purpose subject to the direction of the selectmen of the town of Leicester, through the streets and highways of said town lying outside the corporate limits of said district."* This seems to enable the LWSD, with the consent of the Leicester selectmen to expand to any other portion of the town.[3] Second, section 13 states, in part, *"The said town of Leicester **shall** (emphasis added) have the right at any time to take, by purchase or otherwise, the franchise, corporate property and all rights and privileges of said district on payment to said district of the total cost of its franchise, works and property of any kind…".* Section 13 goes on in some detail including a provision requiring approval by a 2/3rds vote of Town Meeting. Taken together and provided they withstand legal scrutiny these provisions indicate that the creation of a town-wide water district is contemplated by the Act and creates a path for doing so. It

is unclear whether this provision extends to the sewer district created by chapter 181. This provision of the LWSD will be discussed in greater detail later in this report.

Both administrative and operational staff appears to be adequate, but as is the case in the Cherry Valley districts, Superintendent splits time between the office and the field which is standard practice for small and some medium systems. However, this requires that members of the Board or retained consultants assist with planning improvements to the system, financial planning, or organizational management. For example, an asset management plan has been completed and implemented. As discussed in Section 2.0, efforts should also be put toward organizational management needs that require attention from the district personnel or retained consultants. . For example, LWSD would likely benefit from additional field personnel to free-up the superintendent to address unmet needs.

The LWSD provides wastewater treatment to a portion of the Hillcrest Sewer District. The details of inter-agency agreements are discussed in subsequent sections of this report.

The LWSD operates a sewer collection and treatment system which serves approximately 683 customers. The LWSD accepts flow from an additional 131 customers within the Hillcrest Sewer District (HSD). Flow from both the LWSD and HSD customers is treated at the LWSD wastewater treatment facility (WWTF).

The LWSD sewer system consists of about 15 miles of gravity sewer, 3.2 miles of force main, 8 pump stations and a 0.35 MGD wastewater treatment facility. The LWSD WWTF was originally constructed in the early 1900's. The plant has been upgraded several times with the last major upgrade completed in 1988. The 2011 average daily flows to the facility were estimated to be 0.24 MGD during dry weather conditions. The plant discharges to nearby Town Meadow Brook.

LWSD is permitted (NPDES permit issued 2010, MA0101796) to discharge 0.35 MGD (average monthly) of treated municipal wastewater via outfall 001 to the French River (Note: the outfall previously discharged to Dutton Pond (Segment MA42015) but was relocated to Town Meadow Brook -- downstream from Dutton Pond Dam. The permit incorrectly states the discharge is to the French River.)

The facility is required to monitor acute whole effluent toxicity and chronic whole effluent toxicity twice a year using *Ceriodaphnia dubia*. The facility's maximum daily permit limits for whole effluent toxicity are LC50≥100% and CNOEC>62%.
A wastewater treatment facility upgrade is being planned for the facility according to an Environmental Notification Form (ENF) filed in December 2008. The ENF (#14352) indicates that a draft CWMP has been developed and an expansion and upgrade of the facility was recommended (0.732 MGD). I/I estimates at the facility were estimated to account for 42% of the total flow. The permit includes seasonal limits on BOD, total suspended solids (TSS), fecal coliform bacteria, total residual chlorine, total ammonia-nitrogen (NH3-N), total phosphorus (TP), as well as limits on total copper. This permit has expired, and the District is waiting for EPA to issue a revised NPDES permit. The District has held off on WWTP upgrades until the permit is revised and discharge limits identified.

The LWSD currently owns and operates eight (8) Wastewater Pump Stations (WWPS) for the LWSD and operates three (3) WWPS Pump Stations for the Hillcrest Sewer District. The 8 sewer pumping stations within the district were constructed from the mid 1990's to early 2000's.

The LWSD sewer system generally consists of the following components:

1. Wastewater Treatment Facility with 0.35 MGD approved flows, located at 124 Pine Street, Leicester
2. Holcomb Street Sewer Pump Station
3. Homestead Lane Sewer Pump Station
4. Main Street Sewer Pump Station
5. Manville Street Sewer Pump Station
6. Paxton Street Sewer Pump Station
7. Rawson Street Pump Station
8. Town Beach Sewer Pump Station
9. Waite Street Sewer Pump Station
10. Approximately 520 manholes
11. About 15 miles of gravity sewer ranging in size from 6-inch to 16-inches diameter.
12. About 3.2 miles of force main ranging from 2-inch to 8-inches diameter.
13. Main Office with associated equipment.

Leicester Water Supply District (LWSD) Wastewater Treatment Facility (WWTF)

This facility (conventional activated sludge with advanced treatment) was constructed in 1985 and has seen no major upgrades since completion. The facility operated well but is mostly the result of efforts associated with the operations staff. Equipment has been repaired and/or replaced to the point that a modernization project is needed. We visited that facility on December 9, 2020 and were notified that the facility was having operational issues related to a failure of the belt filter press and a clarifier drive failure. This facility is operating under an old NPDES permit which expired in 2015. The current facility utilizes chemical for phosphorous precipitation to meet a seasonal permit limit of 0.2 mg/l. There has been no word from regulators on when a Draft and Final permit for the facility will be issued. The operator knows that a modernization is needed for many aspects of the facility but is hesitant to move forward with upgrades until a new NPDES permit is issued.

It is our belief that within the next 2-3 permit cycles that a Total Nitrogen Limit will be implemented, as the flow is discharged to the French River and ultimately ends up in Long Island Sound. We would expect the Total Nitrogen limit to range from 3-8 mg/l. This will result in the need for a future project to add some sort of denitrification process, typically a de-nite filter or anoxic zones. A budget of about $1M-$2M should be set aside for this project alone. The operators also expressed concern with a potential reduction in the seasonal phosphorous limit to 0.1 mg/l. Should this occur, we would expect the facility to need to optimize chemical addition and to continue with their use of a polishing filter for the effluent prior to discharge. The filtration system may also need to be optimized. A budget of $0.5M to $1M should be allocated for future potential phosphorous reduction upgrades.

Discussions with the operator indicated that they were uncertain as to the type of treatment facility that is envisioned for the future. Options discussed with various engineers have focused on the continuation of conventional activated sludge treatment or a conversion to a Sequencing Batch Reactor (SBR). The latest engineer assisting the LWSD seemed to be on-board with a continuation of the conventional activated sludge approach, and an interim expansion to 0.575 mgd. The options for improving the facility included the following:

1. New Headworks Facility
2. Two new larger diameter clarifiers
3. Aeration Basin Rehab,
4. Additional Biological Treatment
5. Upgrade to Sludge Handling Capabilities
6. Rehabilitation of the Sand Filter, and
7. Increase in the size of the Chlorine Contact Tank.

Per the WWTF operator, the engineer that envisioned the above changes estimated the project to cost approximately $10M, ten years ago. ENR projections alone would drive this project cost up to $14M to $15M (in 2025 dollars). Additionally, these costs to not include the significant increase in O&M costs that a new facility with more stringent treatment goals and greater treatment capacity/volume may have.

During the brief tour of the facility, the following observations/potential projects were identified:

- The headworks facility is tight and does not do a good job removing rags. A new larger headworks facility with mechanical screening and improved grit removal should be provided. - $2M+/- to $2.5M+/-,
- Mechanical surface aerators should be replaced with diffused aeration - $1.5M+/-,
- New larger diameter (40-foot) clarifiers are desired for improved surface overflow rates - $2M+/- to $3M+/-
- Improved solids dewatering and conveying should be provided - $1.5M+/- to $2M+/-,
- Underground fuel storage tank needs to be replaced with compliant dual walled UST or AST - $0.1M+/-
- Blast and Re-Coat structural elements on ABW Sand Filter - $0.1M+/-
- Provide Containment for Ferric Chloride (may require modifications to shed roof) - $0.05M+/-
- Future Total Nitrogen Upgrade - $1.5M+/- to $3M+/-
- Future Phosphorous Removal upgrades - $0.5M+/- to $1.M+/-
- Unscheduled Repair Allowance and Contingency (20%) - $1.8M+/- to $2.6M+/-
- Total - $11M+/- to $15.8M+/-

Any project moving forward should have established goals with respect to the ability to handle increases in flow in a phased approach. Tankage should be designed for ultimate flow projections, while equipment that may be in use for 20+ years prior to an ultimate flow increase can be replaced as part of a larger upgrade project in the future.

