



Wastewarter Management Planning for Bourne's Downtown

June 29, 2012



With assistance from Cape Cod Commission RESET and CHZMHIII



TOWN OF BOURNE

Bourne Wastewater Advisory Committee



TOWN HALL 24 PERRY AVE.

BUZZARDS BAY, MA 02532

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June 22, 2012

Board of Sewer Commissioners Town of Bourne 24 Perry Ave. Buzzards Bay, MA 02532

Re: Wastewater Management Planning for Downtown Bourne

Dear Commissioners:

The Wastewater Advisory Committee to the Board of Sewer Commissioners was authorized by the Board at their meeting on August 24, 2010, and charged with the following:

to serve as advisors to the Board of Sewer Commissioners as it reviews options for wastewater management for the Town with a near-term focus on assisting investors and expanding the wastewater management capacity for the Village of Buzzards Bay and its immediate surrounding areas. This near-term focus has a particular urgency in the context of pending investment in Bourne's Downtown and the need to create a Growth Incentive Zone (GIZ) to facilitate new investment.

To carry out these objectives, committee members will:

- 1. Review previous studies of wastewater management needs, recommend solutions, alternative methods of treatment, and private and public funding strategies,
- 2. Explore alternative approaches to expanding wastewater treatment capacity, including private and public funding strategies,
- 3. Formulate recommendations to the Board of Sewer Commissioners that includes plans, locations, timelines and private and public funding strategies.

A summary of findings and a recommended action plan, as developed in consultation with the Cape Cod Commission Regional Economic Strategy Execution Team (RESET) and CH2M Hill, are presented herein with a full discussion presented in the attached report.

Summary of Findings and Recommended Action Plan

Wastewater is currently collected in Downtown Bourne and Hideaway Village and sent to the Wareham Wastewater Treatment Plant. The wastewater flows to Wareham are limited by the Inter Municipal Agreement (IMA) to an annual average of 200,000 GPD. Downtown Bourne buildout projections show that wastewater capacity will be exceeded with even modest growth or redevelopment.

To address the issues surrounding the limited wastewater capacity, evaluations of potential wastewater treatment facility sites, treated wastewater disposal sites and financing options were conducted. As a result of the analyses, alternatives were developed for siting a treatment facility

and subsurface disposal system within the Downtown area or outside of the Downtown area. The following were identified as key actions necessary as part of a phased approach to developing additional wastewater capacity in Downtown Bourne:

- Continue the services of the Bourne Wastewater Advisory Committee to assist in refining the wastewater option for Downtown Bourne
- Implement a phased approach that will allow for growth utilizing the remaining IMA allocation (Phase 1 of GIZ) while planning for infrastructure needed to develop the additional wastewater capacity needed for Phases 2 and 3 of GIZ
- Engage the public in the wastewater planning process
- Engage the Massachusetts Department of Environmental Protection (DEP) for review and comment on the plan for Downtown Bourne with the goal of DEP plan approval
- Continue discussions with private parties on commercial development plans and private financing options
- Work with the Massachusetts Water Pollution Abatement Trust and DEP to develop public financing options to supplement private investment
- Conduct preliminary hydrogeologic studies at preferred disposal sites

Many of these action items entail little or no cost, but are critical to downtown development and the long term plan of the Town.

In addition to wastewater management, water supply is a limiting factor to Downtown growth. The Town should support the Buzzards Bay Water District in identifying, securing access to, and permitting a new water supply site and investigating an emergency backup connection.

Why act now?

Taking action now will allow the Town of Bourne to control its own destiny and select the options that best meet the needs of the Town and its residents. Given that it can take four or more years to design, permit, and approve wastewater infrastructure, action is required now to avoid delays in Phases 2 and 3 of the GIZ. Delay in action will only increase the costs of implementation and delay economic development.

The BWAC would like to thank the Board of Sewer Commissioners for the opportunity to present these findings and stands ready to assist in moving forward on the path towards a revitalized Downtown Bourne.

Sincerely,

Sallie K. Riggs	William Locke	Michael Brady	Mary Andrews
Chair	Vice Chair	At Large Member	At Large Member
Stanley Andrews	Elaine Lewis Ryan	Don Montour	
Board of Health	Commercial User	Finance Committee	

Cc: Thomas Guerino, Town Administrator Coreen Moore, Town Planner George Tribou, Bourne Plumbing and Gas Inspector Barry Woods, Buzzards Bay Water District Superintendent



Executive Summary



The Town of Bourne has focused for many years on the goal of revitalized economic development in Downtown Bourne. Such a re-development would provide the town with business opportunities, increased commercial activity, and augmented tax income. One of the remaining barriers to achieving this goal is limited wastewater treatment capacity in Downtown Bourne. Recognizing this, the Board of Sewer Commissioners established the Bourne Wastewater Advisory Committee (BWAC) on August 24, 2010 to evaluate options and provide direction for an effective and affordable wastewater management plan.

The committee was fortunate in obtaining the assistance of the Cape Cod Commission, specifically their Regional Economic Strategy Execution Team (RESET) initiative. RESET had the expertise and resources necessary to provide the technical services to support the BWAC efforts. These efforts included an assessment of water and wastewater requirements in Downtown Bourne, and the development of feasible options for wastewater services in Downtown Bourne.

Existing Wastewater Services

The Town of Bourne has an existing wastewater collection system built in the early 1990's which serves downtown Bourne, Taylor Point, and Hideaway Village. The system, which is showing signs of age, delivers this wastewater to the Wareham Wastewater Treatment Plant. The flow of wastewater that Bourne can send to Wareham is limited by an Inter-Municipal Agreement to 200,000 gallons per day (GPD).

Water Supply

The Buzzards Bay Water District currently supplies water to the area from four wells, operating at or near their permitted capacity. Options to increase water supply capacity are reviewed in this report and will need to be considered in conjunction with any plans for wastewater expansion. It is recommended that the town support the Buzzards Bay Water District in planning and securing the additional water necessary for economic growth in Downtown Bourne.





Buildout Analysis

The Cape Cod Commission staff prepared a buildout analysis for the study area following assumptions outlined by current zoning and future market analysis. The buildout analysis, done in close cooperation with the Town Planner, helped the BWAC select a practical buildout assumption of future wastewater flows needed over the next 25 years. Downtown growth will occur incrementally so the BWAC chose to evaluate wastewater services for a range of flows, from 25,000 GPD to 335,000 GPD (practical buildout).

Buildout analysis indicates that the development of even a few new restaurants and/or small hotels in the Downtown area will exceed the remaining wastewater flow capacity and the available water supply.

Technologies for Wastewater Management

The committee evaluated a number of treatment technologies including membrane bio reactors, sequencing batch reactors, and package plants. Subsurface disposal of effluents was determined to be the preferred disposal mechanism for whatever system chosen. In addition to odor control, subsurface disposal systems also allow the surface to be used for a variety of recreational activities or open space.

Treatment and Disposal Sites for Wastewater Management

The Commission's RESET team conducted an evaluation of potential wastewater treatment and discharge sites within the town. Based on decision criteria established by the BWAC, forty-five initial parcels were screened for suitability resulting in five wastewater treatment plant sites and preferred subsurface wastewater discharge sites selected for further analysis. Final sites were located both within and outside of the downtown area; and each is capable of handling the 335,000 GPD of wastewater flow projected for the 25 year practical buildout.

As one alternative, the BWAC considered a public-private financing arrangement, wherein the treatment could be located on a portion of a privately owned parcel in the downtown area and the disposal area located on a town-owned parcel also in the downtown. A detailed analysis of site selection and costs are presented in the report.



Costs would vary by site, but the analysis indicates that treatment facility, subsurface disposal, and the related conveyance systems to handle 50,00 GPD and designed to be expandable to 335,000 GPD, including engineering, permitting, construction management, and overall contingency, would cost a developer approximately \$10 million.



