CENTRALIZED SEWAGE TREATMENT AND THE DEVELOPMENT OF TOWN CENTERS:

WEST NEWBURY CASE STUDY

**Funding provided by Massachusetts Downtown Initiative (MDI)
of the Department of Housing and Community Development**

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Acknowledgments

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This report supplements a presentation made to the Board of Selectmen of West Newbury on September 26, 2018.

Executive Summary

Infrastructure has a significant, but often unseen, impact on the ability to implement economic development strategies. For commercial centers in smaller towns, the ability to expand businesses may be affected by the infrastructure for sewage treatment. Individual septic systems use land that could otherwise support buildings, parking, or public amenities such as plazas or landscaping. The size of individual lots may restrict the size of the business, based on the required size of a leach field associated with a traditional septic system. The placement of the system on the lot may also act as a restriction of the preservation or development of a walkable town center; if the system is in front of the building, the building and public amenities may be pushed back from the street, reducing the impact of the activity generated by the business on street life in the area.

Purpose of Planning Process

The purpose of this planning process is to define the elements a town might need to consider when evaluating the need for and the implications of a package treatment plant as a solution for sewage collection and treatment in a downtown area. This analysis assumes that a community is considering the need to support or expand an existing area that may have several businesses and residences that rely on individual septic systems. This report, which accompanies a presentation to the West Newbury Board of Selectmen on September 26, 2018, is not meant to be an exhaustive study of the technical elements of septic systems. Rather, it is a guide to the implications of sewage management on the ability for rural downtowns to survive (in some cases) and expand (in others).

West Newbury acts as the case study for this planning process. The Town of West Newbury is in northeastern Massachusetts, west of Newburyport and I-95. The Merrimack River defines its northern border; the southern border is Newbury, and the western border is Groveland. The population is 4,235 (2010 census). Preservation of open space for active and passive recreation is a major focus of the Town government and the rural nature of the town is reinforced by the number of farms within its borders, including Long Hill Orchard and Farm, Maple Crest Farm, and Artichoke Dairy, and a number of Christmas tree farms: White Gate, Crane Neck, and Evergreen Farms.

West Newbury's Town Center lies along Route 113, which is the main connection between Groveland and I-95/Newburyport. The Center is a cluster of two churches and several small businesses, including West Newbury Pizza and West Newbury Food Mart, and is not large; businesses are distributed throughout West Newbury as part of its historic development pattern. Single-family residential buildings predominate, but two-family dwellings, home occupation, multifamily dwellings of no more than four units, mixed-use buildings, and accessory dwelling units are allowed, with restrictions.

The Town has identified a need to support the existing cluster of businesses, some of whom have challenges related to existing septic systems. Previous planning processes have identified an interest in expanding the Town Center to include additional businesses. Concerns have also been raised about nearby individual residential septic systems that may be failing. The size of the parcels and the reliance on individual septic systems present challenges to such expansion. West Newbury is therefore a good community in which to test the information needed to consider a package treatment plant and the implications of such a plant on future development.

Sponsorship

The Department of Housing and Community Development provided a grant to the Town of West Newbury under its Massachusetts Downtown Initiative program for this study process. The Town of West Newbury provided staff support, led by the Town Planner, Leah Zambernardi, AICP. Harriman was hired to assist with the study, and the Town appointed a Working Group of staff, elected officials, residents, and representatives from the business community to provide input and feedback.

Process

Harriman met with the Working Group in July, September, and November 2017 to discuss the research, analysis, and implications of the process. Harriman made a final presentation to the Board of Selectmen on September 26, 2018. Updates and presentation materials were posted to the Planning Board's page of the Town's website after each meeting.

Participants in the Working Group sessions were:

- Ann Bardeen, Planning Board
- Brad Beaudoin, Finance Committee
- Julia Fahey, Resident
- Jennifer Fahey, Homeowner
- Robert Janes, Board of Health
- Francis Karam, Business owner
- Frank Long, Homeowner
- Brian Morisseau, Haverhill Bank
- Paul Niman, Homeowner
- Wendy Reed, Conservation Commission
- Patricia Reeser, Open Space Committee
- John Sarkis, Planning Board
- Paul Sevigny, Health Agent/Board of Health
- Bob Williams, Star Construction

The July meeting provided the Working Group with an introduction to the purpose of the study and the process, and to previous community discussion around the needs and preferences for the development of the Town Center.

In September, Harriman presented general information about sewage treatment, including the different systems and options for management, financing, and operating structures. The Working Group also reviewed and discussed specific information about, and implications for, West Newbury.

At the meeting in December, Harriman presented the results of initial build-out scenarios based on alternative options for the Town Center and the implications of those scenarios on the size of the system required to meet total daily flows.

At each meeting, the Working Group provided additional information about the community and its preferences, existing conditions within and around the Town Center, and requests for additional information or analysis. The Working Group's input has been incorporated into each stage of this planning process and into the analysis presented to the Board of Selectmen and in this accompanying report.

The Commonwealth of Massachusetts sponsors an online *Smart Growth/Smart Energy Toolkit* with a module on Wastewater (http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-ww.html). This is an excellent summary of the regulatory, technical, and cost information related to wastewater treatment and its impact on increased density. The information in this module is referenced in portions of this report. However, the focus of this report is on the impact to town centers rather than the discussion of density that is the focus of the Toolkit.

Downtowns and Septic Systems

Installing a centralized treatment plant can have many benefits for rural communities, including allowing a diversity of uses, an increased density of uses in a concentrated area (reducing sprawl), and managing the environmental impact of individual systems on the watershed. The focus of this study process was on the impact of a centralized treatment plant on economic development, and more specifically, on the ability to support and further develop a small village or town center. A community considering installing such a plant must consider three key components: purpose, size and location, and cost.

PURPOSE

The community should engage in a planning process that 1) establishes a vision for its downtown or town center and 2) defines the metrics that indicate a successful realization of that vision. Part of that planning process should be the evaluation of the existing uses in the downtown. Such an evaluation would look at the existing mix of businesses and residences, plans for expansion by current business owners, and known demand for additional commercial space. An inventory of existing businesses allows the community to determine if the current mix meets its needs and to understand what conditions are preventing new uses from locating in the downtown. The community also needs to discover if the current owners are blocked from expansion or have their survival threatened by the use of individual systems.

The combination of small lots and the use of individual septic systems might, for example, prevent restaurants of a certain size within the downtown. If a community values a daytime meeting place, such as a café, or a place to go after work, the inability for a restaurant to locate in the downtown might be a block to fulfilling that community's vision. Restaurants have implications for sewage systems that other uses do not, for example, the need for a grease trap to capture cooking grease and food waste.

Other communities might seek to add more residential to the downtown. The mix of residential and business uses, including retail, small offices, and restaurants, contributes to the vibrancy of a downtown by ensuring activity after the traditional 9-5 office hours. Promoting additional density in an existing center of development contributes to the walkability and sustainability of a town, especially for towns that value the preservation of open space and farmland. Individual septic systems limit the number of dwelling units in an area and make it more difficult for a town to cluster new residential uses in the existing downtown.

Collective support for a downtown vision will lead to a defined purpose for the treatment plant and help inform the size and location for a centralized system.

SIZE AND LOCATION

Size and location are intertwined concepts. The number of residences and businesses connecting to the system determines the design flow (the number of gallons per day that must be treated), with additional capacity built into the calculations to support future users. Who connects to the system helps determine the size and the location of the system. The location must have sufficient room for the system and be close enough to the users to collect the sewage without unreasonable infrastructure costs. Finally, the location must have the appropriate soils and setbacks for wetlands to treat and discharge the flow.

The size and location have impacts for the system's owner/operator, but also for the property owner connecting to the system. More users reduce the initial capital cost to connect per user and the annual cost per user for collection, treatment, and maintenance.

COST AND OWNERSHIP

The cost component includes the initial capital outlay, including land acquisition costs, and ongoing maintenance costs. Initial capital outlay is closely tied to location: the number of initial connections, provision for future connections, and the amount of connecting infrastructure. Maintenance is tied to ownership and management; the centralized system can be owned privately, by the municipality, or by a regional group. The system may be managed by its owners or by a management company hired separately.

Implications for West Newbury

West Newbury has a small town center with one restaurant, office uses, low-density residential, two churches, a food store, and some additional retail. Members of the community have identified a desire to expand the offerings in the Town Center; however, some existing businesses and residences are concerned about failing septic systems with no room on their lot for a replacement system.

The community does not yet have a shared vision about whether to implement a centralized system. The inclusion of this Town as a case study allows this planning process to view the questions surrounding the use of centralized sewage systems to support downtowns through the lens of the specific conditions present within West Newbury.

FIGURE 1: TOWN CENTER AND SURROUNDING CONTEXT, WEST NEWBURY, MA

General Considerations for Centralized Systems

Determining whether a centralized system is appropriate for a downtown rests on a number of considerations: the reasons for public management of sewage; the regulatory environment for sewage management; options for different systems, and the cost, funding, and operational implications of such management.

System Types

Sewage collection, treatment, and disposal impacts human health and the health of animals and the aquatic environment. Improper disposal can have serious impacts on disease transmission and cause the deterioration of water quality, which may affect economic development by closing beaches or fishing grounds.

The Massachusetts Department of Environmental Protection (MassDEP) regulates sewage management with Title 5 of the State Environmental Code (310 CMR 15.00) and Groundwater Discharge Permit Regulations (314 CMR 5.00). The regulatory threshold for moving from individual systems to treatment plants is a design flow of 10,000 gallons per day (gpd) or more.

Small businesses and residences do not trigger this threshold; in rural areas, it is therefore possible to rely on individual septic systems or smaller shared systems to manage sewage treatment. However, individual septic systems are not always viable; existing site conditions (soil type, elevation of the water table), the size of the lot, and poor maintenance can make the use of a traditional septic system impractical or cause an existing septic system to fail. The local Board of Health regulates these individual systems and has requirements that protect groundwater, wetlands, and waterways.