It should be noted that data from an Asset Management Plan for the LWSD contained 103 items related to Treatment which are recommended for completion over a 30-year period. The Total Value assigned to these improvements was $5,154,000. Additionally, as part of a Draft CWMP completed by SEA Consultants, Inc. in 2007, the LWSD WWTF was recommended to be expanded to 0.732 mgd of capacity and converted to a Sequencing Batch Reactor (SBR) facility over a five (5) phase project. Back in 2007, SEA estimated the project to cost $12,800,000 (inclusive of 35% engineering and contingencies). With an ENR projection of the 2007 cost to 2025 costs, it is estimated that this project could cost on the order of $20M-$25M. The review completed on 12/9/20 cannot be viewed to be as comprehensive and complete as other previously completed studies, including the Asset Management planning.

Table 2.12. Leicester Sewer District Monthly Flow Summary - Average Daily Flows (mgd)													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
2016	0.168	0.177	0.162	0.153	0.109	0.084	0.071	0.102	0.075	0.091	0.102	0.13	0.119
2017	0.163	0.142	0.141	0.234	0.144	0.129	0.088	0.074	0.08	0.099	0.115	0.104	0.126
2018	0.136	0.176	0.177	0.194	0.122	0.078	0.088	0.129	0.127	0.143	0.157	0.168	0.141
2019	0.157	0.132	0.156	0.238	0.155	0.095	0.092	0.087	0.092	0.115	0.138	0.198	0.138
2020	0.165	0.153	0.151	0.193	0.129	0.081	0.08	0.073	0.079				
AVG	0.158	0.156	0.157	0.202	0.132	0.093	0.084	0.093	0.091	0.112	0.128	0.15	

Staffing

Refer to LWSD Staffing summary included in Section 2.1.3.

2.2.3 Hillcrest Sewer District

The Hillcrest Sewer District (HSD) is enabled by Chapter 612 of 1954 (the HSD Act). However, the HSD was not active until about 1999 when the Board was elected, district boundaries expanded and voted to build the collection system. The HSD Act provides for a three-member Board of Commissioners to be elected at the annual meeting to three-year staggered terms. The Board is responsible for creating a warrant for the annual meeting and appointing a district clerk and district treasurer who hold office until a successor is chosen. The meeting Moderator is elected at the beginning of each annual meeting.

Wastewater generated by the HSD is conveyed in part to the LWSD and in part to the Oxford-Rochdale Sewer District (ORSD). There are Inter-governmental agreements in place between HSD and both ORSD and LWSD. These agreements provide only for the treatment of wastewater. The project team could locate no agreement for operation and maintenance of the collection system. As is the case with the HWD, the HSD has no staff or officers and is managed by the LWSD with no written agreement to do so.

As authorized under the provisions of Chapter 612 of the Acts of 1954, the HSD boundaries are coterminous with the HWD delineation. The HSD and HWD have separate Boards of Commissioners and clerks. . The HSD and HWD share a common Superintendent and operations staff.

The HSD sewer system generally consists of the following components:

1. Pine Street Pump Station
2. Laurelwood Avenue Pump Station
3. Sterling Street Pump Station
4. About 4.5 miles of 8-inch gravity sewer.
5. About 0.25 miles of 4-inch force main.

The 3 pump stations were all constructed in 2002-2003.

HSD has approximately 260 customer connections. Flow from about 131 customers discharges to the LWSD for treatment at the LWSD WWTP. Flow from remaining customers discharges to the ORSD for treatment at the ORSD WWTP. As sewer flows are not metered at the source, the flows from the HSD customers are reflected in the flows reported for the LWSD and ORSD, respectively.

The HSD is headquartered at the LWSD office located at 124 Pine Street, Leicester, MA.

Staffing

Operations for the HSD are handled by the LWSD. The LWSD staff keep track of their hours worked on the HSD system to bill the HSD accordingly. The HSD has a part-time treasurer and billing position averaging about 15 hours per month (note more hours during the billing months and less during non-billing months so 15 hours per month is an average). The HSD pays the ORSD $4,500 per year to complete the billing for HSD. The HSD clerk is an annual elected, stipend position for recording meeting minutes. The HSD has Three Commissioners, separate from the LWSD commissioners which are also stipend positions.

2.2.4 Oxford Rochdale Sewer District

The Oxford Rochdale Sewer District (ORSD) is enabled by Chapter 250 of the Acts of 1957 (the ORSD Act). The ORSD Act provides for a three-member Board of Water Commissioners to be elected at the annual meeting to three-year staggered terms. The Board is responsible for creating a warrant for the annual meeting and appointing a district clerk and district treasurer who hold office for one year or until a successor is chosen. The meeting Moderator is elected at the beginning of each annual meeting.

Oxford-Rochdale Sewer District (ORSD) currently serves 1,021 customer connections. The ORSD owns, operates, and maintains approximately 15 miles of gravity sewer, 1.7 miles of sewer force main, 4 pump stations, and a 0.50 MGD wastewater treatment facility. The system serves about 3% of the Town of Oxford's population or approximately 300 residents who discharge wastewater flows to the treatment facility along with about 79 customers within the Hillcrest Sewer District (HSD). The ORSD is operated in an office building located at the wastewater treatment facility at 28 Comins Road, North Oxford, MA

The ORSD system includes a wastewater treatment plant (WWTP), 4 sanitary sewer pump stations and 14.5 miles of sewer pipe with approximately 381 manholes.

The original wastewater treatment facility was built in 1971 and has been upgraded in 1996 and 2010 to increase plant capacity. The WWTP is an aerated lagoon WWTP with advanced treatment, mechanical screen, two lined 180,000-gallon lagoons with floating aerators, two 45-foot diameter final clarifiers, 180

square foot ABW filter, chlorine gas; chlorine contact tank; discharges to French River and permitted for 0.50 MGD. The WWTP has chemical feed systems for PAC, sodium aluminate, chlorine gas and bisulfite. There are rotary lobe pumps for RAS and WAS and three 10,000-gallon sludge holding tanks. The WWTP also includes an Admin Building with offices and conference room, storage under with garage doors, a laboratory and 20 ft x 20 ft RAS/WAS pump building.

Oxford-Rochdale Sewer District is permitted (permit issued 6/22/05, MA0100170) to discharge 0.5 MGD (average monthly) of treated municipal wastewater via outfall 001 to the French River. The facility is required under the current permit to conduct quarterly whole effluent toxicity tests using *Ceriodaphnia dubia*. The facility's maximum daily permit limits for whole effluent toxicity are LC50≥100% and CNOEC≥17%. The permit includes seasonal limits on CBOD, total suspended solids (TSS), fecal coliform bacteria, total residual chlorine, total ammonia-nitrogen (NH3-N), total phosphorus (TP), as well as limits on total copper. This permit has expired, and the District is waiting for EPA to issue a revised NPDES permit. The District has held off on WWTP upgrades until the permit is revised and discharge limits identified.

For the four sanitary sewer pump station, three stations have duplex 100 gpm Gorman Rupp pumps (Virginia Drive, Park Lane, Pleasant Street) and 1 station (Clark Street Station) has two 350 gpm Gorman Rupp pumps that serve Hillcrest Sewer District and upper parts of collection system. All the pump stations have buildings, and the Clark Street Pump Station has standby power.

The sewer collection system has about 15 miles of sewer (6-inch to 21-inch) including 21-inch RCP to the WWTP from Comins Road, 18-inch pipe up Mill Street to Stafford St, with the majority of the remaining 8-inch ACP and PVC pipe. The system includes about 1.7 miles of low-pressure sewers (1.5-inch to 6-inch) equipped with E1 pumps.