Financial Options

The town has a number of options when considering financing for potential upgrades to the wastewater infrastructure. The actual means of financing the planning, design, and construction of new facilities will depend upon a number of factors which include possible proposals by commercial developers interested in projects in or near Downtown Bourne. Additionally, a number of state economic grant and loan programs can be considered and have been detailed within this report.

Action Plan

In light of the information collected in this study, the BWAC and the Commission agree that action needs to be taken to allow for the economic development that is essential to revitalization of Downtown Bourne. The following were identified as key actions necessary as part of a phased approach to developing additional wastewater capacity in Downtown Bourne:

- Continue the services of the Bourne Wastewater Advisory Committee to assist in refining the wastewater option for Downtown Bourne
- Implement a phased approach that will allow for growth utilizing the remaining IMA allocation (Phase 1 of GIZ) while planning for infrastructure needed to develop the additional wastewater capacity needed for Phases 2 and 3 of GIZ
- Engage the public in the wastewater planning process
- Engage the Massachusetts Department of Environmental Protection (DEP) for review and comment on the plan for Downtown Bourne with the goal of DEP plan approval
- Continue discussions with private parties on commercial development plans and private financing options
- Work with the Massachusetts Water Pollution Abatement Trust and DEP to develop public financing options to supplement private investment





• Conduct preliminary hydrogeologic studies at preferred disposal sites

Many of the recommended initial action items require little or no cost, but are essential in moving forward towards a successful wastewater management program. The BWAC stands ready to assist.



Acknowledgments



The Bourne Wastewater Advisory Committee would like to thank the Cape Cod Commission RESET staff and CH2M HILL staff for their invaluable assistance on this project.

In addition, we would like to acknowledge the assistance of Town of Bourne employees Tom Guerino, Coreen Moore, George Tribou, and Debbie Judge, and the Buzzards Bay Water District Superintendent Barry Woods.



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Background

The Downtown Bourne area has been the focus of economic development efforts as a means of revitalizing Buzzards Bay Village, and providing business opportunities that will increase the Town's commercial sector to relieve the tax burden on residents. Limited wastewater treatment capacity is a barrier to providing those opportunities. In recognizing the integral role of wastewater infrastructure to provide for economic development and protect the town's coastal waters, the town has established the Bourne Wastewater Advisory Committee (BWAC) to evaluate options and provide direction for consideration. The Cape Cod Commission, through the Regional Economic Strategy Execution Team (RESET) initiative, was requested to provide technical services to support the BWAC effort that will specifically include a review and assessment of water and wastewater planning issues related to Downtown Bourne. The objective of presenting this evaluation in a report is to provide easily understandable information to decision makers and the public on water and wastewater planning issues for Downtown Bourne as it relates to economic development opportunities for the Town of Bourne.



Study Objectives



The purpose of this report is to present the findings of the study performed by the RESET staff relating to water supply and wastewater issues as part of a comprehensive water supply/wastewater assessment of the Downtown Bourne area (including Hideaway Village and the Bourne Development Campus).

The study included the following goals:

- Evaluate water supply and wastewater issues within the study area
- Identify options for water supply and wastewater management
- Assist the Town of Bourne and the Buzzards Bay Water District with water supply and wastewater issues within the area and to provide an action plan for a solution.

The report is organized according to the tasks identified in the Scope of Work endorsed by the Board of Sewer Commissioners at its meeting on June 6, 2011.

STUDY AREA

The study area, as shown in Figure 1, includes Downtown Bourne, Hideaway Village, and the Bourne Development Campus.



Figure 1. Wastewater Management Planning Study Areas





Task 2 - Existing Planning Documentation



Commission staff reviewed prior water and wastewater planning and other related planning documents to provide for a systematic and practical approach to the project. Our review included but was not limited to the following documents:

- 1. Wastewater Management Study, (Tighe & Bond, 2007)
- 2. Wastewater Flow Projection & Conceptual Costs for Bourne Development Campus, (Tighe & Bond, June 2008)
- 3. Wastewater Management Conceptual Alternatives Analysis-South of Canal, (Tighe & Bond, January 2008)
- 4. Report to Sewer Commissioners, (Tighe & Bond, March 2008
- 5. Vision Plan for Bourne's Downtown, (Stantec, 2008)
- 6. Growth Incentive Zone (GIZ) Application (May 2011)
- 7. Bourne Downtown Site Planning, (Cecil Group Inc., June 24, 2009)
- 8. Action Plan for Bourne's Downtown, (November 2008)
- 9. Downtown Zoning Bylaw (October, 2008)
- 10. Market Analysis for Main Street Buzzards Bay, (RKG, November 2006)
- 11. 2000-2011 Monthly Wastewater Flows for Downtown and Hideaway Village
- 12. Downtown Buzzards Bay Design Guidelines, (Stantec September 2008)
- 13. Flood Hazard Mitigation Study for Buzzards Bay, (Kennen, December 2007)
- 14. 2010 Inter Municipal Agreement with Wareham and Bourne for Wastewater
- 15. Town of Bourne Sewer Use Regulations, 1990
- 16. Massachusetts Estuaries Project reports for south-side estuaries in Bourne
- 17. Conservation Law Foundation status of litigation

A full list of documents that were reviewed in conjunction with the development of this report is shown in *Appendix A: Complete List of Documents Review*. Of the documents reviewed, the three main documents were used to support the wastewater planning efforts, which are discussed below.





Wastewater Management Study, Bourne, MA – Tighe & Bond (October 2007). The purpose of the Bourne Wastewater Management Study was to identify wastewater management solutions that would facilitate the revitalization of Main Street Buzzards Bay and other areas of Bourne north of the Cape Cod Canal and provide a framework for long-term wastewater management needs town-wide.

The analysis and recommendations presented in the Committee's report are not meant to replace the Tighe & Bond study but rather to supplement it and provide a greater level of detail within the study area. The recommendations for wastewater management for Downtown Bourne presented in the Committee's report fit into the larger town-wide wastewater management needs described in the Tighe & Bond report. The town should utilize both documents in concert to address wastewater challenges in Downtown Bourne and town-wide.

Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod - Barnstable County Wastewater Cost Task Force – Wright Pierce (April 2010). Cost estimates for capital and operations and maintenance (O&M) costs for individual, cluster, satellite, and centralized systems sized for Cape Cod.

Community Funding for Wastewater Capital Programs - Robert J. Ciolek (July 20, 2011). The presentation discusses five basic funding choices for Cape Cod towns: contributions from a private developer, funding from existing Town sources for capital and/or operating expenses; funding from betterment assessments for capital expenses; funding from a Proposition $2\frac{1}{2}$ override or debt exclusion vote for capital expenses, and funding from a system of rates and charges for operating and/or capital expenses. A copy of this presentation is presented in *Appendix K: Financing Options Presentation*.



Task 3 - Water Supply and Demands



Commission staff investigated water supply issues related to the Buzzards Bay Water District including supply capacity and demands based on existing studies, maps of well sites, and potential water supply sites. The following subtasks were completed as part of this effort and are detailed in the following sections.

- a) Met with Buzzards Bay Water District Superintendent
- b) Assessed present status of water supply and demands
- c) Project potential future deficits and supply needs
- d) Review and refinement of screening for potential lands suitable for water supply

TASK 3A: DISCUSSION WITH BUZZARDS BAY WATER DISTRICT SUPERINTENDENT

Commission staff met with the Buzzards Bay Water District Superintendent Barry Woods on May 18th, 2011. Discussion focused on the current supply, demand, infrastructure, and permits relating to water supply. Copies of the last five (5) years of pumping data were provided and are presented in *Appendix B: Summary of Buzzards Bay Water Pumping Reports*. The Superintendent also provided a copy of the Department of Environmental Protection (DEP) water supply permit that permits the Buzzards Bay Water District to pump an annual average of 530,000 gallons per day (GPD).