INNOVATIVE/ALTERNATIVE (I/A) TECHNOLOGIES

MassDEP has a list of I/A technologies that can replace the conventional septic system.[1] These systems must meet the same standards for environmental protection as a conventional system. Two programs exist for testing new systems in the field: a Pilot Test program and a Provisional Use program. These systems must still meet the protection standards of the conventional system. Some of these systems are designed for flows of less than 10,000 gpd, and may be of interest for property owners with problems installing a conventional system.

SHARED SYSTEMS

A shared system can provide an opportunity to serve multiple businesses and/or residences, allowing the land that would have been used for a leach field on each lot to be re-purposed for alternative uses: building relocation and/or expansion, public amenities, and parking.

Shared or cluster systems are traditional septic systems that can support multiple businesses, residences, or a mix of both with a single leach field. As with individual systems, the design flow must still be less than 10,000 gpd and the installation of such systems is regulated by Title 5 and the local Board of Health, with a review by MassDEP.

Shared Wastewater Treatment Plants (those with design flows of 10,000 gpd or more) are regulated by MassDEP and are subject to the Groundwater Discharge Permit Regulations (314 CMR 5.00). These regulations control the design of the treatment plant and the impacts on subsurface soils and groundwater flows, which may limit the location of the plant. Standards for treatment are higher for wastewater treatment plants than for septic systems, and the cost of installation and ongoing operations is

1 MassDEP, http://www.mass.gov/eea/agencies/massdep/water/wastewater/title-5-innovative-alternative-technology-approvals.html, last accessed January 18, 2018.

higher. However, that cost can be spread across a larger number of users for a lower cost per user.

Bourne, Hubbardston, and Littleton have each undertaken a feasibility study within the last six or seven years. Each has chosen a different path to address wastewater treatment needs in their Town Centers. A summary of the recommendations and a link to each study can be found in *Recommended Feasibility Studies* at the end of this report.

IMPLICATIONS FOR TOWN CENTERS

With individual or shared systems, the size of the septic system controls the density of uses (e.g., the number of bedrooms or square feet of business per system). If a lot can only accommodate a septic system of a certain capacity, then the use on the lot is limited by the capacity of the system. I/A systems may address some of the challenges related to site conditions that cannot be met with a conventional system.

Shared/Cluster systems can replace a series of existing individual systems in a town center and can be upgraded to meet future demand, if that demand is projected to have a design flow of less than 10,000 gpd. Again, density will be controlled by the availability of land to accommodate the leach field required for the system. Land for alternative leach fields may need to be identified in case the first field fails.

With Shared Wastewater Treatment Plants, the density of uses is defined by the Town's zoning ordinance and subdivision controls. The plant can be designed to accommodate existing and future expected flows and the design may allow later expansion.

Ownership

The ownership of a treatment system can be private, public, or regional. Individual and shared systems can be owned by all three. A town may own an individual system for each municipal building or a shared system to support adjacent facilities. A condominium or homeowners' association may own and maintain a cluster system that supports all units in a multi-tenant building or a cluster development.

Shared Wastewater Treatment Plants are more likely to be owned by a public or regional entity, although management may be provided by a town department or agency, a multi-town management district, a regional water and sewer commission, or a private management firm. A well-known regional agency is the Massachusetts Water Resources Authority (MWRA), which serves 61 communities. Private entities, such as a large business or school, may also own a wastewater treatment plant. In Newbury (Byfield), the Tritown [Triton] Regional High School, the Triton Regional-Junior High School, and the The Governor Dummer [Governor's] Academy have certified wastewater treatment plants, as do several large businesses in the Lord Timothy Dexter Industrial Park in Newburyport.[2] The Lynn Regional Wastewater Treatment Facility is owned by the city but managed by Veolia Water.

MassDEP defines the regulatory structure for the operations of a wastewater plant in 314 CMR 12.00 *Wastewater Treatment Plants*. For any of the ownership options above, the operating personnel are required to be certified as such under 257 CMR 2.00.

2 Massachusetts Board of Wastewater Treatment Plants Certification Program, *Graded Wastewater Treatment Plants by Town,* https://www.mass.gov/doc/graded-wastewater-treatment-plants-by-town.

IMPLICATIONS FOR TOWN CENTERS

For a town center, who owns the system will be tied to the purpose of the system. If the system is part of a municipal economic development effort, the town may choose to own the system. Alternatively, ownership of the system may be private: individual business owners may support a shared system to allow expansion of their businesses, or a private developer of a new cluster development may allow adjacent property owners to tie into the development's system.

Ownership also affects (1) capital costs and financing and (2) operations and associated funding strategy.

Costs

The Barnstable County Wastewater Cost Task Force prepared *Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod: Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning.* This report, published in April 2010, is the only recent report that compares costs across multiple communities. Although the soil conditions and land costs in Cape Cod are not the same as those in Essex County, this report has the most relevant survey of average costs for construction and operations and maintenance of centralized systems in Massachusetts.

Communities evaluating a wastewater treatment plant need to consider two types of costs and the associated funding strategies to meet each. The operating costs do not need to be met only by the municipal operating budget, nor is a debt-exclusion override of Proposition 2 ½ the sole source of funding for the initial construction of the plant.

Residential costs are used for the analysis below, as information on average residential costs and usage is easier to find than for commercial costs, which can vary significantly by size and type of business.

CONSTRUCTION

For Cape Cod, the average capital costs for the construction of systems of different capacities are as follows:[3]

CAPACITY	UNIT CONSTRUCTION COST (PER GPD OF CAPACITY) 2010*	2017**	COST FOR TOTAL CAPACITY (2017)
10,000 gpd	$70	$87	$870,000
100,000 gpd	$35	$44	$4,400,000
1,000,000 gpd	$17	$21	$21,000,000

*ENR Construction Cost Index of 8600

** ENR Construction Cost Index of 10692

A design flow of 10,000 gpd is equivalent to 30 three-bedroom units or 200,000 square feet of retail. The systems above could support the following number of dwelling units:

CAPACITY	COST FOR TOTAL CAPACITY (2017)	DWELLING UNITS	INSTALLATION COST PER DWELLING UNIT
10,000 gpd	$870,000	30	$29,000
100,000 gpd	$4,400,000	300	$14,667
1,000,000 gpd	$21,000,000	3,000	$7,000

The installation cost per dwelling unit drops for each unit as the capacity of the system rises because the capital cost is spread across more users. A search across installation companies in Massachusetts suggests the cost to

3 Barnstable County Wastewater Cost Task Force, *Comparison of Costs for Wastewater Management Systems Applicable To Cape Cod: Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning*, April 2010, page 2.

install a septic system for a single-family home is approximately $10,000-$50,000. In an area with inappropriate soils and/or ledge, such as parts of West Newbury, the cost is likely to be at the higher end of the range.

Construction costs will be less per unit as more units are added and will be less for a system that supports a smaller area than for a system that must collect sewage from a larger district.

For most businesses, 310 CMR 15.00 specifies the design flow calculation on a gpd per 1,000 square feet of area. There are exception, including restaurants, for which the design flow calculation is based on the number of seats. However, the minimum design flow for a restaurant is 1,000 gpd, which translates to approximately 28 seats for a restaurant or 50 seats for a fast food restaurant,

OPERATIONS AND MAINTENANCE (O&M)

Capital costs represent the initial costs of land and construction. However, they are not the only costs. Annual costs to operate the system and maintain the equipment also vary by system type. For Cape Cod, the average costs for O&M for systems of different capacities are as follows:[4]

	UNIT O&M COST (PER GPD OF CAPACITY)	
CAPACITY	2010*	2017**
10,000 gpd	$13	$17
100,000 gpd	$5	$7
1,000,000 gpd	$2	$3

*ENR Construction Cost Index of 8600

** ENR Construction Cost Index of 10692

4 Barnstable County Wastewater Cost Task Force, *Comparison of Costs for Wastewater Management Systems Applicable To Cape Cod: Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning*, April 2010, page 2.

For centralized systems, operating costs will include the following:

- Personnel (salary/wages and benefits) for licensed operators and administrative staff
- Chemicals and other supplies
- Electricity (although the system could be paired with a solar energy system to offset some of the cost of power. This would be site-dependent)
- Sludge disposal
- Regular maintenance and monitoring

COSTS FOR BUSINESSES/RESIDENTS

The initial cost is a tie-in fee that must be paid when the property owner connects to the system (see Financing, below). Ongoing costs are based on usage, and often charged quarterly.[5] Charges for inspections and emergency repairs are by the hour.

In Massachusetts, the design flow for a single-family house is calculated at 110 gpd per bedroom, with a minimum 330 gpd per house (assuming a minimum of three bedrooms in a single-family house). However, the industry standard for the average annual consumption of a single-family household is 90,000 gallons (also expressed as 120 hundred cubic feet or HCF)[6] which translates to approximately 250 gpd. Annual costs to the homeowner would be calculated on the actual flow; however, cost comparisons across communities use the standard 120 HCF as the basis for comparison.

In 2017, average annual sewer costs within the MWRA service area range from $265.50 in Clinton to $1,622.20 in Belmont.[7] The MWRA operates a system of wastewater treatment plants and the cost to property

5 Tighe & Bond, 2014 *Massachusetts Sewer Rate Survey*, http://rates.tighebond.com/Downloads/2014%20MA%20Sewer%20Survey.pdf, last accessed January 25, 2018, page 2.
6 The Community Advisory Board to the Massachusetts Water Resources Authority, *2017 Annual Water and Sewer Retail Rate Survey*, http://mwraadvisoryboard.com/wp-content/uploads/2017/12/2017RateSurvey.pdf, last accessed January 25, 2018, page i.
7 Ibid. page 6.

owners varies by community; the MWRA charge is only a portion of the overall cost as municipalities must maintain their own infrastructure.