Oxford Rochdale Sewer District (ORSD) WWTF

This facility (aerated lagoon with advanced treatment) appears to be very well run and in decent shape. The facility was upgraded in 1995 and included an increase in capacity from 184,000 gpd to 500,000 gpd. The operator noted that a NPDES permit renewal application was submitted in 2014, and to date they have not seen a Draft or Final permit issued. The facility started enhanced chemical treatment for phosphorous removal in the late 1990s (seasonal limit of 0.2 mg/l). The operator is hesitant to move forward with any upgrades to the facility until they have a permit in hand, and due to the fact that the facility is running well. Recent upgrades/additions to the WWTF include a mechanical bar screen and RAS pumps. The operator noted that there is approximately $780,000 set aside as a WWTF stabilization fund that will be used to offset some of the costs of future upgrades. The operator noted that upgrade projects are typically funded through USDA loans rather than SRF loans.

It is our belief that within the next 2-3 permit cycles that a Total Nitrogen Limit will be required, as the flow is discharged to the French River and ultimately ends up in Long Island Sound. We would expect the Total Nitrogen limit to range from 3-8 mg/l. This will result in the need for a future project to add some sort of denitrification process, typically a de-nite filter or anoxic zones. A budget of about $1M-$2M should be set aside for this project alone. The operators also expressed concern with a potential reduction in the seasonal phosphorous limit to 0.1 mg/l. Should this occur, we would expect the facility to need to optimize chemical addition and optimize effluent filtration. This could add $0.5M to $1M should this be required.

During the brief tour of the facility, the following observations/potential projects were identified:

- SC #2 – Steel Weirs/Baffles are deteriorating and should be replaced with FRP units – $50,000+/-
- SC #2 – Corrosion was noted on the clarifier mechanism. Recommend blasting and re-coating – $60,000+/-
- MCCs in RAS Building – The MCCs in the RAS Building are outdated and difficult to service. Replace with newer technology - $150,000+/-
-
- Future Total Nitrogen Upgrade - $1.5M+/- to $3M+/-
- Future Phosphorous Removal upgrades - $0.5M+/- to $1M+/-
- Unscheduled Repair Allowance and Contingency (20%) - $0.5M+/- to $0.9M+/-
- TOTAL - $2.75M+/- to $5.2M+/-

It should be noted that data from an Asset Management Plan for the ORSD contained 89 items related to Treatment which are recommended for completion over a 50+ year period. The Total Value assigned to these improvements was $2,614,500. The review completed on 12/9/20 cannot be viewed to be as comprehensive and complete as other previously completed studies, including the Asset Management planning.

Table 2.13. 2014 – 2019 ORSD Flow Data (Total Flow Treated (MG/MGD)

Month	2014	2015	2016	2017	2018	2019
January	9.905 / .320	7.686 / .248	7.656 / .247	10.220 / .330	9.670 / .312	12.950 / .418
February	7.002 / .250	5.188 / .185	9.304 / .321	8.443 / .302	10.58 / .378	10.12 / .361
March	11.870 / .383	8.968 / .289	10.450 / .337	9.150 / .295	12.320 / .397	11.460 / .370
April	11.460 / .382	11.620 / .387	9.565 / .319	13.570 / .452	12.670 / .422	14.150 / .472
May	9.044 / .292	6.200 / .200	7.314 / .236	10.240 / .330	9.749 / .314	11.950 / .385
June	5.369 / .192	6.683 / .239	5.044 / .168	8.429 / .281	6.102 / .204	7.735 / .258
July	4.265 / .138	5.49 / .177	4.204 / .136	6.531 / .211	6.935 / .224	6.636 / .214
August	3.877 / .125	4.170 / .135	4.563 / .147	5.114 / .165	9.573 / .309	6.246 / .201
September	3.952 / .132	4.072 / .136	4.224 / .141	4.855 / .162	9.765 / .329	5.573 / .191
October	5.061 / .163	4.738 / .153	5.514 / .178	5.514 / .178	11.350 / .366	7.299 / .235
November	5.4564 / .182	4.876 / .163	5.825 / .194	8.147 / .272	14.250 / .475	9.089 / .303
December	10.800 / .348	6.140 / .198	8.095 / .261	8.247 / .266	13.160 / .424	13.370 / .431
TOTAL	88.059	75.831	81.758	98.460	126.124	116.578
Daily Avg	.241	.208	.224	.270	.346	.319

Staffing

The ORSD is required to have a minimum of 2 fully licensed wastewater operators work full time Monday through Friday. On the weekends, the ORSD is allowed to have one operator stop by the WWTP for 2 hours on Saturday and 2 hours on Sunday. When an operator takes vacation, they are allowed to have one operator working. Should emergencies occur, they call the LWSD to provide operators to assist.

The ORSD has a full-time Superintendent who maintains a current wastewater operator license. The Superintendent swaps weekends with the other wastewater operator. The ORSD employs one full-time licensed wastewater operator. The ORSD is a Grade 4 system. The superintendent is the chief operator and holds a Grade 5 license. The assistant operator holds a Grade 4 license. The ORSD employs a treasurer and billing position which averages about 15 hours per week. Currently the treasurer is in office at ORSD in the afternoons after the LWSD office hours (the same person fulfills LWSD, HWSD, HSD and ORSD treasurer positions). The ORSD clerk is a stipend position as are the three commissioner positions.

2.3 Moose Hill Reservoir and Moose Hill Water Commission

Moose Hill Reservoir was authorized under the provisions of Public Law 566 Small Watershed Program administered by the US Department of Agriculture Soil Conservation Service. The dam was constructed in 1966 impounding Shaw Brook for the purposes of flood control storage capacity, water supply and low flow augmentation. Sponsoring Local Organizations signed on to the Watershed Work Plan Agreement dated September 28, 1962; the Supplemental Watershed Work Plan Agreement No. 1 dated June 29, 1962 and Supplemental Watershed Work Plan Agreement No. 2 dated April 1968. Sponsoring Local Organizations included the Southern Worcester County Conservation District, Northern Worcester County Conservation District, Town of East Brookfield, Town of Leicester, and the Massachusetts Water Resources Commission. An Agreement was then executed between the Commonwealth of Massachusetts and the Town of Leicester dated December 12, 1972 for the purpose of construction of the Moose Hill Reservoir as a multi-purpose floodwater retarding and municipal water supply structure. An Operation and Maintenance Agreement was executed between the Soil Conservation Service, the Massachusetts Water Resources Commission and the Town of Leicester dated September 22, 1978.

The Moose Hill Reservoir Dam is currently owned and controlled by the Massachusetts Department of Conservation & Recreation (DCR), as successor to the Water Resources Commission referenced as a signatory Sponsoring Local Organization in the agreements listed above. The Town of Leicester continues to share in the costs of operation and maintenance in accordance with the 1978 Operation and Maintenance Agreement. The Town's share of the annual costs is 33.2%.

The Moose Hill Water Commission is the designated department of the Town of Leicester which is responsible for coordination of payments for the town's share of the costs of operation and maintenance of the reservoir and for coordination of any plans for the development of the reservoir as a source of public water supply. The Commission is administratively within the Leicester Planning & Economic Development Department.

The agreements referenced above are included in Appendix B-1.

An Intermunicipal Agreement (IMA) was executed between the Leicester Water Supply District (LWSD) and the Town of Leicester dated May 13, 2003 to provide an interim water supply and sewer connection for the rezoned portion of Route 9 West to assist the Town in promoting the rezoned Route 9 West corridor for business activities. The IMA goes on to state that: "It is understood that current District plant capacities for water and sewer are limited and will only provide an interim solution. Therefore, the long-range goal of the Town and the District shall be the development of the Moose Hill Reservoir and/or Shaw Pond as a primary water source for the entire Town."

The IMA includes 18 numbered paragraphs describing the actions taken or to be taken by the District and the Town, respectively. Specific water and sewer lines listed to be financed by the Town and constructed under a Massachusetts Highway Project 600858-02 include a water line in Route 9 and water booster station as part of a joint Town/District construction project; a sewer line in Route 9 and West Main Street and Sewer Pump Station on or adjacent to Town Beach Road (IMA paragraphs 4 and 5). Paragraph 10 calls for the District to construct and own a water storage tank at the District's expense "at a later date to provide fire flow storage and future water storage from the Moose Hill Reservoir facility."