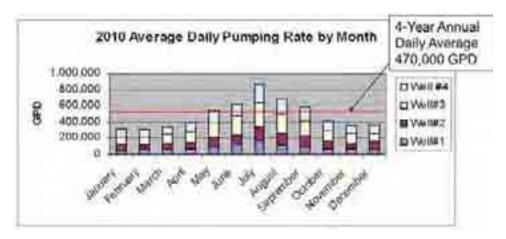
TASK 3B: CURRENT WATER SUPPLY AND DEMANDS

The Buzzards Bay Water District currently operates four water supply wells. Pumping rates vary over the course of the year with the greatest demand experienced in the summer months. The average daily pumping rate at each of the four wells is presented in Figure 2 for each month of 2010.



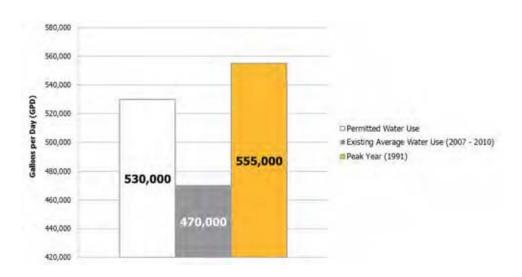






The combined four-year annual daily average (2007-2010) pumping rate for all four (4) wells was 470,000 GPD. Historically, this annual daily average pumping rate reached as high as 550,000 GPD in 1991. The current pump configuration has the capacity to handle the current demand. However, as shown in Figure 3, average annual daily pumping rates have exceeded the 530,000 GPDDEP Water Management Act Permit.

FIGURE 3. ANNUAL AVERAGE DAILY WATER USE - PERMITTED, EXISTING, PEAK





TASK 3C: FUTURE SUPPLY NEEDS



A build-out analysis provides an indication of the development growth potential in the downtown area and the need for increased water supply demands. Water use demands for practical and theoretical build-out scenarios (discussed in detail in Task 5), are projected to be 730,000 GPD and 1,770,000 GPD, respectively. For planning purposes, the Committee has chosen 25% of the practical build-out (335,000 GPD) for the present timeline.

Given that the actual pumping rates combined with the projected buildout demand will exceed the current DEP water withdrawal limit, options to increase water supply capacity will need to be considered. One option to explore would be installing a new well to add additional supply. In order to develop a new well, the following steps will need to be completed:

- Open space allowance for water supply purposes
- Test Well Investigation
- DEP New Source Approval
- Water Management Act Permit

Siting a new supply well will be critical and the town should assist the Buzzards Bay Water District in selecting viable sites.

Also worthwhile of consideration going forward would be a connection with other water districts. Currently the District has no connections with other districts and therefore no emergency back-up water supply.

TASK 3D: SCREENING FOR POTENTIAL LANDS SUITABLE FOR WATER SUPPLY

Screening for potential land suitable for water supply is a critical step in developing new water supply sources for the town. A methodology from the Commission's Priority Lands Acquisition Assessment Plan (PLAAP) (1999) was used in this process. The PLAAP uses a map overlay process which looks at priority conservation targets to protect water supply resources. This mapping takes into account both natural and manmade obstacles and designates which areas are most suitable for water supply.

The PLAAP map series is described below and the maps, Figure 4-Figure 8, are presented on the following pages.

The first step of the analysis was to define PLAAP study area. As shown in Figure 4, the study area was identified as the Buzzards Bay Water District and the surrounding area. Next, groundwater flows and water supply sites, water supply protection areas (Zone II's) and buffers, and water supply obstacles were identified within the study area as presented in Figure 5. The District owned land, water table contours, and groundwater flow are shown in Figure 5. Groundwater contours are from the USGS groundwater flow model of the Plymouth-Carver Aquifer. Groundwater flow is perpendicular to the contours showing that groundwater flow is generally southwest through the study area to discharge into Buttermilk Bay and the Cape Cod Canal.

Constraints to developing water supply sites are identified in Figure 6. This shows wetland areas, rivers, ponds, and vernal pools which are water dependent ecosystems are sensitive to water withdrawals. A 100 foot buffer around these areas was added. Constraints to water supply from development are shown in Figure 7. Developed areas include residential and commercial development and roadway areas. The white areas remaining are those that are suitable for water supply exploration.

Using the information presented in the three previous maps, potential water supply areas were identified and are shown in Figure 8. The "best case" areas are shown in blue with "satisfactory" and "potentially constrained" shown in orange and red respectively.

The town should consider the water supply potential of these areas when evaluating proposed competing land uses. In general, the sites with the greatest potential would be up gradient from existing and proposed future development. To the greatest extent possible, the town should take action to protect potential water supply areas. This will allow the town to secure a sufficient water supply for the town as it exists today and allow for future growth.







Figure 4.
Base Map of PLAAP Study Area

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1 Miles

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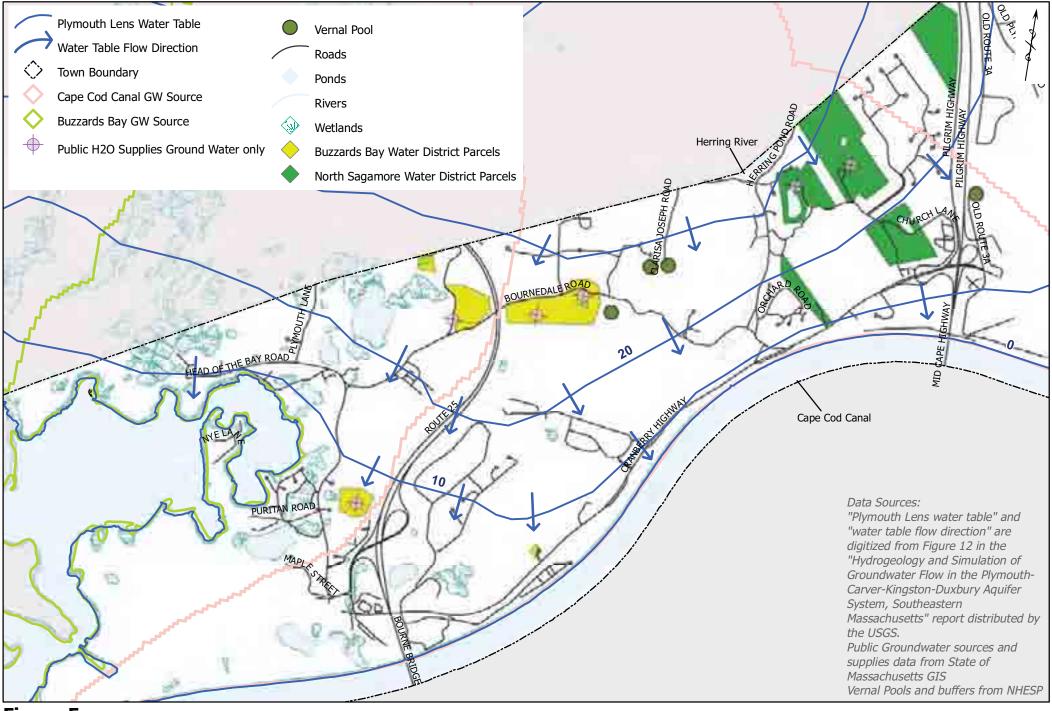