Closer to West Newbury in location and size, the Town of Essex charges $23.70 per thousand gallons[8] or an annual cost of $2,133 on the average household usage of 90,000 gallons. Wastewater from the Town of Essex is treated by the City of Gloucester's Wastewater Treatment Plant. The sewer rate for the City of Gloucester s $14.50 per thousand gallons for fiscal year 2018.[9] This disparity of rates in part reflects that larger number of users; the Town of Essex has a population of 3,504 (2010 U.S. Census) and its sewer system in 2000 served 800 properties[10] while Gloucester has a population of 2,7898. Veolia manages the George Reilly Water Pollution Control Facility which has a permitted capacity of 5.15 MGD (millions of gallons per day). Of this approximately 225,000 gpd is from the Town of Essex.[11]

Newburyport charges $8.34 per 100 cubic feet for the first 3,000 cubic feet and $9.09 per 100 cubic feet over 3,000 cubic feet for an annual cost of $1,141 per 120 HCF.[12] Newburyport has a population of 17,416 (2010 U.S. Census). The capacity of its wastewater treatment plant is 3.4 MGD.[13]

IMPLICATIONS FOR TOWN CENTERS

Larger systems can spread annual costs among more users; however, the largest possible system is not always appropriate for the needs of the downtown. Towns must carefully consider their vision and goals for their downtown and use that to determine the appropriate system.

8 Town of Essex Water Department, http://www.essexma.org/Pages/EssexMA_Water/rates, last accessed January 25, 2018.
9 City of Gloucester Public Works Department, http://gloucester-ma.gov/index.aspx?NID=316, last accessed April 20, 2018.
10 Town of Essex, Sewer Regulations, http://www.essexma.org/Pages/EssexMA_Wastewater/S01ADF27E-01ADF28B.0/Sewer%20regs%20revision%202013.pdf, last accessed April 20, 2018.
11 Veolia North America, https://www.veolianorthamerica.com/en/case-studies/gloucester-mass, last accessed April 20, 2018.
12 City of Newburyport Department of Public Services, Sewer Division, https://www.cityofnewburyport.com/sites/newburyportma/files/file/file/water_and_sewer_rates_fy2016_0.pdf, last accessed January 25, 2018.
13 City of Newburyport, https://www.cityofnewburyport.com/sewer/pages/waste-water-treatment-facility-information, last accessed April 20, 2018.

Individual septic systems can be more costly than centralized systems. Failure of individual systems in a small town center will require a case-by-case solution: replacement, an alternative system, or vacancy of that space until a new owner can find a solution. Massachusetts offers a personal tax credit to homeowners to replace a failed system;[14] however, this credit is not available to businesses. A centralized system would prevent vacancies caused by failing septic systems.

Payment for the installation or replacement of individual septic systems is upfront, although there are a few loan programs available. By contrast, a municipality or regional agency can issue a bond for a centralized system and pay the capital cost over a 30-year period, rather than immediately. This allows users who connect to the system to spread their cost of connection accordingly.

Financing

Financing a centralized system requires two sources of funds; the initial capital cost and ongoing operating costs. The establishment of a Sewer Enterprise Fund allows the operating agency to manage all revenues and expenses related to the system within a single funding entity. This would include the construction costs, operating and management costs, assessments for connections, and the regular usage charges (usually quarterly). The Commonwealth provides a guide to best practices relative to an enterprise fund: https://www.mass.gov/files/documents/2017/10/11/best-practice-enterprise-funds.pdf.

Funding sources for construction costs will depend on the entity managing the system. The Town, a regional agency, or a private entity may issue bonds for the construction costs. The Town has additional sources

14 Massachusetts Executive Office of Energy and Environmental Affairs, http://www.mass.gov/eea/agencies/massdep/water/wastewater/title-5-and-septic-system-faqs-financing.html, last accessed January 25, 2018.

of funding not available to a private entity, including Community Development Action Program (CDAG) and the MassWorks grant program. Public-private partnerships could use District Improvement Financing (DIF) or Tax Increment Financing (TIF) to take advantage of the increase in property values to help cover the cost of the bond. In addition, the federal Clean Water State Revolving Fund (CWSRF) may provide funding for projects addressing water quality; in Massachusetts, this loan is administered by MassDEP.[15]

At least a portion of the capital costs will be paid by assessments on property owners who are eligible to connect to the system. A single Sewer Betterment Unit (SBU) is based on the usage of a single-family house. The Sewer Betterment Assessment (SBA) for each property owner is based on the number of SBUs of each use (for example, a two-family home is 2 SBUs) and is charged to all property owners within the service area, whether or not the owner connects to the system. Often, 50% of the SBA is charged during construction and the remainder when the system is complete. The SBA becomes a lien on the property and must be paid when the property is sold. However, the property owner may pay the SBA in full or over 20-30 years, with interest.

In calculating the total amount of the SBA, capacity must be reserved for future connections as all property owners within the service area are legally entitled to connect to the system. The higher the number of SBUs in the system, the lower the assessment per SBU.

15 http://www.mass.gov/eea/agencies/massdep/water/grants/clean-water-state-revolving-fund.html

Next Steps

The Massachusetts Smart Growth/Smart Energy Toolkit provides a comprehensive list of next steps:[16]

1. Develop a comprehensive Wastewater Management Plan
2. Identify larger projects as anchor opportunities
3. Identify and procure sources of public funding
4. Provide density incentives where appropriate
5. Be aware of Total Maximum Daily Load (TMDL) programs* and nitrogen sensitive areas in your community

When considering how to apply these to a conversation around town centers, it is important to reflect on the purpose of the community's investigation into the use of wastewater treatments plants. The next section will focus on West Newbury as a case study to explore the implications of a wastewater treatment plant on their system.

*MassDEP regulates TMDLs and establishes requirements for the watersheds throughout the state. More information is available here: https://www.mass.gov/guides/the-basics-of-total-maximum-daily-loads-tmdls. TMDL programs are developed by local communities.

16 Commonwealth of Massachusetts, Wastewater module, *Smart Growth/Smart Energy Toolkit*, (http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-ww.html), last accessed January 17, 2018.

Implications for West Newbury

As noted above, West Newbury is the perfect location for a case study to apply the general considerations noted above and assess the impact of different growth scenarios on the possibility of moving from individual systems to a treatment system that would support more development.

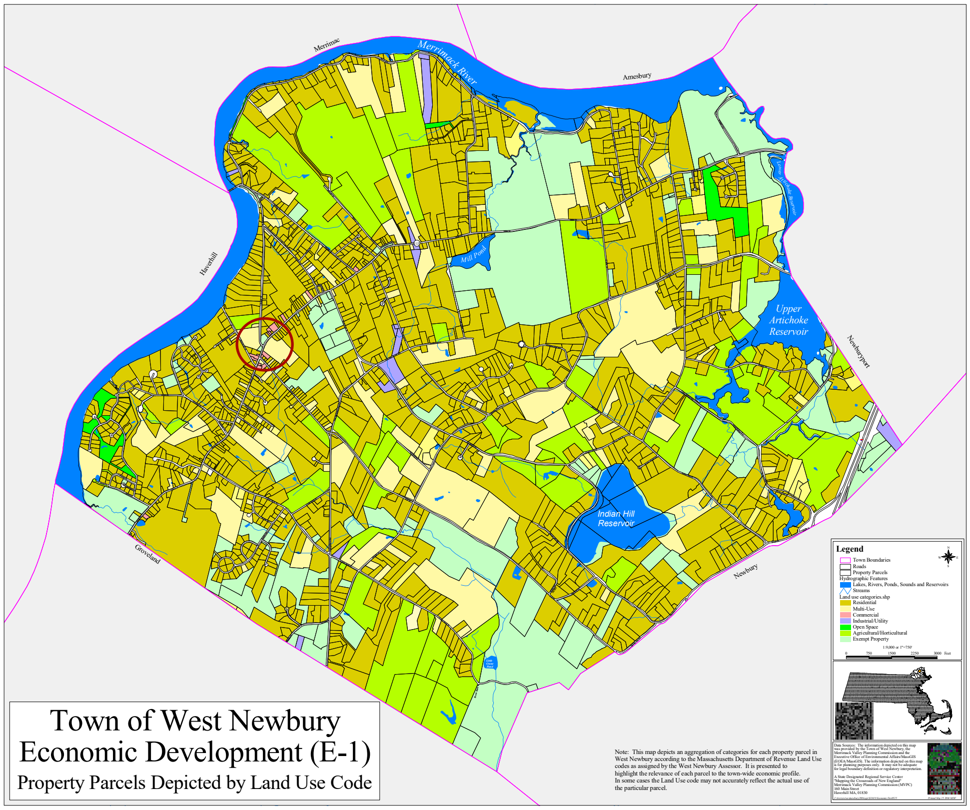
This report does not recommend a specific system or course of action. The community of West Newbury will have this information available to them as the residents, business owners, and Town officials continue their conversations about the future of the Town Center. The case study simply provides a framework for that continuing conversation and identifies areas of further analysis and discussion.

Economic Development

Town centers contribute more than tax revenue to the municipal budget. They can be a gathering place for a community – a place where information is exchanged while goods and services are bought and sold.

West Newbury is fortunate to have several places for outdoor recreation, including Pipestave Hill, the Mill Pond Recreation Area, and many trail systems. Businesses, including farms, are scattered throughout the town. However, the small cluster of businesses centered on the intersections of Church and Maple Streets with Main Street/Route 113 provide an opportunity to address the desire of some residents for indoor gathering spots, such as a café or small restaurant.