Paragraph 13 states: "Once Moose Hill Reservoir facility water is provided to the water mains; the water mains shall also become a distribution/transmission main from the Moose Hill Reservoir facility. The booster pump station shall become a standby station in the event the Moose Hill Reservoir facility is taken offline or place out of service. Any connections made to the water main between the facility and the Route 9/Route 56 intersection shall be metered for water and the District shall compensate the Town for the water used. The rate for water so metered shall be determined by the formula described on "Exhibit 3" attached hereto." A file search has been unable to locate a copy of the referenced Exhibit 3. It remains unclear as to whether the Town or the District initially drafted the referenced formula which presumably describes the basis of compensation from the Strict to the Town for the purchase of the water delivered to the District from the Moose Hill Reservoir facility. The complete Agreement for Expansion of Water and Sewer Service Along Route 9 Between Leicester Water Supply District and Town of Leicester is included in Appendix B-3.

Feasibility Studies

Subsequent to the execution of the IMA between the Town and LWSD, LWSD engaged the services of SEA Consultants, Inc. to produce the first of two studies to evaluate the feasibility and costs required to develop Moose Hill as a source of public water supply.

Two studies were conducted to evaluate the feasibility and costs to develop Moose Hill as a source of public water supply. The first of these was prepared by SEA Consultants, Inc. (SEA) dated June 2008. This study considered that Moose Hill was capable of supplying up to 1.5 Million Gallons per Day (MGD) based on the reliable watershed yield of the reservoir. This would be subject to review and approval of the MassDEP and treatment requirements under the Safe Drinking Water Act and the actual yield could be less than 1.5 MGD. The study estimated the cost for development of a drinking water supply at Moose Hill Reservoir at $8,886,000 (in 2008 dollars), including costs for the following listed items:

1A 1.5 MGD Surface Water Treatment Plant	$4,500,000 (2008 dollars)
1B Land Acquisition/Site Development	Not Specified
2 Transmission Main (16" DI Pipe)	$1,375,000 (2008 dollars)
3 0.50 MGD Elevated Storage Tank	$1,530,000 (2008 dollars)
4 Surface Water Intake	Not Included
5 Residuals Force Main & PS	Not Included
Sub-Total	$7,405,000 (2008 dollars)
Engineering Services (Design, Procurement, Construction Svc.)	$1,481,000 (2008 dollars)
Permitting	Not Included
TOTAL	$8,886,000 (2008 dollars)

The second study was conducted in 2017 by Whitewater Consultants and their project partner Environmental Partners Group. This study focused on developing:

1. Planning level capital and operation and maintenance cost estimates for the potential water system infrastructure improvements associated with a new surface water treatment plant at the Moose Hill Reservoir and connection to the Town's existing water system, and
2. A forecast of the implementation schedule for the project, starting with a more detailed feasibility study through design, permitting and construction completion.

Table 2, Summary of Typical New England Surface Water Quality provided the only water quality information specific to Moose Hill Reservoir, dated 1996. Water quality reported on included Turbidity (0.5 – 1.5 NTU); Color (50 – 130 CU); pH (5.5 – 7.0 SU); Iron (0.07 – 0.7 mg/L); and Manganese (0.03 – 0.3 mg/L). Hardness, Coliform and Organics were listed in Table 2, but no data was included for these parameters.

Table 3 – Draft Capital Cost Estimate of Water Treatment Plant and Distribution System Improvements substantially updated the 2008 cost estimates producing a total capital cost estimate of $20,173,681 (in 2017 dollars), estimated as follows:

1A 1.5 MGD SW Treatment Plant	$10,233,945 (2017 dollars)
1B Land Acquisition/Site Development	Not Included
2 Finished Water Transmission Main	$1,787,5000 (2017 dollars)
3 0.50 MG Water Storage Tank	$2,065,500 (2017 dollars)

4 Surface Water Intake	$600,750 (2017 dollars)
5 Residuals Force Main & PS	$1,451,250 (2017 dollars)*
Sub-Total	$16,138,945 (2017 dollars)
Engineering Services	$4,034,736 (2017 dollars)
Public Outreach & Permitting	$750,000 (2017 dollars)
TOTAL	$20,173,681 (2017 dollars)

*Not including discharge treatment costs. For example, if residuals are discharged to the LWSD, the WWTF requires expansion to accept this flow since the existing WWTF does not have the capacity to accept this additional volume. An alternative would be to discharge to the Spencer WWTF; however, it is understood that this facility does not have the capacity to accept the additional flow either. Another alternative would involve trucking of residuals to a treatment facility with the capacity to accept such materials. A line item should be included in the above costs for WWTF expansion and upgrade due to the significant burden the existing nearby WWTFs would have for receiving residuals from the surface water treatment facility.

The study also included a projected cost forecast for 2025 of $27,609,076.

Table 5 of this study also estimated the annual operation and maintenance costs for a 1.5 MGD water treatment plant at $796,072 (2017 dollars).

The referenced feasibility studies are provided as Appendices B-4 and B-5, respectively.

Water Supply Approval Process – Massachusetts Department of Environmental Protection (MassDEP)

MassDEP has provided the Moose Hill Water Commission with two letters providing documentation of the process required for Leicester to develop Moose Hill Reservoir as a source of public drinking water. The first such letter is dated November 9, 1987 from James Fuller, then Deputy Regional Environmental Engineer for the Department of Environmental Quality Engineering (DEQE), forerunner to MassDEP. Mr. Fuller indicates that engineers from his office completed a review of the SEA report "Preliminary Design Report, Moose Hill Reservoir Water Treatment Facility, March 1986" and states that: "Based on this report, this office approves the Moose Hill Reservoir as a source for a public water supply."

The letter goes on to require that plans and specifications of treatment facilities to address drinking water regulations are required to be submitted and approved by this office prior to use of this supply and prior to construction of the treatment facilities. The letter further points out the obligation of other required permits and approvals including the Interbasin Transfer Act, Water Management Act and MEPA. Finally, the letter indicates that "the Moose Hill Reservoir presently does not serve any customers. Steps should then be taken to enter into agreements with any or all of the three water districts in the Town of Leicester to provide them with this water."

The second correspondence from DEP to the Moose Hill Commission is dated November 3, 2008, from Marielle Stone, Section Chief of the Central Regional Office Drinking Water Program of the MassDEP. This letter outlines in detail the process and procedures required to be met in order to establish a new drinking water source and treatment facility in order for the Moose Hill Reservoir to be used as a source of public drinking water. Included among an extensive list of studies and reports is a Preliminary Report

and Site Examination for a Source Greater than 70 GPM (BRP WS 17). The Preliminary Report must include:

1. Details of the proposed location of the intake structure.
2. A bathymetric map of Moose Hill Reservoir.
3. Mapping of the watershed, the reservoir and its tributaries, DEP Zones A, B and C, and proposed sampling locations.
4. Mapping of land use, ownership, and potential sources of contamination within the watershed.
5. Mapping of the potential water supply service areas, water and sewer districts, and possible service interconnections.
6. Population projections to be served by Moose Hill Reservoir for use in developing Water Needs Forecasts by DCR.
7. Detailed estimates of capital, operation and maintenance costs and the method(s) to finance capital charges and operational expenses.
8. Completion of relevant portions of the Site Screening package, including:
    a. Early Notice of the Proposed Project in the Environmental Monitor.
    b. Water Conservation Plan for Public Water Suppliers; and
    c. Alternatives Analysis.

MassDEP specifies that it must conduct a Site Examination which will include an evaluation of the proposed water quality sampling program covering a minimum of one year of sampling for some eleven categories of water quality parameters.

MassDEP letters are included in Appendix B-6

Current Status

Since the submission of the Draft Final Moose Hill Reservoir Feasibility Study Update, dated July 27, 2017, no specific actions have been taken to recognize Moose Hill Reservoir as an approved source of public water supply as specified by MassDEP. The watershed and bathymetric mapping specified in the MassDEP correspondence referenced above has not been developed as of this time. The water quality sampling of the reservoir specified by MassDEP has not been initiated. No specific budget requests appear to have been made or acted upon in the context of town meeting actions with reference to determining the suitability of Moose Hill Reservoir as a new water source or how water drawn from Moose Hill Reservoir would be made available to the Districts providing drinking water within their respective service areas. While the IMA between the Town and the LWSD appears to remain in effect, initiation of new discussions between the Town and all of the water districts would be prudent with regard to the future use of Moose Hill Reservoir as a possible town-wide source of public water supply.