Figure 5.
Groundwater Flow and Water Supply Areas





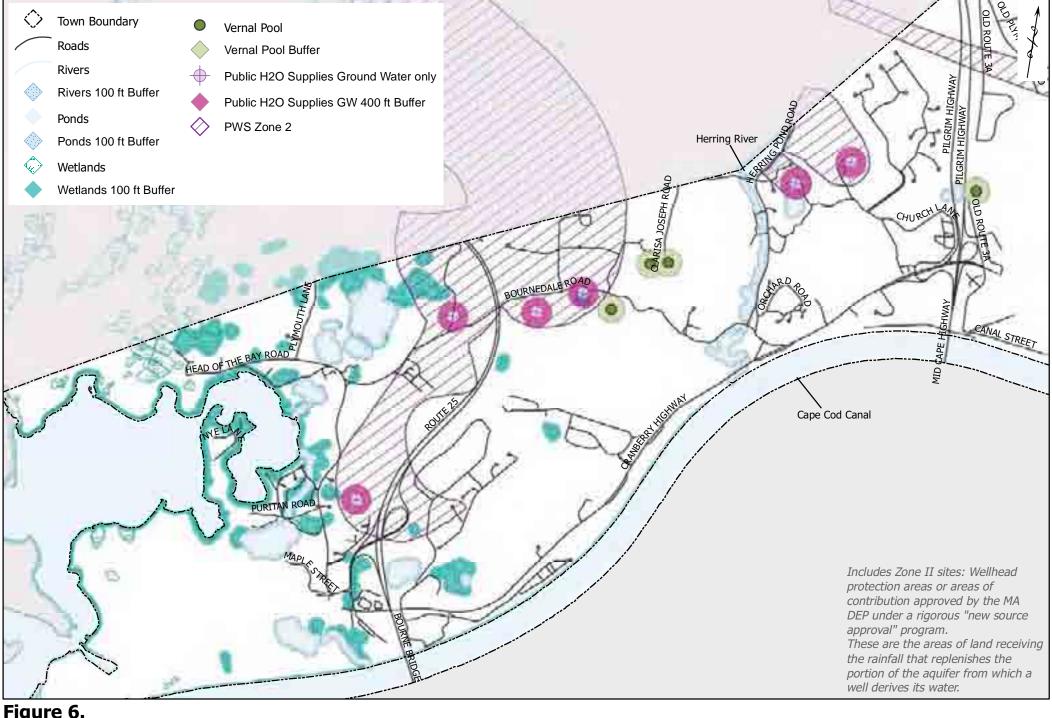


Figure 6. Water Supply Protection Areas and Buffers





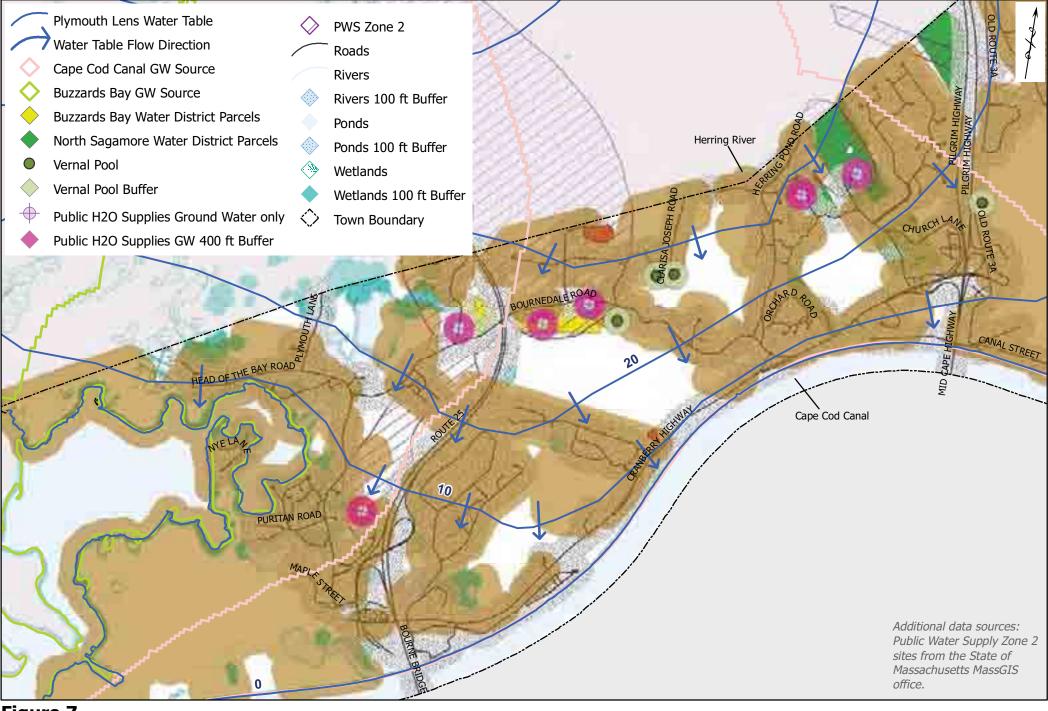
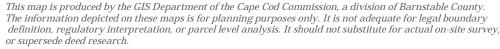


Figure 7. Water Supply Obstacles







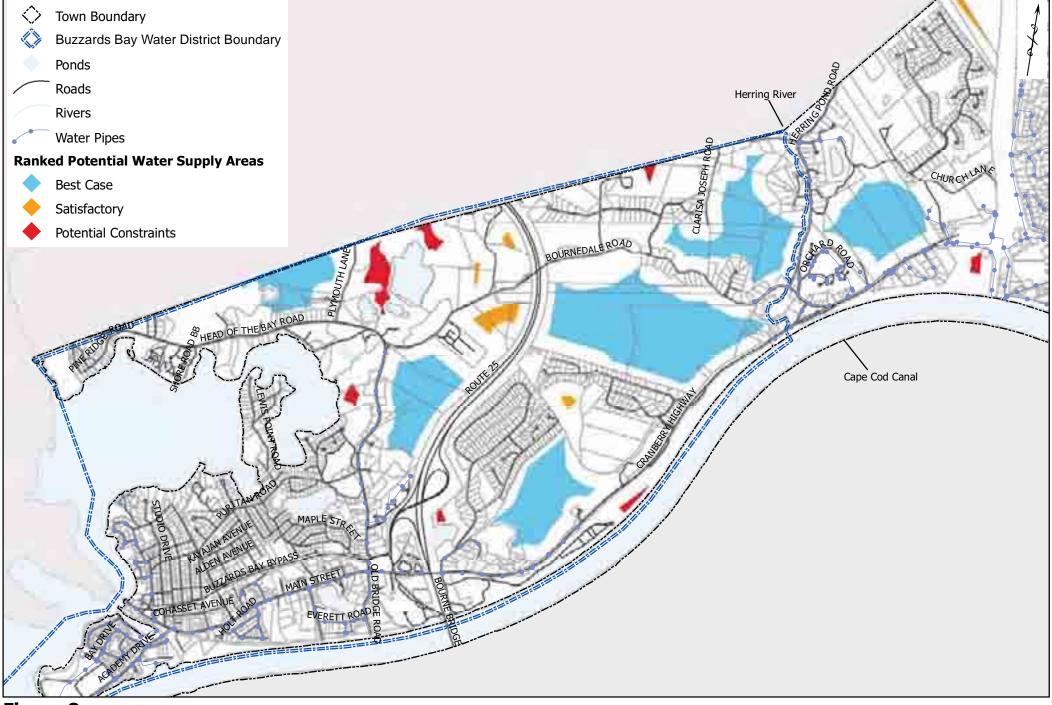


Figure 8.
Potential Water Supply Areas









As part of this task, the RESET staff reviewed existing documents relating to sewer use patterns, regulations, inter municipal agreements, and potential and future allocation agreements as it effects future expansion planning. The following subtasks were completed as part of this effort and are detailed in the following sections.