As noted above, the need for individual systems to support each building can be a constraint on the further development of the business environment. The small lots in the Town Center make replacement of failing systems difficult or impossible and the expansion of existing uses or the addition of new uses more difficult. Land used for leach fields is un-



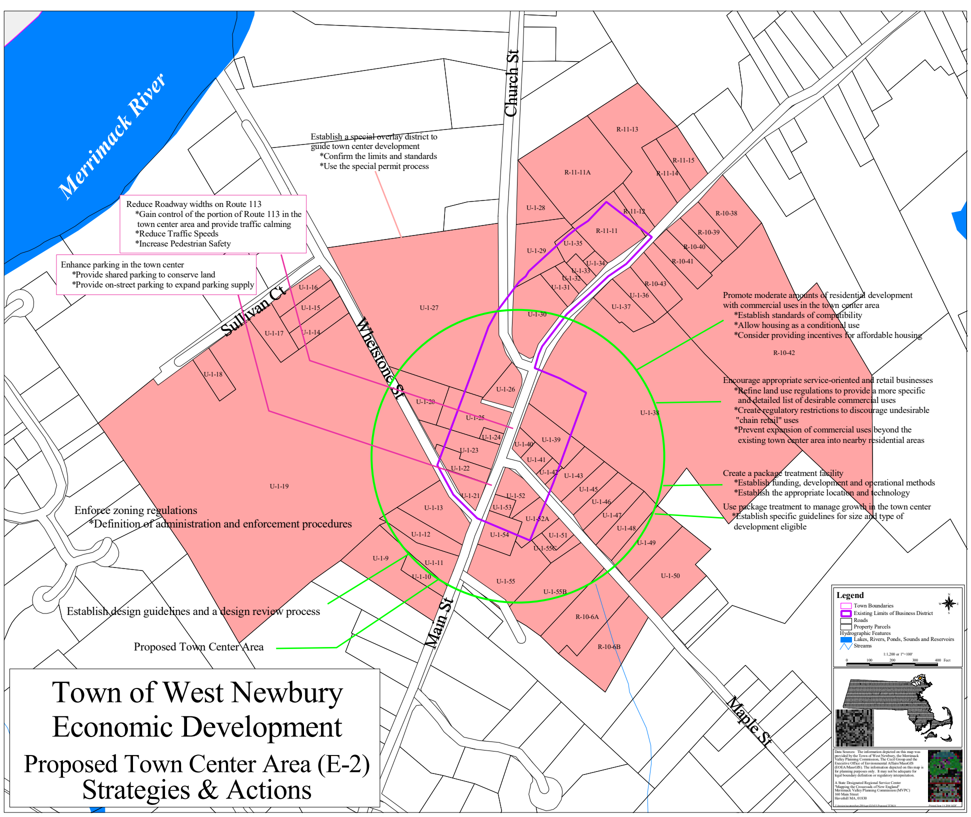


FIGURE 2: PROPOSED TOWN CENTER DEVELOPMENT, *COMMUNITY DEVELOPMENT PLAN*, JUNE 2004

available to be used for buildings, parking, or amenities to attract more customers.

These constraints also exist for additional housing in the Town Center. The number of dwelling units will be limited by the type of system used, whether than system is an individual septic system supporting a single- or two-family house or a shared/cluster system supporting multiple dwelling units, as with the development on Follansbee Lane or the proposed development on Dunn's Farm.

Previous Planning Efforts

The Priority Growth Strategy in the *Merrimack Valley Regional Plan* identified the Town Center as a Village Center. Village Centers are one of the four types of areas in the Plan that have the "best potential for appropriate new growth."[17] The report identified Concentrated Development Centers including West Newbury's Town Center, which is further identified for Downtown Mixed Use,[18] which would include residential and retail uses.

An earlier study, the Town of West Newbury's 2004 *Community Development Plan*, identified a boundary for a proposed Town Center Development. The recommendations for this plan included the creation of a package treatment plant and the use of the plant to manage growth in the Town Center.[19] The study also recommended zoning changes and public infrastructure improvements to support new development.

In 1999, Weston & Sampson Engineers, Inc. undertook a feasibility study for building an on-site sewage disposal system. The study included an 100-seat restaurant, two apartment/condominium buildings, and an expanded service area. The study also assumed the expansion of the West

17 Merrimack Valley Planning Commission, *Merrimack Valley Regional Plan*, June 2013, page 4.
18 Merrimack Valley Planning Commission, *Merrimack Valley Regional Plan*, June 2013, page 26.
19 Town of West Newbury, *Community Development Plan*, June 2004, page E-1.

Newbury Food Mart. The study estimated the average daily wastewater flow at 4,165 gpd; with the assumptions above, the recalculated daily flow increased from 18,700 gpd to 21,400 gpd. Weston & Sampson noted that a small packaged treatment plant would be required to address these flows; the Town, at that time, reviewed a property on Whetstone Street for the location.

The Town is updating its *Open Space and Recreation Plan* (OSRP). As part of the process, the Town undertook a survey in 2016. This survey provided helpful information about potential uses for the Town Center, including small restaurants or cafés, and additional services. The survey also indicated that respondents would support Town expenditures to

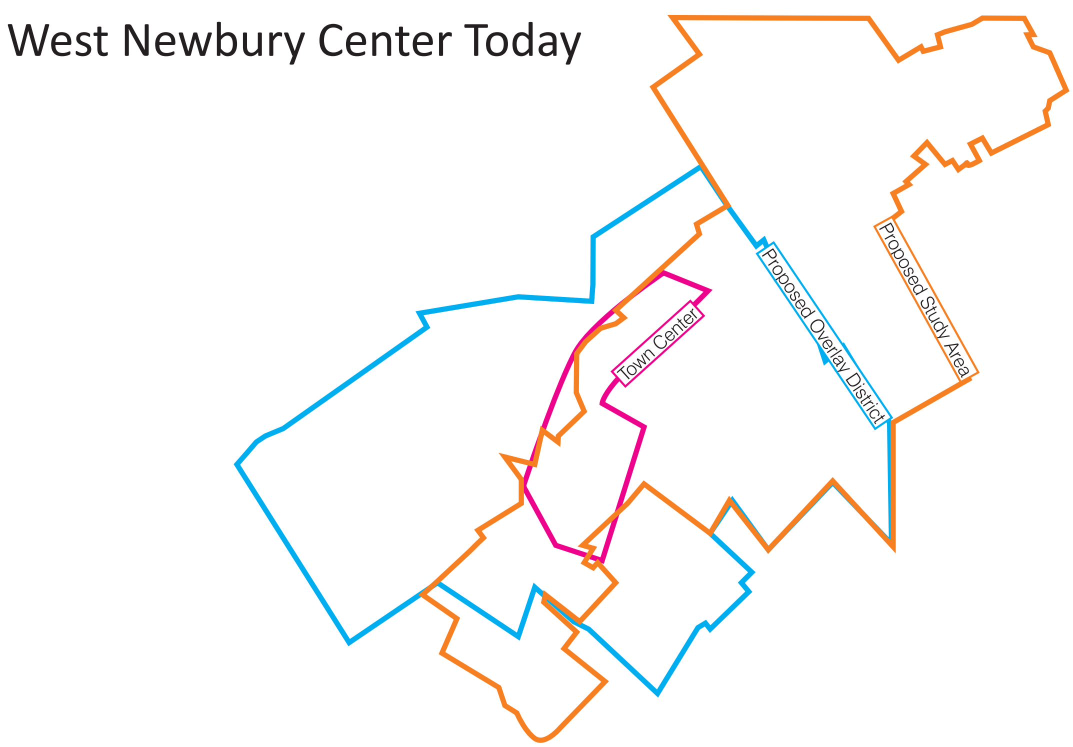


FIGURE 3: BOUNDARIES OF PREVIOUS PLANNING EFFORTS AND INITIAL STUDY AREA

further protect groundwater (Very Important and Important, just over 90%).

The Town's *Housing Production Plan* (2010) recommends adopting a Town Center Overlay District.[20] This overlay would include upper-floor housing as-of-right, but notes that a shared wastewater treatment plant within the Town Center would be required.

Previous planning efforts show that both the West Newbury community and the regional planning agency have identified the Town Center for possible new growth; such growth could move the Town Center to a level of development that would require a package treatment plant. However, some constraints may limit the location of a package treatment plant and require that it meet certain operational standards.

Site and Location Constraints

The proximity of the Town Center to the Merrimack River will require that a package treatment plant meet the Title 5 requirements relative to the TMDL, a measurement of the maximum amount of a specific pollutant that can be discharged into a water body.

Additional constraints include the type of soils, the presence of ledge, and the elevation of the water table. Poor drainage and a high water table restrict the placement of both traditional septic systems and the package treatment plant.