For the purposes of the current assignment to evaluate the potential options for restructuring the delivery of water and sewer services within the Town of Leicester, Moose Hill Reservoir continues to represent a potential source of drinking water, subject to the approval of MassDEP and determination of treatment and distribution system requirements in the amount of 1.5 MGD. The current average daily demand total for the three current water districts is about 1.2 MGD. As such, it is possible to envision a future scenario in which Moose Hill could be developed as a source of public water supply capable of meeting the present-day water demands of the existing service areas of the existing water districts.

As a first step towards determining whether the development of Moose Hill as a drinking water supply would be cost-effective an analysis was conducted to compare the potential costs to develop and then

operate a treatment facility meeting DEP requirements from Moose Hill Reservoir to the costs of purchasing treated water from the City of Worcester. This analysis used the current purchase price per ccf from Worcester applied to the 1.5 mgd design basis for a water supply developed using Moose Hill Reservoir as its source of supply. Purchase of a daily volume of 1.5 million gallons per day (~732,000 ccf per year) of water from Worcester at $3.63 per ccf produces an annual cost of $2,656,800. Estimating the costs to develop a water supply at Moose Hill including treatment facility, intake, storage tank and additional water mains and related costs resulted in estimated total capital costs of approximately $30 Million. In addition, the costs of annual operation and maintenance costs were estimated in the range of from $860,000 to $1.5 Million.

Assuming an issuance cost of 1% of the total capital cost results in a total principal cost of $30,300,000. Bond costs were estimated based on an interest rate of 4.0% over a 30-year return period results in an annualized debt service cost of $1,752,252. Adding the range of annual O&M costs to the annual debt service cost results in total annual costs that range from $2,612,252 to $3,252,252. This preliminary cost comparison does not make any assumptions regarding possible changes in Worcester's charge basis over time. At this stage, it would not appear that development of Moose Hill to meet the demands of the service areas associated with the water districts as presently constituted would result in rate reductions for the short-term. However, it is necessary when evaluating new water supply sources to look out longer than 10 to 20-years.

In evaluating the potential development of Moose Hill for future water supply use, it would also be prudent to consider the future water demands, both for the water districts presently in place and for any plans to extend water service to any other areas within the Town of Leicester. It would be critical to consider whether the ability to provide 1.5 MGD will prove sufficient against future demand projections (which are beyond the scope of the current study) or expansion of water service to areas of town which are currently unserved by any of the existing water districts. Finally, it would also be prudent to consider whether the City of Worcester supply may become limited in its ability to meet the demands of the Leicester service areas at any point in the future.

2.4 Stiles Lake Water District

The Stiles Lake Water District was established in 1976 pursuant to chapter 476 of the Acts of 1976. Although the provisions of this enabling act mirror the description of a water district established for the purpose of providing water supply and distribution services within the boundaries established, the sole purpose for the creation of this water district was to provide an organizational framework for residents abutting Stiles Lake to be able to manage the finances and regulatory obligations as owners of the dam at the outlet of the lake. These purposes have been confirmed in discussions with the Chair of the Stiles Lake Water District. At present, there are no public water supply services provided by this district; nor are there plans to do so in the foreseeable future. All residents within the defined district boundary as described in the enabling act rely on private wells for their water supply purposes. For these reasons, no further assessment is required in relation to the Stiles Lake Water District. Future consideration may be given to the activation of this district giving due regard to the language of its enabling act which does in fact describe a typical water district, similar to the enabling act legislation for each of the other water districts operating within the town of Leicester.

3.0 CURRENT ASSESSMENT OF DISTRIC CONDITIONS - SUMMARY

3.1 Financial

In addition to current technical and regulatory assessments of each of the Districts it is important to understand their current financial conditions. These financial condition assessments are important to paint a full picture of the Districts currently but are critical to understanding the financial and customer impacts associated with the consideration and analysis of any future consolidation options. In order to perform an initial financial assessment, the following information was requested of and reviewed for each District.

- Historical and current operating budgets, in as much detail as possible for categorization and planning purposes.
- Annual debt service schedules for outstanding debt.
- Historical comprehensive annual financial reports or other audited or unaudited annual financial reporting documents.
- Annual reserve fund balances, restricted and unrestricted, and any policied sources and uses.
- Future capital expenditures and any know sources of funding.
- Existing rates, user charges, and miscellaneous fees; and
- Detailed historical customer and billing information.

The following sections present an existing snapshot of the rate and financials of each of the Districts.

3.1.1. Cherry Valley – Rochdale Water District

The Cherry Valley – Rochdale Water District (CVRWD) has an annual operating budget of approximately $1.3 million. The CV-RWD's largest cost drivers currently include payroll and related expenses, an intermunicipal agreement payment to the City of Worcester, and annual debt service payments. These three annual cost items alone account for almost two-thirds of the CVRWD's current annual revenue requirements.

The CVRWD's total annual revenue is currently $1.3 million; made up predominantly by user charges to customers through monthly water rates. The District currently employs a four-tier inclining block rate structure along with a monthly fixed charge. Other miscellaneous, and comparatively small, sources of revenue for the CVRWD include customer penalties, tower rental payments, interest income, etc.

The CVRWD is currently operating in a structural cash surplus. This means that on an annual basis, currently, the CVRWD is collecting more from revenues than it is spending. The District also has a healthy unrestricted fund balance of $300,000. Although CVRWD will most likely be required to implement rate increases in the future to generate the. additional revenues needed to adequately support future capital expenditures, which are presented in Section 2 of this report, those rate increases should be moderate and reasonable.

In order to understand on a deeper level, the financial, rate, and customer impact situation currently faced by the CVRWD and its customers, the following metrics have been compiled in tabular format. These data will be relied upon as needed for comparison purposes as consolidation options are considered. To provide context, the following definitions can be referred to for purposes of understanding each metric. These definitions carry through the remainder of this section for each of the Districts.

- Typical Annual Bill – Represents an annual water or sewer bill for a residential customer with a 5/8" meter and using 60 hundred cubic feet (Ccf) or 45,000 gallons of water annually.
- Annual Cost per Connection – Instead of calculating an actual bill defined by an assumed amount of consumption, as presented by the Typical Annual Bill, this metric simply takes each District's total annual revenue requirements and divides by the total amount of connections.
- Cost per Billable Unit – This is another metric utilized to portray total annual revenue requirements in a comparative manner. Total annual revenue requirements are divided by the total annual billable units by District. Billable units are typically in the format of Ccf or thousand gallons.
- Annual Revenue Requirements – The total annual cash needs of each District, currently. Please note that these revenue requirements will change over time to reflect inflationary adjustments as well as additional capital expenditures.
- MHI Burden – MHI, or Median Household Income, has historically been used in the water and sewer industry as a comparative metric for purposes of defining whether water and sewer bills are affordable for customers. MHI Burden takes the Typical Annual Bill and divides it into the service areas' MHI. Historically, any MHI Burden in excess of 2.0% for water or sewer bills individually, would be considered unaffordable. There have been opponents of this metric in the industry, pointing to the fact that MHI income levels do not necessarily represent the income of the most economically disadvantaged customers. To reflect this, lower income levels are utilized for comparison purposes, which will be presented utilizing the LQI Burden below.
- % of HH Living in Poverty – Represents the percent of households in the service area which are currently living in poverty. This is a good metric for understanding the general affordability issue at hand.
- Total Annual Revenue – The total annual revenue currently being collected by each respective District. This reflects all revenue sources, not just user charges. This value does not reflect future rate increases, no matter how necessary they are.
- LQI Burden – As discussed in the definition for MHI Burden, this metric operates in the same manner, but utilizes the upper limit income of the lowest quintile of households for purposes of comparing a Typical Annual Bill to. This is thought to be more indicative of the burden water or sewer bills place on a truly economically disadvantaged household.
- Bills in Hours of Min. Wage – Represents the number of hours someone would have to work, earning minimum wage, to pay for the Typical Annual Bill. This is assuming Massachusetts' existing minimum wage of $12.75.