- a) Review Inter Municipal Agreement (IMA)
- b) Summarize allocation issues
- c) Develop outline for allocation tracking

TOWN OF BOURNE MUNICIPAL INFRASTRUCTURE

The Town of Bourne has an existing wastewater collection system that was built in the early 1990's and serves Downtown Bourne through eightinch gravity sewers and Taylor's Point and the eastern section of downtown through a low pressure system. Flows are collected at Hideaway Village/Main Street Pump Station and pumped via a six-inch ductile iron force main along Main Street across Buttermilk Bay to the Wareham Wastewater Treatment Plant (WWTP). According to early design documentation, the capacity of this collection system is estimated to be approximately 140,000 GPD. It is possible that the capacity of the existing infrastructure can accommodate much more than 140,000 GPD, however a rigorous engineering assessment would be required for a determination. Hideaway Village is also served by an existing collection system and the Hideaway Village Pump Station that pumps flow through a six-inch ductile iron force main to the Wareham WWTP.). According to early design documentation, the capacity of this collection system is estimated to be approximately 60,000 GPD.

The existing wastewater collection system is show in Figure 9. All of the wastewater collected in municipal system is pumped to the Wareham wastewater treatment plant per the Inter Municipal Agreement (IMA) detailed in the next section.

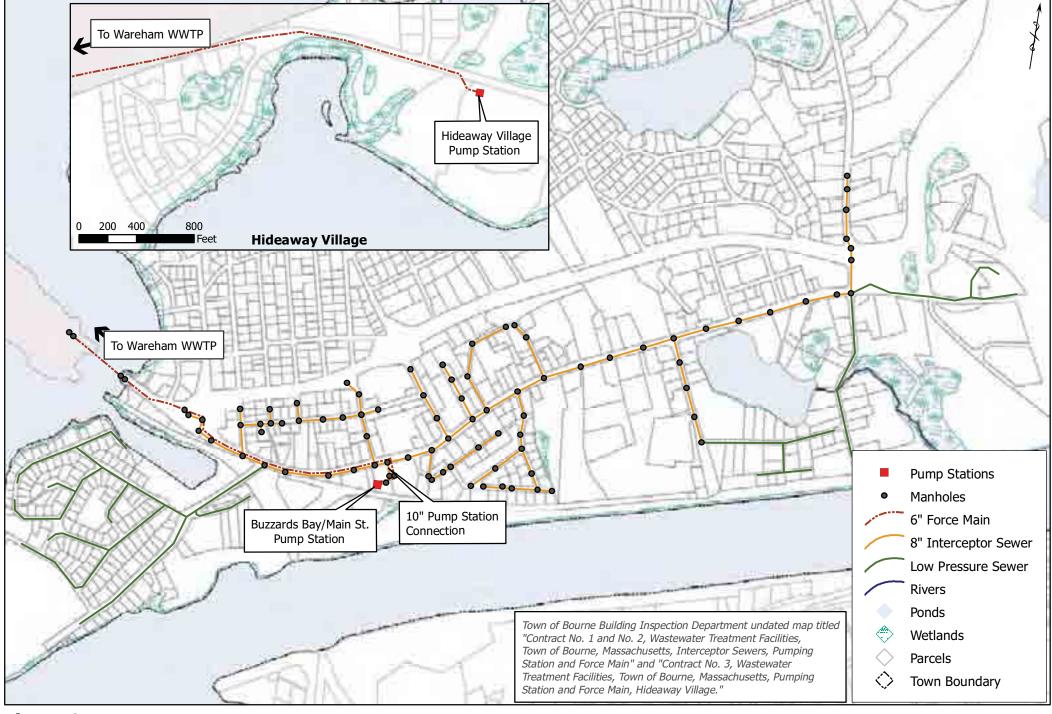


Figure 9. Existing Sewer Lines

0 375 750 1,500 Feet



CAPE COD COMMISSION



Apart from the municipal system, the Massachusetts Maritime Academy, located in the Downtown area, collects and treats all of the wastewater generated on its site. The treatment plant is designed for an average of 77,000 GPD. The treated effluent is disposed of via an outfall pipe into Buzzards Bay, using a NPDES Permit for an average flow of 140,000 GPD.

TASK 4A & 4B: INTER MUNICIPAL AGREEMENT & ALLOCATIONS

The "Agreement for Wastewater Collection, Treatment and Disposal between Town Of Wareham, Massachusetts and Town Of Bourne, Massachusetts," commonly referred to as the Inter Municipal Agreement (IMA) details the terms by which the Town of Bourne sends wastewater flows to the Wareham Wastewater Treatment Plant (WWTP). The IMA was developed in 1989 and goes through 2009. It was renewed, with only minor changes to language in 2009. The IMA describes the terms of the agreement and payment, for example, Bourne paid Wareham a proportionate share of Wareham's capital investment for common infrastructure, including the WWTP. It states that Wareham will take up to 200,000 GPD (average annual daily) from Bourne, with approximately 140,000 GPD (average annual daily) allocated to the Downtown Bourne area and 60,000 GPD (average annual daily) allocated to the Hideaway Village area.

The IMA also states that, in the event that Bourne's total average daily wastewater flow entering the common sewage works within any two consecutive quarters exceeds 180,000 GPD, then Bourne shall notify Wareham and define measures that will be taken to manage the quarterly flow increase to keep the total within the total flow capacity allocated to Bourne.

EXISTING WASTEWATER FLOWS

To understand how the existing infrastructure is being utilized, wastewater pumping records were requested from the town of Bourne. The records provided measurements of the monthly average number of gallons per days pumped to Wareham from the Downtown (Main Street





pumping station) and the Hideaway Village pumping stations. Data from 2000 through 2011 was analyzed and is presented in Figure 10. As highlighted in the figure, the most recent three-year average is 87,000 GPD (2009 – 2011) and the highest three-year average is 160,000 GPD (2003-2005). Detailed data is provided in *Appendix C: Summary of Downtown Bourne Wastewater Pumping Reports*.

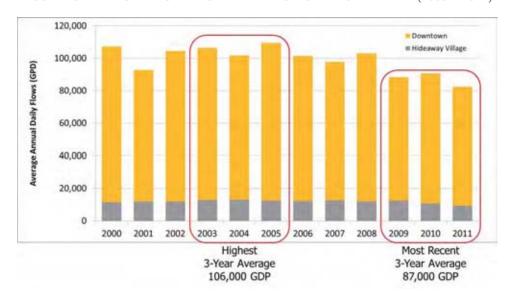


FIGURE 10. AVERAGE ANNUAL WASTEWATER FLOW SENT TO WAREHAM (2000 2012

TASK 4C: ALLOCATION TRACKING OUTLINE

With the IMA limiting the wastewater flows to average annual daily flow of 200,000 GPD, and with a 180,000 GPD action trigger, it is important for the town to track and monitor the flows being sent to Wareham. The tracking is a requirement of the IMA as flow data is collected at the two pumping station feeding the flows into Wareham. Continued monitoring of the actual flows versus the flow limit will be important is inform the town as to the available allocation that is available for development.

It is important to note that this "available allocation" is in constant flux as actual flows will vary year to year. Considering the most recent three-year average flow (2009-2011) and the highest three-year average flow (2003-2005), Table 1 presents Bourne's available allocation to the Wareham WWTP.





TABLE 1. AVAILABLE ALLOCATION TO WAREHAM WWTP

	Highest 3-Year Average (2003-05)	Most Recent 3-Year Average (2009-11)
IMA Wastewater Allocation Trigger	180,000 GPD	180,000 GPD
(annual average allocation)		
Downtown Bourne (annual average)	-93,000 GPD	-76,000 GPD
Hideaway Village (annual average)	-13,000 GPD	-11,000 GPD
Optimus Senior Living (allocation)	-23,000 GPD	-23,000 GPD
Available Allocation	51,000 GPD	70,000 GPD

OTHER CONCERNS

A discussion on the performance of septic systems, 100 year flood plain, groundwater, soils, water quality issues with estuaries/Massachusetts Estuaries Project, drinking water supply, freshwater ponds, Areas of Critical Environmental Concern, Outstanding Water Resource, leachate, septage, and wastewater constituents biological oxygen demand (BOD), total suspended solids (TSS), total nitrogen (TN), total phosphorus (TP)) are addressed the October 2007 Tighe and Bond report.