20 Town of West Newbury, *Housing Production Plan*, 2010, page 37.

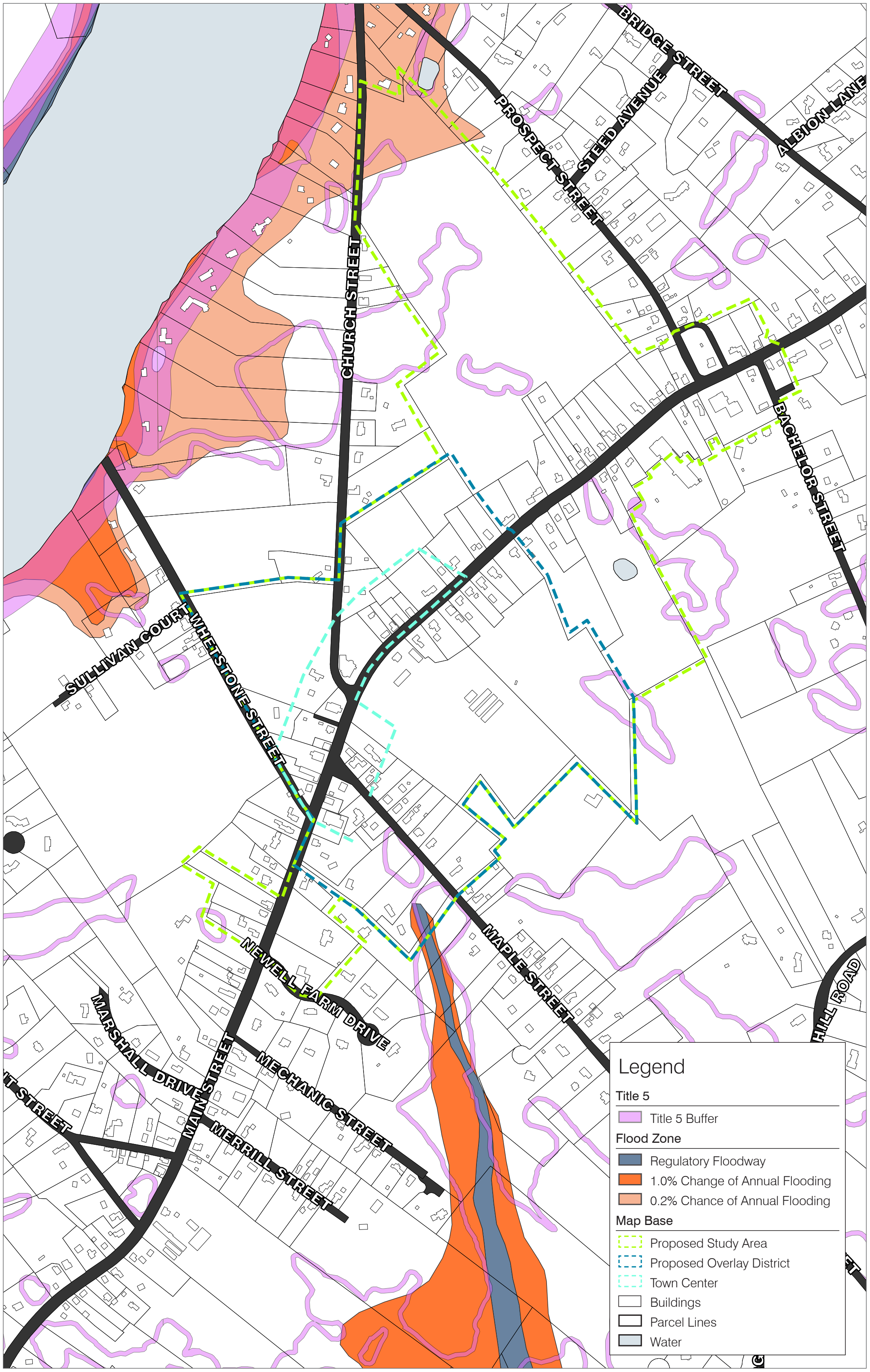


FIGURE 4: SITE CONSTRAINTS: FLOOD ZONES AND TITLE 5

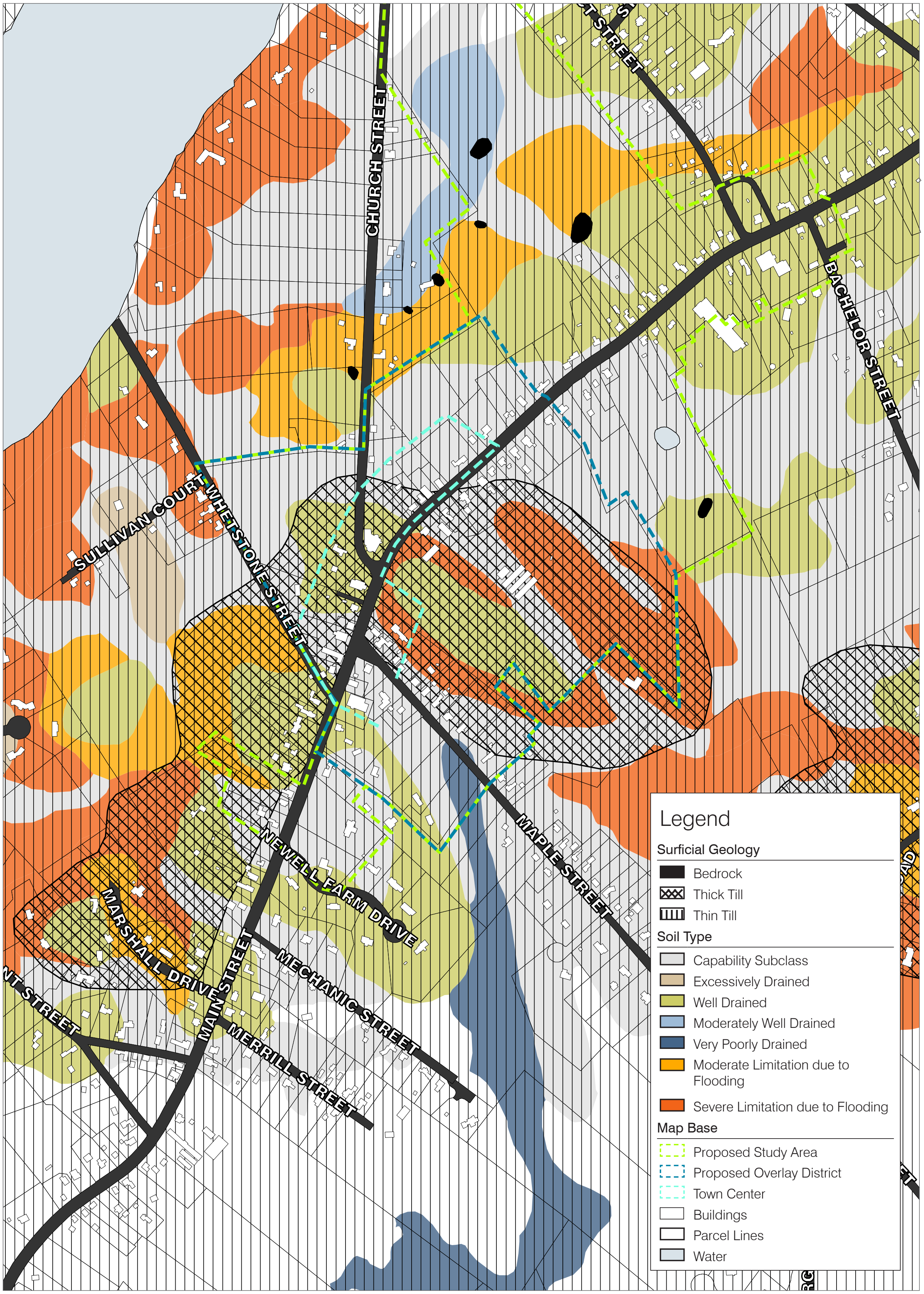


FIGURE 5: SITE CONSTRAINTS: SOIL TYPES

Determining Who Connects

The question of who connects to the system determines the amount of flow that must be treated and helps identify a possible location for the plant – one that is a reasonable distance from the Town Center. In addition to the types of uses, the boundary of the area to be served has an impact on the design of the plant. This study looked at three options for the initial analysis: the Town Center as commonly defined, the boundary of the overlay district proposed in the 2004 *Community Development Plan*, and a larger study area that was proposed for this study process. Changes to the boundary during the process were a direct result of feedback from the Working Group after the meetings.

The Town can control the density of uses within the Town Center with two methods: (1) the allowable uses and dimensional standards of buildings and lots within the Town Center and (2) the geographic area within which a property owner can connect to the system (the "sewerage district") and the capacity of that system. The choice of who connects (i.e., within which geographic area) can act as a limit on future development. Such a limitation can be a signal that a community wants additional growth (an expanded area and design capacity that is in excess of needs in the early years of the system) or that the community wishes to limit growth to a targeted area (small geographic area or design capacity that is sized for a smaller design flow). The community should understand the implications of its choices in terms of the district boundary and the amount of capacity built into the system.

A final consideration for who connects is the age of the existing systems – those who have recently installed a septic system are less likely to want to connect immediately to a new system. In addition, the preservation of capacity for future users was a topic of discussion with Working Group members.

FIGURE 6: AGE OF EXISTING SEPTIC SYSTEMS

KEY TO FIGURE 6: DATA PROVIDED BY THE TOWN OF WEST NEWBURY

ID	ADDRESS	SEPTIC INSTALLATION	SEPTIC CAPACITY	USE
0	331 Main Street	1995-2003	0	
1	325 Main Street	1995-2003	0	
2	333 Main Street		0	
3	335 Main Street		0	
4	337 Main Street	1995-2003	0	
5	345 Main Street	2003-2017	0	
6	347 Main Street	2003-2017	0	
7	357 Main Street	2003-2017	0	
8	356 Main Street	2003-2017	0	
9	350 Main Street	2003-2017	0	
10	323 Main Street	2003-2017	0	
11	319 Main Street		0	
12	317 Main Street		0	
13	291 Main Street	1995-2003	750	Office
14	289 Main Street	Approved but not installed	300	Main St Auto
15	4 Maple Street		440	
16	6 Maple Street	2003-2017	330	
17	322 Main Street		330	Mixed-use
18	320 Main Street		450	Office
19	Main Street (U1-350)		0	No building
20	318 Main Street		225	Residential
21	314 Main Street	2016	440	Residential
22	308 Main Street	1995-2003	750	Church
23	2 Church Street	1995-2003	0	
24	300 Main Street		0	Church
25	290 Main Street		200	Retail
26	284 Main Street	1995-2003	200	Post Office
27	282 Main Street	Approved but not installed	1,406	Pizza Shop
28	278 Main Street	2003-2017	330	Residential
29	279 Main Street	2003-2017	400	Bank
30	277 Main Street		200	Retail
31	275 Main Street		600	Food Mart
32	11 Maple Street	1995-2003	200	Music
33	13 Maple Street	2003-2017	0	
34	Maple Street (U1-55C)		0	No building
35	274 Main Street		0	
36	270 Main Street		0	
37	268 Main Street		0	
38	265 Main Street	2003-2017	0	