Table 3.1. CV RWD Key Financial Metrics		
Typical Annual Bill $998	Annual Cost per Connection $1,415	Cost per Billable Unit $16.57
Annual Revenue Requirements $1,303,956	MHI Burden 1.64%	% of HH Living in Poverty 4.1%
Total Annual Revenue $1,350,000	LQI Burden 2.12%	Bill in Hours of Min. Wage 74.0

Table Note: MHI = Median Household Income; LQI = Lowest Quintile Income; HH = Households

3.1.2. Hillcrest Water District

The Hillcrest Water District (HWD) has an annual operating budget of approximately $299 thousand. The HWD's largest cost drivers currently include payroll and related expenses, annual professional services, and debt service. These three annual cost items account for almost half of the HWD's current annual revenue requirements.

The HWD's annual revenue is currently $296 thousand; made up predominantly by user charges to customers through quarterly water rates. The District currently employs a two-tier inclining block rate structure along with a quarterly minimum charge which includes 2 hundred cubic feet (Ccf) of usage. The HWD has other miscellaneous revenue sources, such as other charges and interest income, but are negligible in its grand total of revenue.

The HWD is currently operating an about break-even operation from a revenue versus costs standpoint. The District has a healthy unrestricted fund balance of about 40% of its annual revenue stream. Assuming adequate financing of the HWD's future capital expenditure needs, future rate increases will be required, albeit to a manageable degree.

In order to understand on a deeper level, the financial and rate situation currently faced by the HWD and its customers, the following metrics have been compiled in tabular format. These data will be relied upon as needed for comparison purposes as consolidation options are considered.

Table 3.2. HWD Key Financial Metrics		
Typical Annual Bill $480	Annual Cost per Connection $761	Cost per Billable Unit $13.46
Annual Revenue Requirements $298,950	MHI Burden 0.79%	% of HH Living in Poverty 4.1%

Total Annual Revenue	LQI Burden	Bill in Hours of Min. Wage
$295,811	1.02%	35.6

Table Note: MHI = Median Household Income; LQI = Lowest Quintile Income; HH = Households

3.1.3. Leicester Water Supply District - Water

The Leicester Water Supply District's water operations (LWSD-W) has an annual operating budget of approximately $777 thousand. Its largest cost drivers currently include payroll and related expenses, engineering and capital related costs, and debt service.

The LWSD-W's annual revenue is currently $787 thousand; made up predominantly by user charges to customers through quarterly water rates. The District currently employs a three-tier inclining block rate structure along with a quarterly fixed charge. The LWSD-W has other miscellaneous revenue sources, such as interest income, connection fees, , and annual rental fees.

The LWSD-W is currently operating a structural cash surplus with a healthy unrestricted fund balance of over 20% of its annual revenue stream. Assuming adequate financing of the LWSD-W's future capital expenditure needs, future rate increases will be required, albeit to a manageable degree.

In order to understand on a deeper level, the financial and rate situation currently faced by the LWSD-W and its customers, the following metrics have been compiled in tabular format. These data will be relied upon as needed for comparison purposes as consolidation options are considered.

Table 3.3. LWSD-W Key Financial Metrics

Typical Annual Bill	Annual Cost per Connection	Cost per Billable Unit
$574	$990	$12.37
Annual Revenue Requirements	MHI Burden	% of HH Living in Poverty
$777,042	0.94%	4.1%
Total Annual Revenue	LQI Burden	Bill in Hours of Min. Wage
$787,452	1.22%	42.5

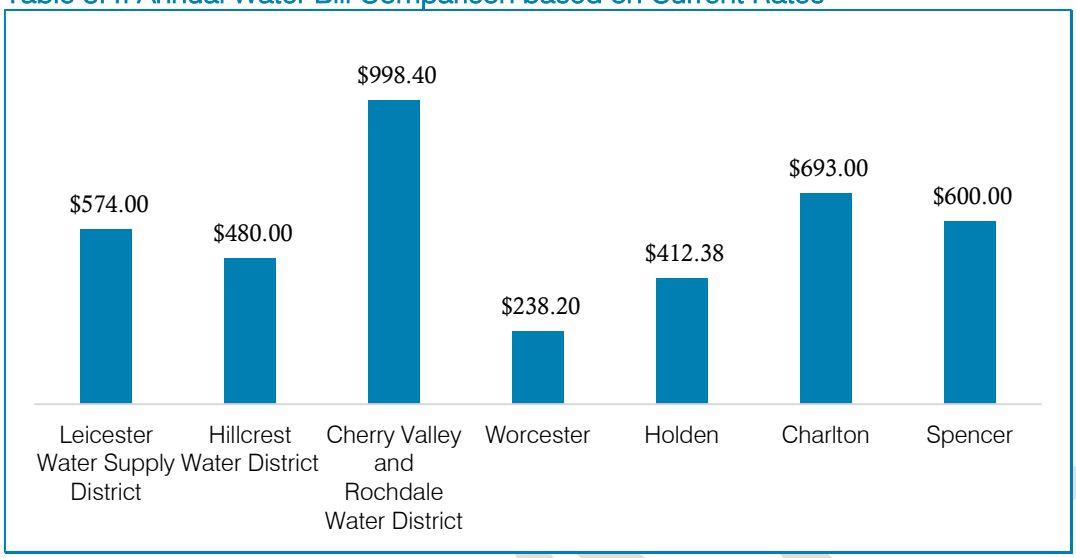
Table Note: MHI = Median Household Income; LQI = Lowest Quintile Income; HH = Households

3.1.4. Summary of Water District's Key Financial Metrics

The graphic in Appendix C provides side-by-side comparisons of the various water districts. At this time, the Weston and Sampson project team are drawing no firm conclusions as to the importance in the magnitude of differences between the comparative metrics between districts and are instead presented for information purposes only at this time. As the project proceeds as planned, and various consolidation options are considered, these comparative metrics will be utilized to help formulate and compare options over structure and time. Included in Appendix C, but also worthy of being presented here in the body of this report is a comparison of an annual water bill, presented for all 3 water districts, as well as 4 neighboring municipal water utilities. Bills are presented on an annual basis and assume a residential

customer with 60 Ccf of annual consumption and a 5/8" meter, where applicable and rates differentiate by meter size.

Table 3.4. Annual Water Bill Comparison based on Current Rates



3.1.5. Cherry Valley Sewer District

The Cherry Valley Sewer District (CVSD) has an annual operating budget of approximately $894 thousand. CVSD's largest cost drivers currently include payroll and related expenses, wholesale wastewater costs, and debt service. These three annual cost items account for over 80% of the CVSD's current annual revenue requirements. Cherry Valley's annual debt service requirements alone account for almost half of its annual revenue requirement.

The CVSD's annual revenue is currently $760 thousand; made up predominantly by user charges to customers through monthly sewer rates. The District currently employs a four-tier inclining block rate structure along with a monthly fixed charge. Other miscellaneous, and comparatively small, sources of revenue for the CVSD include liens and interest income.

The CVSD is currently operating in a structural cash deficit. In addition, the District also has a current unrestricted fund balance which is negative. In order to remove CVSD's existing structural deficit, an almost 18% rate increase would be required. This would be on top of recent rate increases of significant magnitudes, as well as future required rate increases to support inflationary changes, capital expenditures, and replenishing of the District's unrestricted fund balance, bringing the District's bills even more significantly higher than comparative customer bills as other surrounding sewer utilities. Please see section 3.1.9, Table 3.9 for a chart of comparisons.

In order to understand on a deeper level, the financial and rate situation currently faced by the CVSD and its customers, the following metrics have been compiled in tabular format. These data will be relied upon as needed for comparison purposes as consolidation options are considered.