REGULATORY REQUIREMENTS

DEP Groundwater Discharge Program — Wastewater treatment facilities that discharge more than 10,000 GPD to ground water are governed by the MA DEP under 314 CMR 5.00. The regulations require a rigorous hydrogeologic assessment to determine the proposed site's suitability and capacity and to characterize and minimize potential impacts on nearby or downgradient resources. The permit requires regular monitoring of performance.

Clean Water Act - the Federal Clean Water Act is implemented by the State DEP. The law requires that the state identify impaired waters and specific plans to restore water quality. These plans require the establishment of a Total Maximum Daily Load (TMDL) as a management





goal for regulatory compliance. In the case of coastal waters impaired by nitrogen, the law requires that the TMDL will outline the percent nitrogen removal required and provide guidance to the Towns on the types of controls and measures that might be effective in complying with the TMDL limits.

Massachusetts Estuary Project (MEP) Nitrogen Study - To reach compliance with Massachusetts water quality standards, the Massachusetts Estuaries Project (MEP) in the School for Marine Science and Technology (SMAST) at the University of Massachusetts at Dartmouth completes, under contract to the MADEP, technical studies for water bodies that are impaired under the state 303(d) impaired waters classification. These technical studies are used to develop Total Maximum Daily Loads (TMDLs) for those water bodies. MEP studies have not yet been completed for Cape Cod Canal or Buttermilk Bay.

DEP State Revolving Loan Regulations - The DEP has established requirements that must be met for towns to apply for low interest loans for wastewater infrastructure projects. The SRF regulations specify that Comprehensive Wastewater Management Plans must be developed to recommend and implement programs to attain TMDL limits and water quality standards for the pollutants of concern.

NPDES Permit for Wareham WWTP – The Wareham WWTP has a surface water discharge to the Agawam River and is, therefore, regulated under a discharge permit issued jointly by the EPA and the Massachusetts Department of Environmental Protection (MADEP). The discharge permit includes an industrial pretreatment requirement, which is reflected in the Bourne – Wareham IMA. The total average wastewater flow capacity of the Wareham Plant according to the IMA is 1.5 MGD of which Bourne is allocated 200,000 GPD. Original NPDES permits for outfalls into surrounding coastal waters are extremely difficult to amend for increased capacity.

Massachusetts Maritime Academy – As discussed previously, the MMA has its own treatment facility with a direct ocean discharge into the Cape Cod Canal through an EPA NPDES permit with an average capacity of 140,000GPD. The MMA currently uses an average of 66,000 GPD. Like the Wareham plant that has an existing outfall, the regulatory hurdle for amending a NPDES permit is extremely difficult.

New Source Approval – DEP regulations for the siting of a new public water supply well requires that a rigorous hydrogeologic assessment of the safe yield and potential impacts of a new water supply well.







Task 5 – Buildout Analysis and Wastewater Flows



Commission staff prepared a buildout analysis for the study area following assumptions outlined by current zoning and future market analysis.

INTRODUCTION TO BUILDOUT

A build-out analysis is an opportunity to create a snap shot of future development potential under current zoning. The methodology requires a series of both fixed and partial constraints. Fixed constraints are determined by both use and dimensional requirements in the zoning code, and partial constraints include more flexible assumptions such as the types of commercial uses (i.e retail, hotel, office, etc.) and the ratio of those commercial uses to residential uses within the zoning district. The result is a maximum development scenario that can be useful as a community visioning tool. However, build-out analyses *do not* predict actual future development, and in this case, it *is not* a parcel level analysis. Rather, fixed and partial constraints are applied to land within the district in the aggregate from which a development scenario emerges.

BUILDOUT METHODOLOGY

The town's 2011 assessor data was used as the basis for calculating the theoretical buildout potential under the town's form based zoning code adopted in 2008. Parcels within the database were aggregated by land area according to the four Downtown District (DTD) zoning districts; Downtown Gateway (DTG), Downtown Core (DTC), Downtown Waterfront (DTW) and Downtown Neighborhood (DTN). These zoning districts are presented in Figure 11.



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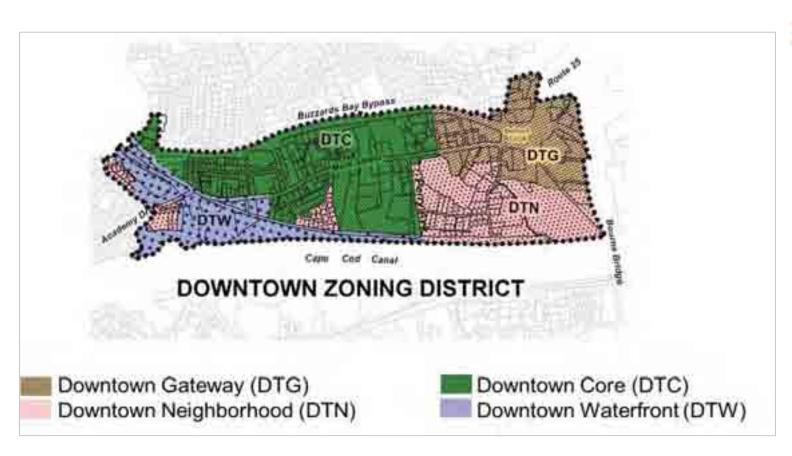


FIGURE 11. DOWNTOWN ZONING DISTRICTS





The DTN parcels retained their R-40 zoning requirements under the new zoning, including a 40,000 sf minimum lot size. Preliminary build-out analysis for the DTN shows the district as nearly built out with only 8 units remaining. Given this limited buildout potential, the DTN parcels were removed from the buildout analysis for the DTD. Remaining parcels in the DTD that met certain characteristics, such as municipally or federally owned land and protected open space, were also removed from the total developable area. Finally, parcels located within the floodplain, as delineated by the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRMs) were analyzed assuming ground floor parking, whereas parcels located outside the floodplain were not. This analysis was conducted at the direction of the Bourne Wastewater Advisory Committee and resulted in slightly higher densities within the floodplain as surface parking was no longer a limiting factor of development density within the buildout methodology. Table 2 contains the buildout factors used for both fixed and partial constraints.

TABLE 2. BUILDOUT FACTORS

Buildout Factors – Fixed Constraints ^a			
FAR	2		
Lot Coverage	80%		
Open Space	20%		
Building Height	52		
Stories	4		
Parking (by use):			
# spaces/1000 sf restaurant	10		
# spaces/1000 sf office	3		
# spaces/1000 sf retail	3		
# spaces per residential unit	1.5		
# spaces per hotel/motel unit	1		
Minimum Lot Size (sf)	3500		
Buildout Factors -	- Partial Constraints ^b		
% site used for ancillary uses	5%		
Shared Parking Reduction Credit	30% ^c		
Residential Unit (GFA)	1333		
Hotel/Motel Unit (GFA)	650 ^d		
Average Residential Unit Size (sf)	1000		
Average sf/parking space	400		

^aBourne Downtown District Zoning Bylaw (2800)

^bMassGIS Scope of Services for Buildout Analysis

^cAssumption of CCC/Town Planner (up to 50% shared credit allowed under zoning)

^dTown of Yarmouth Buildout Input

MIX OF USES

As previously mentioned in the Introduction to Buildout section of this report, determining the mix of uses (or the ratios between certain types of commercial development and residential development) is an important step in conducting a buildout analysis. Commission staff worked with the Town Planner and the BWAC to determine an appropriate mix of uses for each district. The mix of uses are flexible assumptions intended to align with the Town's vision for certain types of development within the DTD. Table 3 represents the mix of use assumptions for the DTD buildout.