ID	ADDRESS	SEPTIC INSTALLATION	SEPTIC CAPACITY	USE
39	25 Follinsbee Lane	2003-2017	0	
40	15 Church Street	Approved but not installed	0	
41	16 Church Street	2003-2017	0	
42	332 Main Street	2003-2017	0	
43	340 Main Street	Approved but not installed	0	
44	344 Main Street		0	
45	360 Main Street	1995-2003	0	
46	260 Main Street	1995-2003	0	
47	262 Main Street		0	
48	330 Main Street		450	Pearson's Honda
49	334 Main Street		0	
50	353 Main Street	2003-2017	0	
51	294 Main Street	2003-2017	330	Residential
52	7 Whetstone Street	2003-2017	0	

EXISTING USES WITHIN THE TOWN CENTER	
Food: West Newbury Pizza; West Newbury Food Mart	**Office:** West Newbury Insurance; Winfield Crossings
Retail: Excentrique	**Farm:** Dunn's Farm
Services: United State Postal Service; Haverhill Bank; West Newbury Barber Shop;Thom Child and Family Services; Pentucket Area Early Intervention	
Community Church of St. Ann; West Newbury Congregational Church	**Auto** Main Street Auto; Pearson Automotive
Residential: Single-Family	

PROPOSED ADDITIONAL USES	
Food: Café, Bakery	**Office**
Residential: Apartments/Condos	

PROPOSED ADDITIONAL USES: OSRP SURVEY
Downtown with restaurants, businesses, gathering spaces
Small restaurant, services
Restaurant/café/coffee shop

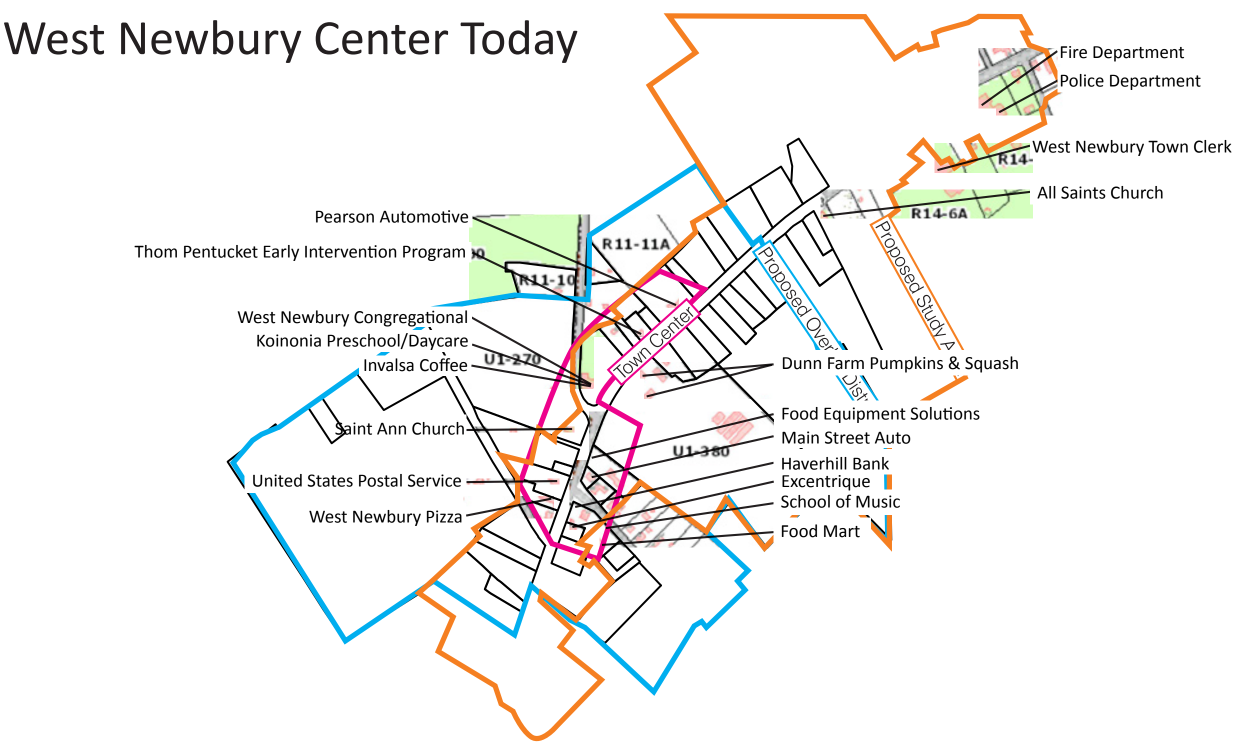


FIGURE 7: EXISTING USES IN TOWN CENTER

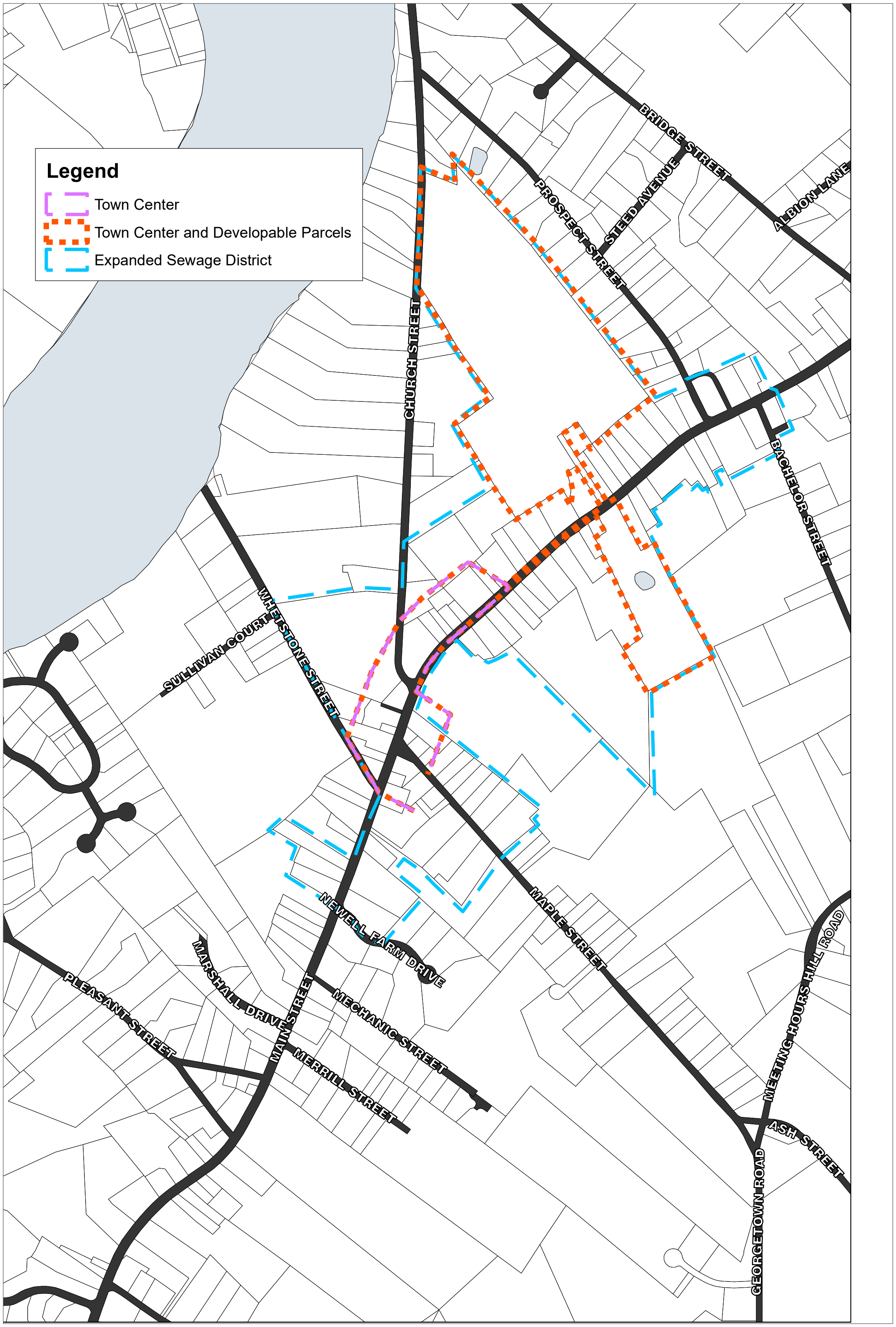


FIGURE 8: AREAS OF BUILD-OUT SCENARIOS

Build-Out Scenario

The build-out analysis presented below is a method of understanding the impact of future land uses on the potential type and size of the system. This analysis used four scenarios to determine the service area and estimate future flows:

- Scenario A1: Existing Town Center – This is the baseline scenario and is the area of the existing Town Center with the existing mix of uses.
- Scenario A2: Mixed-Use Town Center – This scenario assumes that all existing residential uses within the Town Center are converted to accommodate ground floor retail uses. This scenario does not increase or decrease the number of residential units.
- Scenario B1: Expanded Town Center – This scenario assumes that Dunn's Farm (317 Main Street) is developed as 200 betterment units of housing at the request of the Working Group and Mullen Woods (Church Street and with access from Main Street) is developed into housing as 12 betterment units. This assumes that Mullen Woods will be partially developed for housing, allowing two acres for a package treatment plant to be located on this property.
- Scenario B2: Expanded Mixed-Use Town Center – This scenario combines Scenarios A2 and B1, and assumes that the sewage district would expand to Bachelor Street in the east, Newell Farm Drive in the west, and Maple Street in the south. This scenario does not increase or decrease the number of residential units, except for Dunn's Farm and Mullen Woods, as described in Scenario A2.