Table 3.5. CVSD Key Financial Metrics		
Typical Annual Bill $1,929	Annual Cost per Connection $1,909	Cost per Billable Unit $38.63
Annual Revenue Requirements $893,505	MHI Burden 3.17%	% of HH Living in Poverty 4.1%
Total Annual Revenue $760,071	LQI Burden 4.10%	Bill in Hours of Min. Wage 142.9

Table Note: MHI = Median Household Income; LQI = Lowest Quintile Income; HH = Households

3.1.6. Hillcrest Sewer District

The Hillcrest Sewer District (HSD) has an annual operating budget of approximately $338 thousand. The HSD's largest cost drivers currently include outside services, treatment related costs, and annual debt service.

The HSD's annual revenue is currently $300 thousand; made up predominantly by user charges to customers through quarterly rates. The District currently employs a flat rate per customer, irrespective of water usage, meter size, or customer classification. The HSD receives other revenue sources, in addition to its flat fees, of other charges and investment earnings.

The HSD is currently operating an about break-even operation from a revenue versus costs standpoint. The District has a healthy unrestricted fund balance of about 60% of its annual revenue stream. Assuming adequate financing of the HSD's future capital expenditure needs, future rate increases will be required, albeit to a manageable degree.

In order to understand on a deeper level, the financial and rate situation currently faced by the HSD and its customers, the following metrics have been compiled in tabular format. These data will be relied upon as needed for comparison purposes as consolidation options are considered.

Table 3.6. HSD Key Financial Metrics		
Typical Annual Bill $540	Annual Cost per Connection $861	Cost per Billable Unit $15.23
Annual Revenue Requirements $338,240	MHI Burden 0.89%	% of HH Living in Poverty 4.1%
Total Annual Revenue $299,577	LQI Burden 1.15%	Bill in Hours of Min. Wage 40.0

Table Note: MHI = Median Household Income; LQI = Lowest Quintile Income; HH = Households

3.1.7. Leicester Water Supply District - Sewer

The Leicester Water Supply District's sewer operations (LWSD-S) has an annual operating budget of approximately $657 thousand. Its largest cost drivers currently include payroll and related expenses, and engineering and capital related costs.

The LWSD-S's annual revenue is currently $671 thousand; made up predominantly by user charges to customers through quarterly sewer rates. The District currently employs a two-tier inclining block rate structure along with a quarterly fixed charge. The LWSD-S has other miscellaneous revenue sources, such as interest income, connection fees, and assessments and betterments.

The LWSD-S is currently operating a structural cash surplus with a healthy unrestricted fund balance of over 20% of its annual revenue stream. Assuming adequate financing of the LWSD-S's future capital expenditure needs, future rate increases will be required, albeit to a manageable degree.

In order to understand on a deeper level, the financial and rate situation currently faced by the LWSD-S and its customers, the following metrics have been compiled in tabular format. These data will be relied upon as needed for comparison purposes as consolidation options are considered.

Table 3.7. LWSD-S Key Financial Metrics

Typical Annual Bill $551	Annual Cost per Connection $837	Cost per Billable Unit $10.46
Annual Revenue Requirements $657,042	MHI Burden 0.91%	% of HH Living in Poverty 4.1%
Total Annual Revenue $671,706	LQI Burden 1.17%	Bill in Hours of Min. Wage 40.8

Table Note: MHI = Median Household Income; LQI = Lowest Quintile Income; HH = Households

3.1.8. Oxford-Rochdale Sewer District

The Oxford-Rochdale Sewer District (ORSD) has an annual operating budget of approximately $546 thousand. The ORSD's largest cost drivers currently include payroll and capital related investments and maintenance.

The ORSD's annual revenue is currently $610 thousand; made up predominantly by sewer user charge revenue. The District currently employs a flat annual charge for sewer, irrespective of the amount of water a customer uses, or its meter size or customer classification. The ORSD has other miscellaneous revenue sources but are negligible in its grand total of revenue.

The ORSD is currently operating a structural cash surplus with a healthy unrestricted fund balance of approximately 50% of its annual revenue stream. Assuming adequate financing of the ORSD's future capital expenditure needs, future rate increases will be required, albeit to a manageable degree.

In order to understand on a deeper level, the financial and rate situation currently faced by the ORSD and its customers, the following metrics have been compiled in tabular format. These data will be relied upon as needed for comparison purposes as consolidation options are considered.

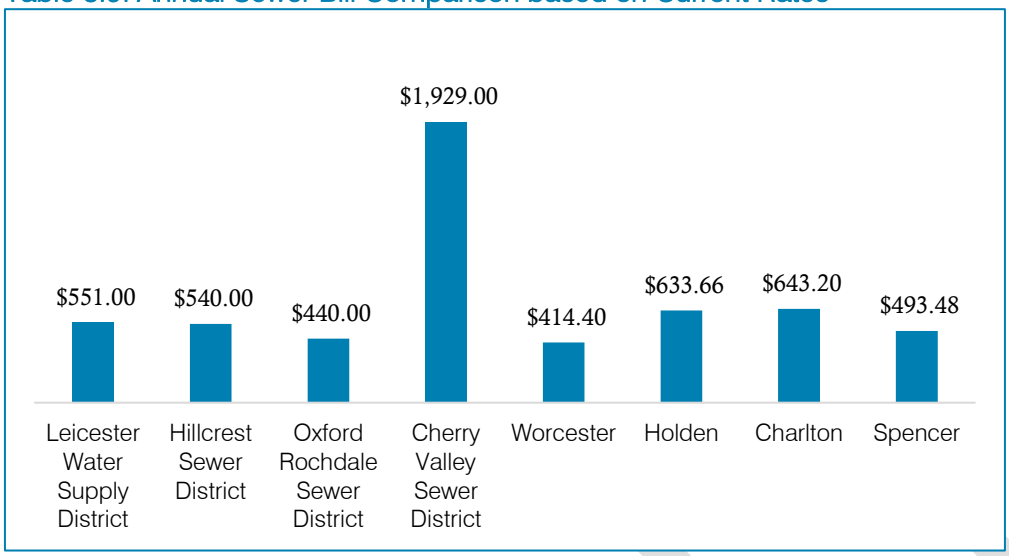
Table 3.8. ORSD Key Financial Metrics		
Typical Annual Bill $440	Annual Cost per Connection $511	Cost per Billable Unit $3.58
Annual Revenue Requirements $544,587	MHI Burden 0.72%	% of HH Living in Poverty 4.1%
Total Annual Revenue $610,227	LQI Burden 0.94%	Bill in Hours of Min. Wage 32.6

Table Note: MHI = Median Household Income; LQI = Lowest Quintile Income; HH = Households

3.1.9. Summary of Sewer District's Key Financial Metrics

Table 3.9 provides side-by-side comparisons of the various sewer districts. At this time, the Weston and Sampson project team are drawing no firm conclusions as to the importance in the magnitude of differences between the comparative metrics between districts and are instead presented for information purposes only at this time. As the project proceeds as planned, and various consolidation options are considered, these comparative metrics will be utilized to help formulate and compare options over structure and time. Included in Appendix D, but also worthy of being presented here in the body of this report is a comparison of an annual sewer bill, presented for all 4 sewer districts, as well as 4 neighboring municipal sewer utilities. Bills are presented on an annual basis and assume a residential customer with 60 Ccf of annual water consumption and a 5/8" meter, where applicable and rates differentiate by meter size.

Table 3.9. Annual Sewer Bill Comparison based on Current Rates



3.2 Structure and Organization

Each of the 6 districts were established by separate special acts of the Massachusetts Legislature over a 118-year period beginning in 1888 with the creation of the Leicester Water Supply District.[1] All of the districts are governed in a manner similar to the open town meeting government in Massachusetts with an elected executive (i.e. Board of Commissioners) and legislative body that is open to all voters residing in the district. Initially, managing officers for most of the districts were elected by the annual meeting but recent changes to by-laws allow the appointment of clerk, treasurer, and superintendent by the Board of Commissioners. Some of the districts have executed inter-agency agreements providing for shared management and operation.

The Board of Commissioners convene an annual meeting. A Moderator selected by the voters present at that meeting presides over the annual meeting. Annual meetings are generally not well-attended. Membership on the boards of each district is characterized by low turn-over with little or no competition for positions and the same is true for most managing officers. None of the districts formally plan for succession of Commissioners or other officers.