TABLE 3. DTD BUILDOUT MIX OF USE ASSUMPTIONS

Mix of Uses	DTG	DTC	DTW
% Residential	60%	60%	70%
% Commercial	40%	40%	30%
% restaurant	5.0%	5.0%	10.0%
% office	8.0%	5.0%	3.0%
% retail	5.0%	10.0%	5.0%
% hotel	10.0%	10.0%	5.0%
% institutional	10.0%	5.0%	2.0%
% consumer services	2.0%	5.0%	5.0%



BUILDOUT RESULTS



DOWNTOWN BOURNE

Table 4 summarizes the findings of the theoretical buildout analysis for Downtown Bourne. For the complete buildout analysis, see *Appendix D: Buildout Analysis*.

TABLE 4. DOWNTOWN BOURNE THEORETICAL BUILDOUT PROJECTIONS

	Downtown	Downtown District (DTD) w/	
	District (DTD)	Wastewater Flows	
Residential (units)	1,803 Units	396,669 GPD	
Commercial (SF)	3,244,928 SF	943,408 GPD	
	Total	1.34 million GPD	

Given the amount of development potential within the district, and associated wastewater flows, the Commission RESET Team worked with the BWAC to identify a practical buildout approach for the Town to move forward with in their wastewater infrastructure planning efforts. Table 5 represents a 25% cut of the theoretical buildout potential for Downtown Bourne. This is a typical planning approach that has been used in other recent Comprehensive Wastewater Management Planning (CWMP) efforts across the Cape. The BWAC recommends this practical buildout scenario as the Town moves forward with water supply and wastewater planning efforts.

TABLE 5. DOWNTOWN BOURNE PRACTICAL BUILDOUT PROJECTIONS

	Downtown District (DTD)	Downtown District (DTD) w/ Wastewater Flows
Residential (units)	541 Units	99,167 GPD
Commercial (SF)	811,232 SF	235,852 GPD
	Total	335,000 GPD



Buildout projections for these two areas were conducted using existing peak wastewater flows for Hideaway Village and a preliminary development scenario for the Bourne Development Campus (BDC). Buildout projects are represented in Table 6.





TABLE 6. HIDEAWAY VILLAGE AND BDC BUILDOUT PROJECTIONS

Bourne Development Campus	SF	GPD
Commercial	125,000	
Storage	12,500	
Office	50,000	
Industrial	62,500	
Total	250,000	47,500
Hideaway Village	269 units	20,000
Total GPD		67,500



Task 6 - Wastewater Facility Siting



A key component to wastewater planning is the identification of one or more feasible sites for a wastewater treatment facility and an associated subsurface disposal system, north of the Cape Cod Canal. The Commission's RESET staff conducted an evaluation of potential wastewater facility and discharge sites.

The overall approach that was used for determining appropriate sites was

- 1) develop initial criteria to screen potential parcels,
- 2) identify potential parcels,
- 3) develop decision criteria on which to score and rank parcels,
- 4) develop weightings for each decision criteria,
- 5) rate each decision criteria for each parcel, and
- 6) calculate an overall score for each parcel and rank.

The highest rated parcels were selected for further analysis. Sites that were deemed appropriate for disposal were evaluated separately from parcels that were appropriate for a treatment plant.

The initial criteria developed for identifying potential wastewater treatment and subsurface disposal sites were:

- Appropriately size to meet disposal and treatment flow requirements
- Adequate soil permeability
- Groundwater depth greater than 6 feet
- Located outside of Zone IIs (drinking water)
- Located outside of Sensitive Habitat, Wetlands, or Water Bodies
- Located outside of the 100 year Flood Plain
- Considered undeveloped or open space

Using these initial criteria and existing Geographic Information System (GIS) information, the areas of Bourne north of the Cape Cod Canal that were not suitable for wastewater treatment or subsurface disposal were identified as shown in Figure 13

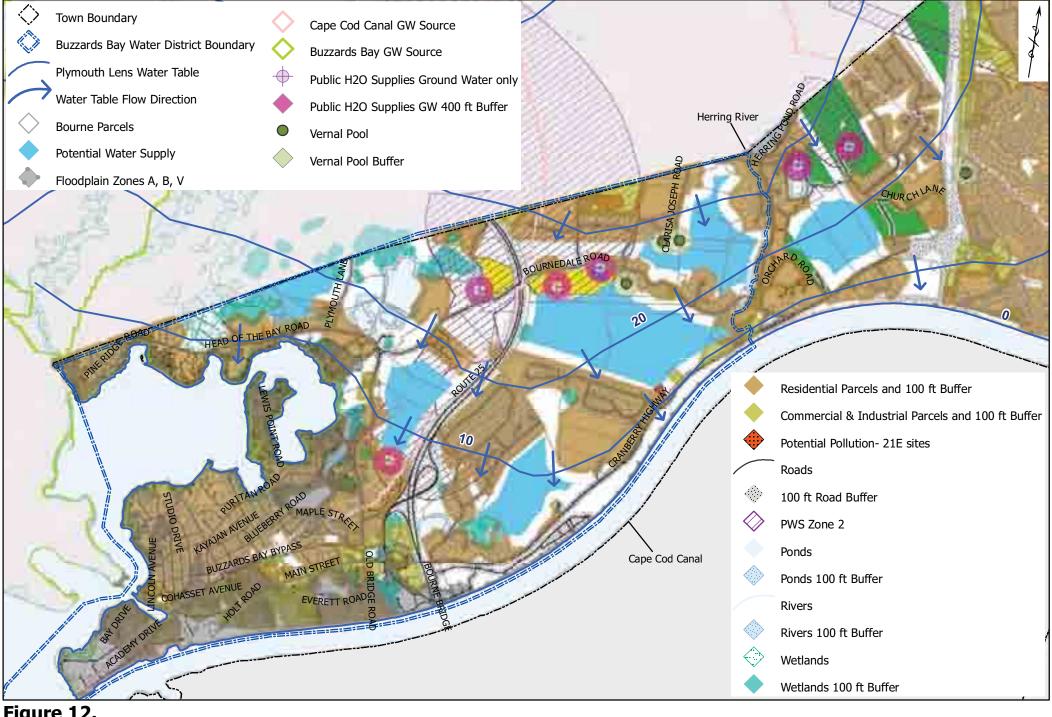


Figure 12.
Areas Unsuitable for Wastewater Treatment or Disposal Systems







SUBSURFACE DISPOSAL SITES

Based on this analysis, 41 potential subsurface disposal sites (parcels) were identified, as shown in Figure 13. In addition, decision criteria and associated ratings were identified, based on discussions with BWAC, as shown in Table 7. The BWAC identified the appropriate weighting for each decision criteria in order of importance (1 thru 10) — the lower the weight or rating, the higher the importance.