The methodology and assumptions for all calculations in this section are provided in the Appendix.

The breakdown of betterment units and flows by scenario is shown below:

TOTALS (GPD)	SCENARIO A1: EXISTING TOWN CENTER	SCENARIO A2: MIXED-USE TOWN CENTER	SCENARIO B1: EXPANDED TOWN CENTER	SCENARIO B2: EXPANDED MIXED-USE TOWN CENTER
Parcels	20	20	23	89
Betterment Units	24	31	236	318
Usage Flow (gpd)	8,881	10,281	100,841	136,005

The threshold of 10,000 gpd would be triggered for Scenarios A2, B1, and B2, thus requiring the additional regulatory control over the centralized system. The implications are that a cluster system would work well for Scenario A1, but that a shared wastewater treatment plant would be required for the other three scenarios.

The Working Group reviewed these numbers at the December 2017 meeting, and requested that the consultant team stress test the calculations, looking at alternative methods of determining the flow and examining whether the 10,000 gpd threshold continued to be triggered.

The team examined two additional scenarios:

- Minimum standards – Under this test, all residential units dropped from 440 gpd to the required design flow minimum of 330 gpd per household as specified under Title 5.
- Average daily indoor water use per household – This scenario used current water consumption benchmarks as the basis for flow estimation. These numbers are not possible to implement under current state law.

The revised scenarios are shown in the table below:

TOTALS (GPD)	SCENARIO A1: EXISTING TOWN CENTER	SCENARIO A2: MIXED-USE TOWN CENTER	SCENARIO B1: EXPANDED TOWN CENTER	SCENARIO B2: EXPANDED MIXED-USE TOWN CENTER
Parcels	20	20	23	89
Betterment Units	24	31	236	318
Usage Flow (gpd)	8,881	10,281	100,841	136,005
Minimum Standards	8,881	10,281	77,881	105,455
Average daily indoor use	8,881	10,281	47,131	64,625

This examination of alternatives does not change the threshold between the existing Town Center (A1) and a mixed-use Town Center (A2), because the data for these scenarios were based on actual flow as provided by the Town and, for the mixed-use scenarios, the minimum gpd for retail allowable by law.

A centralized system above the 10,000 gpd threshold would be required to support additional development in the Town Center. The stress test does show reduced flows for both the expanded Town Center that includes redevelopment of the Dunn and Mullen properties (B1) and a mixed-use Town Center and expanded area (B2). However, neither scenario would be reduced below the 10,000 gpd threshold.

The recommended system types for each scenario are as follows:

TOTALS (GPD)	SCENARIO A1: EXISTING TOWN CENTER	SCENARIO A2: MIXED-USE TOWN CENTER	SCENARIO B1: EXPANDED TOWN CENTER	SCENARIO B2: EXPANDED MIXED-USE TOWN CENTER
Parcels	20	23	23	89
Betterment Units	24	31	236	318
Usage Flow (gpd)	8,881	10,281	100,841	136,005
System Type	**Cluster**	**Shared Wastewater Treatment Plant**		

The cluster system would accommodate flows of less than 10,000 gpd and be under the jurisdiction of the Board of Health of the Town of West Newbury. The shared wastewater treatment plant would accommodate the larger design flows, but would require greater regulatory control and a more complex system.

The flows of the current Town Center are not far below the 10,000 gpd threshold, and the Town may wish to consider the implications of moving directly to a shared wastewater treatment plant rather than implementing the smaller cluster system.

Next Steps for West Newbury

Discussions with the Working Group indicated that the community does not have consensus about the installation of a centralized wastewater management system. West Newbury has a series of next steps as it considers whether to move forward with its evaluation of future septic needs.

The primary step is to initiate a series of conversations within the community about the possibilities and implications. The Town can use the materials provided by this study process in informational sessions designed to encourage discussions about the Town's needs.

The purpose of these conversations is to define which of the criteria are most important when considering the installation of a centralized system: the need to support existing businesses whose individual systems are failing; the desire to expand the uses and density within the Town Center; or the need to protect land, ground water, and public health from the impact of failing individual systems. The discussion around these criteria can help inform the Town's decision.

A concurrent effort would be the development of a market demand analysis. Such an analysis would evaluate the susceptibility of certain parcels to change their existing use. Conversations with property and business owners within the services areas defined in the build-out scenarios will help establish who might want to connect to a centralized system now, in the future, or not at all. This market demand analysis would provide specific information to answer those questions that can be identified, but not resolved, by this study process.

Finally, the community will need to have a conversation about the appropriate site and financing structure for a centralized system, if it chooses to move in that direction.

The Town of West Newbury should consider creating a Comprehensive Wastewater Management Plan, as defined in the *Massachusetts Smart Growth/Smart Energy Toolkit*. The process of creating this document will allow the community to address the questions and topics within this report in greater depth than this study process allowed.

As part of the development of a Comprehensive Wastewater Management Plan, the Town will need to develop cost information, including land acquisition costs. Because this study process used Mullen Woods as the location of the centralized septic system, the scenarios did not consider a land acquisition cost. If another site is chosen, then the acquisition cast will need to be incorporated into the financial analysis.

Recommended Feasibility Studies

COMMUNITY	STUDY DATE/ RECOMMENDATION	AREA/CAPACITY	FINANCIAL STRUCTURE	ESTIMATED COST
Bourne (Municipal ownership)	2012 Membrane Bio Reactor (MBR) Treatment Plant 335,000 gpd	Downtown	CPA MassWorks grant Economic Development Administration grant	$6,893,000
Hubbardston	2011 Decentralized system	Town center: 840 acres	Recommended use of grants;	$8,260,000
Littleton (Municipal ownership)	2012 Community Water and Energy Resource Center (CWERC) 30,000 gpd in Phase I	Littleton Common area: 72 acres for full build-out	Recommended Public/Private Partnership (P3)	$450,000 for planning and design work; $4,300,000 in Phase I Anticipated May 2018 Annual Town Meeting vote on $1.5 million design costs

MASSACHUSETTS *SMART GROWTH/SMART ENERGY TOOLKIT*: COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

- Maps of growth centers, preservation lands and transitional areas between the two;
- A detailed discussion of the types of wastewater management strategies applicable to the community's housing, environmental, fiscal and commerce-related goals;
- A discussion of the different densities of development that will occur within and surrounding identified growth centers;
- An examination of the community's administrative capacity with regard to permitting innovative systems and/or establishing wastewater authorities;
- Cost estimates associated with construction, permitting, design, administration and maintenance of any intended public facilities;
- Identification of any existing bylaws or regulations that would conflict with the intended wastewater strategies; and
- Identification of any public funding opportunities associated with infrastructure development or financing.

Commonwealth of Massachusetts, Wastewater module, *Smart Growth/Smart Energy Toolkit*, (http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-ww.html), last accessed January 17, 2018.

	STATUS	FEASIBILITY STUDY
	Funding voted October 2017	*Evaluation of Downtown System* https://www.townofbourne.com/sites/bournema/files/file/file/2012_july_final_ver.pdf
	No further information	*Evaluation of Water and Sewer Systems* http://www.mrpc.org/sites/montachusettrpc/files/file/file/hubbardston_water_sewer_feasibilty_study.pdf
	Planning and design work funded in 2017	*Smart Sewering Strategy* https://www.littletonma.org/sites/littletonma/files/uploads/littletonsmartseweringstrategy-jan2012-crwa-nsu_0.pdf Additional Resources https://www.mma.org/littleton-works-toward-nation%E2%80%99s-first-%E2%80%98smart-sewer%E2%80%99-treatment-plant-0 https://www.littletonma.org/sites/littletonma/files/uploads/smartseweringforsmallcommunities.pdf https://www.littletonma.org/littleton-common-sewer-feasibility-study-committee

Resources

- Weston & Sampson Engineers, Inc., Letter to Nilsson & Siden Associates, Inc. re: Feasibility of On-Site Sewage Disposal Systems for Main Street, West Newbury, September 27, 1999.

- *The Community Septic Management Program* http://www.mass.gov/eea/agencies/massdep/water/wastewater/community-septic-management-programs.html

- *Massachusetts Smart Growth/Smart Energy Toolkit* http://www.mass.gov/envir/smart_growth_toolkit/pages/mod-ww.html

- *A Massachusetts Guide to Needs Assessment and Evaluation of Decentralized Wastewater Treatment Alternatives* www.mass.gov/eea/docs/dep/water/wastewater/w-thru-z/wwtrplan.doc

- EPA Wastewater Technology Fact Sheet:
  Package Plants: https://www3.epa.gov/npdes/pubs/package_plant.pdf
  Wastewater Treatment Plants: http://www.mass.gov/eea/agencies/massdep/water/wastewater/wastewater-treatment-plants.html
  In-Plant Pump Stations: https://www3.epa.gov/npdes/pubs/in-plant_pump_station.pdf

- Barnstable County Wastewater Cost Task Force, *Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod: Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning*, April 2010 http://www.apcc.org/waterquality/CapeCodWastewater-Costs--April2010.pdf

- Charles G. Willing, Jr., *Private Ownership of Ground-Discharging Small Sewage Treatment Plants: a Case for Preventive Regulation,* http://lawdigitalcommons.bc.edu/cgi/viewcontent.cgi?article=1535&context=ealr

Build-Out Methodology and Assumptions

This appendix provides the methodology and assumptions that underline the build-out analysis described in this report.

Classification Pairing

The largest area examined contains 89 parcels. The Assessors database lists 25 different descriptions of land use for these parcels. The first step in the build-out analysis required pairing the land use descriptions with corresponding classifications from CMR 15.205 System Sewage Flow Design Criteria. Fourteen of the land use descriptions did not match perfectly, so the team selected the classification that fit best.