Each district has adopted by-laws and rules and regulations. The most recently revised rules and regulations are 7 years old (ORSD); the most recently adopted by-laws are 6 years old (LWSD). By-laws are essential to the administration of the districts while rules and regulations are essential to the proper operation of the systems. Both should undergo periodic review to ensure consistency with law, regulation, and actual practice. See Table 2.2 for a list of bylaws and regulations by date of adoption[1]. Although there is no standard timeframe for review, rules and regulations should be reviewed every 5 years and anytime a significant regulation or permit condition is changed by federal or state authorities. By-laws are less likely to require revision and can be reviewed less often.

While the districts have taken steps towards professional management of their finances by appointing rather than electing treasurers, none appear to have job descriptions that adequately describe the necessary skills, education, experience, and work performance for these positions. Specifically, two

districts (CV-RWSD and ORSD) have provided job descriptions. In the case of ORSD, there is no job description for Treasurer and the descriptions for operations personnel are 25 years old. CV-RWSD the Treasurers job description is a fairly extensive list of duties, but lacks mention of educational and experiential qualifications, required training or certification, needed skills or abilities, and other factors such as the level of confidentiality that the job requires. Complete job descriptions are an important management tool as they set forth the standards for the job, the expectations of the organization and help meet legal requirements established in, for example, anti-discrimination and fair labor statutes.

Along with moving to appointed treasurers, many of the districts share Treasurers to improve efficiency. However, it is not clear what the recruitment and selection process has looked like in the past for these positions. The project team noted that although there is no certification process that is entirely applicable to district treasurers, certification, and professional development through the Massachusetts Collectors & Treasurers Association (MCTA) is likely relevant. Although there are portions of the program that are not relevant, the MCTA Treasurer certification program covers many beneficial topics, such as, cash control procedures-, short- and long-term borrowing, municipal finance law, ethics, capital budgeting and financing, and procurement. The districts would likely benefit from further professionalization of these positions through job descriptions, a rigorous recruitment and selection process as vacancies occur, and more support for training and ongoing professional development of individuals holding the position.

In general, the districts have seen a great deal of longevity in leadership positions. The stability that comes from successfully retaining competent leadership should not be understated. All organizations will eventually experience turn-over in key positions. The loss of institutional knowledge when this turn-over occurs can be substantial. Having basic human resources and financial management structures in place will help ensure smooth transitions. For example, it appears that only one district has formal HR policies and another an employee handbook. There are no formal employee performance evaluations or written financial policies and procedures. While this may be typical of similar water and sewer districts in Massachusetts, these are worthy endeavors. Additionally, some of the districts do not have a debt management plan or a robust capital planning process. The project team recognizes that many of these occur, but in many cases, they rely on individual knowledge and habit rather than being established or documented in the management structure.

[1] See Appendix A for copies of by-laws and rules and regulations.

4.0 ORGANIZATIONAL & MANAGERIAL STRENGTHS & WEAKNESSES (LEICESTER)

The strengths of the districts are rooted in the involvement of a core group of leaders who have devoted their careers to the success of these organizations. Each district has enjoyed a great deal of stability in their management as commissioners tend to stay on for extended periods. They have employed qualified, capable, and appropriately licensed superintendents to manage the operations. Administratively they are in the hands of dedicated and hands-on treasurers and staff who juggle the needs of multiple districts and provide customer service that is highly responsive to their customers. They appear to take seriously their fiduciary responsibilities and ensure that there are periodic external financial audits.

There is also a great deal of cooperation among the districts. Several inter-agency agreements are in place providing joint management of districts and districts appear to cooperate very well ad hoc. For example, there are two treasurers in place to oversee the finances of 6 districts and three superintendents who oversee their operation. Although formal inter-agency agreements exist between some of the districts, they do not cover all of the financial and operational relationships, nor do they cover every aspect of the formalized relationships.

Organizationally, the districts are challenged by being small, and facing increasing costs and extensive regulation. On the other hand, the districts have mitigated these challenges through stability in leadership, strong technical ability, and well-established long-term relationships.

The districts essentially operate as independent "towns" organized to provide water and/or sewer services to discrete geographic areas. Governed by voters in attendance at an annual meeting and an elected Board of Commissioners the districts most resemble Massachusetts Open Town Meeting in its most elementary form. State and federal laws and regulations governing the spectrum of management functions from human resources to finance to the environment have developed and evolved as to require increased specialization and greater technical skill from municipal officials. In response, towns have adapted the original Open Town Meeting form through special acts, charters, and extensive by-laws to professionalize management to one degree or another.

In the 20th century some towns began to absorb the various water districts that existed within their boundaries. They benefitted from being subject to the full panoply of town policy, the oversight of various committees, and financial infrastructure. Perhaps most important is the ability of the town to pledge its full faith and credit towards the construction and improvement of water and sewer facilities. In this way, the per capita cost of improvements was minimized as they were spread over the property base of the entire town. After the adoption of proposition 2 ½ the trend towards enterprise funds accelerated. Separating water and sewer revenues from the town property tax base strengthened the ability to finance improvements. .

None-the-less, many small districts continue to successfully provide water and sewer service in Massachusetts. These districts benefit from being separate entities from towns by having greater rate-payer control of finances, access to financing through the US Department of Agriculture which provides grant dollars to small systems as compared with medium or large systems that tend to receive funding in the form of loans, and a high degree of customer service.

The size of the districts tends to exacerbate any structural weakness that may exist by making them less efficient. Small districts, by definition, have a limited base upon which to recover their costs. Naturally, they will seek to minimize overhead, and administrative costs as demonstrated by the Districts sharing of administrative and operational staff. They will train their focus on the cost to meet the minimum technical standards for the provision of service. Left with few resources to devote to non-operational costs, the districts lack the means to develop and implement policies, procedures, and instruments without relying on retained consultants. Imagine for a moment that every town department had to develop its own financial and human resources infrastructure and the inefficiency becomes apparent.

The project team has noted that current efforts to consolidate, for example LWSD and HWD, have the effect of mitigating these apparent inefficiencies. In effect, these districts recognize some of the limitations and have taken positive steps.

These challenges are evidenced by a lack of formal financial or personnel policies, few written job descriptions or qualifications, and limited strategic planning. Even the smallest organizations need to concern themselves with a myriad of personnel policies from access to communication technology to workplace violence prevention. Financial policies are also of paramount importance in assuring accuracy and accountability. Appendix A contains lists of recommended financial and personnel policies. The districts should conduct audits of the extent to which they meet the recommendations.

The size of the districts can also lead to financial stress. The provision of water and sewer service is highly regulated with increasingly stringent standards. Capital improvements and replacements bring significant cost of construction and financing. Wastewater and drinking water treatment facilities, for example, are made up of a system of components that are necessary whether the facility is large or small. In this way, the costs are, to a degree, fixed. Systems must spread these costs over time and their base of customers. High fixed costs spread over a small customer base will result in higher per unit user fees, as demonstrated by the recent experience of the Cherry Valley Sewer District.

5.0 MANAGEMENT OPTIONS

5.1 Maintain Status Quo w/ Recommended Improvements

5.2 Merger / Consolidation Options & Challenges

5.3 Town Department Options

5.4 Acquisition by Private Utility Company

6.0 RECOMMENDATIONS FOR LONG-TERM MANAGEMENT OF WATER & SEWER SERVICES

APPENDIX A

Organization Materials

APPENDIX A-1

Enabling Acts

APPENDIX A-2

Bylaws

APPENDIX A-3

Regulations

APPENDIX A-4

HR Policies

APPENDIX A-5

Financial Policies

APPENDIX B

Moose Hill Documents

APPENDIX B-1

Authorizing Agreements

APPENDIX B-2

Leicester-SCS-WRC O&M Agreement

APPENDIX B-3

Leicester-LWSD IMA

APPENDIX B-4

Feasibility Study, SEA, 2008

APPENDIX B-5

Feasibility Study, Whitewater Consultants, 2017

APPENDIX B-6

DEP Correspondence

APPENDIX C

Financial Metrics