These pairings are as follows:

LAND USE DESCRIPTION FROM ASSESSORS OFFICE	CLASSIFICATION FROM CMR 15.205	DEGREE OF MATCH
General Office Buildings	Office building	Complete
Single Family Residential	Family Dwelling, Single	Complete
Two-Family Residential	Family Dwelling, Multiple	Complete
Three-Family Residential	Family Dwelling, Multiple	Complete
Residential Condominium	Family Dwelling, Multiple	Complete
Developable Residential Land	Family Dwelling, Multiple	Best Fit
(formerly Charitable Organizations (private hospitals, etc...). Removed June 2009.)		Best Fit
(formerly Municipalities/Districts. Removed June 2009.)	Family Dwelling, Single	Best Fit
(formerly Religious Organizations. Removed June 2009.)	Place of worship with kitchen	Best Fit
Auto Repair Facilities	Service Station [No Gas]	Complete
Gasoline Service Stations - providing engine repair or maintenance services, and fuel products	Service Station [No Gas]	Complete
Improved, Municipal Public Safety	Office building	Best Fit
Improved, Selectmen or City Council (Municipal)	Office building	Best Fit
Medical Office Buildings	Doctor Office	Best Fit

LAND USE DESCRIPTION FROM ASSESSORS OFFICE	CLASSIFICATION FROM CMR 15.205	DEGREE OF MATCH
Mixed Use (Primarily Commercial, some Residential)	Retail Store (except supermarkets)	Best Fit
Mixed Use (Primarily Residential, some Agriculture)	Family Dwelling, Single	Best Fit
Mixed Use (Primarily Residential, some Commercial)	Family Dwelling, Single	Best Fit
Multiple Houses on one parcel	Family Dwelling, Multiple	Complete
Property Used for Postal Services	Office building	Best Fit
Restaurant	Restaurant	Complete
Small Retail and Services stores (under 10,000 square feet)	Retail Store (except supermarkets)	Complete
Supermarkets (in excess of 10,000 square feet)	Supermarkets	Complete
Telephone Exchange Stations	Factory, Industrial Plant, Warehouse or Dry Storage Space without cafeteria	Best Fit

Relevant Unit Multipliers

Each CMR 15.205 classification is attached to two or three figures: a relevant unit (e.g., per bedroom), design flow criteria for that unit (e.g., 110 gallons per bedroom per day), and, in many cases, a minimum allowable flow in gallons per day. As a second step, the consultant team identified the relevant unit for each parcel and then calculated the relevant unit multiplier.

- <u>Per 1,000 Square Feet</u> – Most commercial uses in CMR 15.205 are assigned flows on a per 1,000 square foot basis. In this case, the consultant team simply divided the building size field from the Assessors database by 1,000.
- <u>Restaurants</u> – 310 CMR 15.00 requires that the design flow be calculated at a certain number of gpd per seat for the restaurant itself, the thruway service area, and for a fast food restaurant; however, the minimum daily flow is 1,000 gpd. This minimum flow would be the equivalent of a 28-seat restaurant or a 50-seat fast food restaurant.

- Per Bedroom – The consultant team assumed that all residential units, regardless of size, had four bedrooms, creating a multiplier of four in the case of single-family residences; eight in the case of two-family residences; and twelve in the case of three-family residences. For the "minimum standards analysis" stress test, this per bedroom figure was brought down to three.
- Per Garage Bay – Design flow for automobile service uses require a calculation per garage bay. There are two parcels in the study area where a bay count was required to generate flow. In these instances, the consultant team used Google Streetview to count bays.
- Per Seat – Design Flow for places of worship is evaluated on a per seat basis. There are two places of worship in the study area, the Town provided an actual usage for the first of these; usage for the second place of worship was based on this number.
- Per Doctor – Not relevant, as an actual usage figure was supplied by the Town.
- Per Person – The only property in the study area described as a Factory, Industrial Plant, Warehouse, or Dry Storage Space was a telephone exchange station. The consultant team assumed that one person worked in this space.

Design Flow Calculation

As a final step, the consultant team multiplied the relevant unit multiplier for each parcel by the relevant Title 5 Flow Criteria. The consultant team replaced this product with minimum allowable flow values from CMR 15.205 where relevant. In this analysis, it was assumed that parcels without buildings (classified as vacant, developable, and undevelopable parcels) had flows of zero gpd.

- Data Supplied by the Town – West Newbury supplied actual usage data for 18 parcels, all in the Town Center. An actual usage figure was used wherever possible. The two parcels in Town Center that do not have actual data are Parcel 001U 0000 00260/300 Main Street, which is a church, and Parcel 001U 0000 00350/Main Street, which is undevelopable. The estimate for 300 Main street was based on the actual usage of the other church in the Town Center.

This work yielded an estimated design flow under current Title 5 regulations as shown in the table below:

AREA	GPD
Existing Town Center	8,881

Future Build Out

The analysis of future build-out explores two scenarios: first, that all residences located in the 20 parcels within the Business district are converted so that the ground floor is used for commercial purposes while the upper floor is retained as a residence and second, that all vacant, developable parcels are built out to the a density specified by an existing development plan or by the Town.

PARCELS WITHIN THE BUSINESS DISTRICT

Of the 20 parcels in Town Center, just 7 are residential and could therefore accommodate further retail use. The consultant team assumed that all ground floor square feet is newly dedicated to one retail use (50 gpd per 1,000 square feet, minimum: 200 gpd) without impacting the residential usage. This option was selected because it generated the largest estimate for the projected flows.

VACANT, DEVELOPABLE PARCELS

Of the 89 parcels in the packaged treatment plant study area, only six are vacant. Of these, just three are identified as developable:

- Mullen Woods (Church Street with access from Main Street) – 34.19 acres over 2 parcels
- Dunn's Farm (317 Main Street) – 14.78 acres on 1 parcel

The planned development of these parcels is as follows:

- Mullen Woods – The *Summary Report on Affordable Housing*, dated November 2007, identifies 18 acres of potentially developable land on the 34.19-acre site. This report estimates a design flow of 3,960 gpd for 12 single-family homes. This report also explored the option of 25 units of senior housing (3,750 gpd) and 20 age-restricted condominium units (3,000 gpd).
- Dunn's Farm – At the meeting on December 4, 2017, the Working Group requested an assumption of 200 units on this site. At four bedrooms per unit, the design flow would be 88,000 gpd.

Stress Testing/Alternative GPD Scenarios

The future build-out, described above, employed a conservative approach to estimating current and future demand, which means that in all cases, the most water intensive or most dense redevelopment scenario was used. To explore the impact of this conservative approach, the consultant team explored two additional scenarios:

- Minimum standards – This scenario reduced estimated gpd for each use to the minimum flow specified in legislation. For instance, under this test, all residential units were assumed to use 330 gpd rather than 440 gpd.

- Average daily indoor water use per household – This scenario used current water consumption benchmarks as the basis for flow estimation. These numbers are not possible to implement under current state law.

MINIMUM STANDARDS

- All households are assumed to have three bedrooms (330 gpd), rather than four (440 gpd), unless actual usage data was supplied by the Town.
- Mullen Woods is developed into 20 age-restricted condominiums (3,000 gpd).
- Mixed-use conversions still use 530 gpd (330 gpd for residential and 200 gpd for small retail). (Note that the numbers for mixed-use conversions do not shift under this scenario as it still relies on actual usage data provided by the Town.)

AVERAGE DAILY INDOOR WATER USE PER HOUSEHOLD[21]

- All households are assumed to use 60 gallons per bedroom per day (rather than the State minimum of 110) and all households are assumed to have three bedrooms (180 gpd), rather than four (240 gpd). The typical daily use of a person in a single-family home is 60 gpd.
- Mullen Woods is developed into 20 age-restricted condominiums but using 60 gallons per bedroom per day (2,520 gpd).
- Mixed-use conversions still use 530 gpd (330 gpd for residential and 200 gpd for small retail).

AVERAGE DAILY INDOOR WATER USE PER BUSINESS

- The Town of West Newbury does not have a sufficient range of business types to determine average or minimum daily usage of the types of businesses envisioned for an expanded Town Center. Estimates of gpd for all scenarios used the minimum allowable design flow. The stress tests in this report thus test the impact of lower daily flows on residential units only.

21 *Residential End Uses of Water, Version 2*, published April 2016, written by the Water Research Foundation. https://www.awwa.org/portals/0/files/resources/water%20knowledge/rc%20water%20conservation/residential_end_uses_of_water.pdf

Additional Assumptions

This build-out scenario is based on publicly available information and information provided by the Town of West Newbury. As recommended earlier, the Town should consider a full Comprehensive Wastewater Management Plan prior to moving forward with any formal decision on a centralized system. As a general survey, the build-out analysis has some additional assumptions:

- Construction cost data is from 14 facilities located in southeastern Massachusetts built over a 13-year period prior to 2009 and provided in the *Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod: Guidance to Cape Cod Towns Undertaking Comprehensive Wastewater Management Planning* prepared by the Barnstable County Wastewater Cost Task Force.
- Report data has been adjusted to make the cost in 2009 dollars current to 2010 based on ENR Cost Construction Index 8600 and then has been projected forward to May 2017 based on ENR Cost Construction Cost Index 10692.
- Design flows range from 15,000 gpd to 2.3 MGD.
- Calculations included deriving the pure construction cost of treatment, and excluding costs of collection, transport, or disposal. The cost estimating procedure later adds a consistent allowance for non-construction aspects of capital cost such as design, permitting, construction phase engineering services, legal expenses, and land.
- The Cape Cod study includes the general cost of land in Construction Costs. For West Newbury, the cost of land may increase or reduce the construction cost based on the need to acquire land or the ability to use land already owned by the Town.
- Collection system calculations assume that the system will use gravity sewers. Pump Stations have been excluded from the cost.

HARRIMAN