TABLE 7. SUBSURFACE WASTEWATER DISPOSAL SITE DECISION CRITERIA, RATIONG, AND WEIGHTS

Decision Criteria	Rating	Weight
Down Gradient of Wells, Water		
Bodies, Vernal Pools/Wetlands, or	yes (1) - no (5)	1
Environmentally Sensitive Habitat		
Proximity to Downtown Buzzards Bay	close (1) - far (5)	2
Cost of Acquisition/Value of Property	low (1), med (3), high (5)	3
Proximity to Historical and	f/1)/[]	4
Archeological Areas (Not located on)	far (1) - near (5)	4
Area to Expand/Reserve Area/Future	# acres > 3, many (1) -	5
Flexibility/Phasing	few (10)	
Accessibility for Maintenance and		(
Operations	good (1) - poor (10)	6
Compatibility with Adjacent Land Uses	good (1) - poor (10)	7
Number of Abutters	few (1) - many (5)	8
Competing Uses for Land	none (1) - many (1)	9
Wooded Area	minimal (1) - very (5)	10

For each potential parcel, a rating was then assigned for each decision criteria by BWAC, and an overall score was calculated for each parcel, as shown in *Appendix E: Subsurface Disposal Site Selection Matrix*

The four top ranked parcels were selected for further analysis, as shown in Table 8 and Figure 14. Two sites are located within the downtown area, one site is located out of downtown, along the Scenic Highway, and one

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site is located near Hideaway Village. All sites are owned by the Town, except for the Kramer property. They encompass a range of sizes as shown in Table 8.

TABLE 8. SUBSURFACE WASTEWATER DISPOSAL SITES SELECTED FOR ANALYSIS

Site Number	Ownership	Size (acres)	Location
10	Private	4	Kramer Property (Hideaway Village)
16	Town	124	Scenic Highway (Out of Town)
19	Town	8	Queen Sewell Park (Downtown)
29	Town	4	Community Center (Downtown)

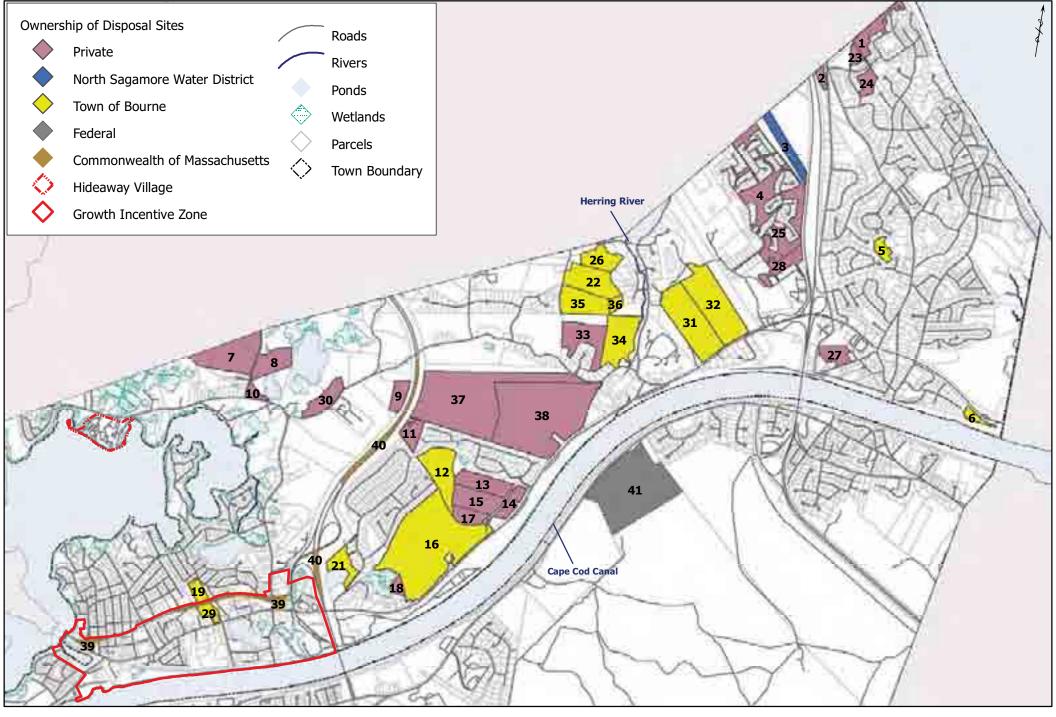


Figure 13.
Potential Wastewater Subsurface Disposal Sites





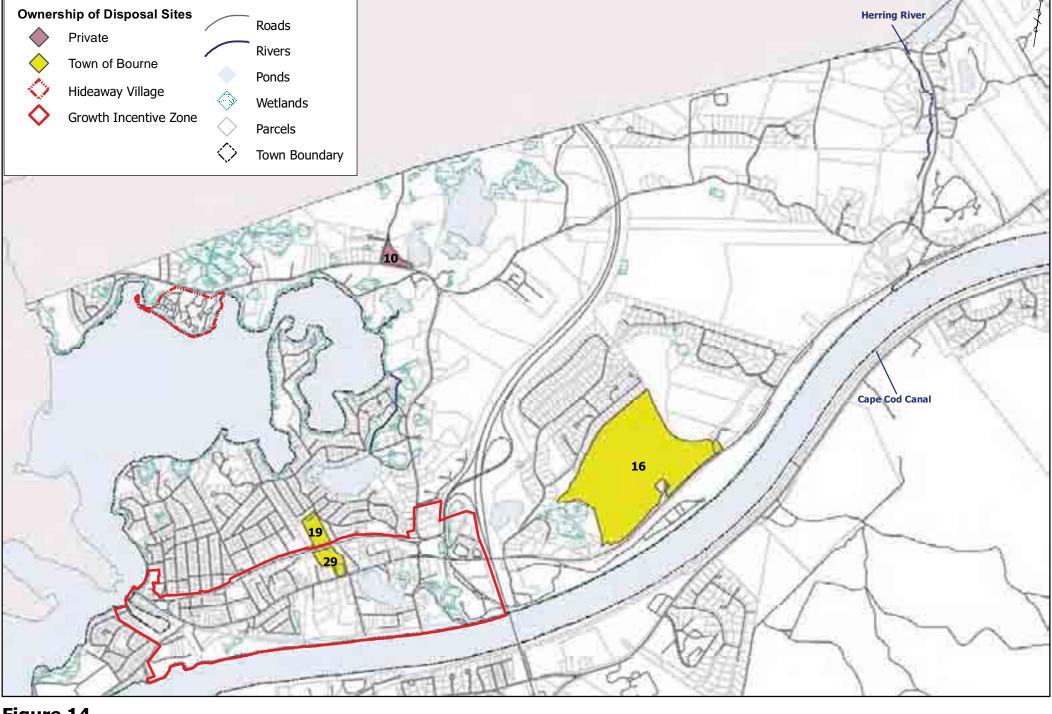


Figure 14. Preferred Subsurface Wastewater Disposal Sites









TREATMENT SITES

Based on the analysis summarized in Figure 13, 45 potential wastewater sites (parcels) were identified, as shown in Figure 15. Additional downtown sites were identified as potential treatment sites due to the smaller land requirements for a treatment plant versus a subsurface disposal field. In addition, decision criteria and associated ratings were identified, based on discussions with BWAC, as shown in Table 9. The BWAC identified the appropriate weighting for each decision criteria in order of importance (1 thru 9) – the lower the weight or rating, the higher the importance.

TABLE 9. WASTEWATER TREATMENT SITE DECISION CRITERIA, RATINGS, AND WEIGHTS

Decision Criteria	Rating	Weight
Compatibility with Adjacent Land Uses	good (1) - poor (10)	1
Cost of Acquisition/Value of Property	low (1), med (3), high (5)	2
Number of Abutters	few (1) - many (5)	3
Accessibility for Maintenance and Operations	good (1) - poor (10)	4
Area to Expand/Reserve Area/Future Flexibility/Phasing	# acres > 1, many (1) - few (10)	5
Competing Uses for Land	none (1) - many (10)	6
Proximity to Downtown Buzzards Bay	near (1) - far (5)	7
Proximity to Historical and Archeological Areas (Not located on)	near (1) - far (5)	8
Wooded Area	minimal (1) - very (5)	9

For each potential parcel, a rating was assigned for each decision criteria by BWAC, and an overall score was calculated for each parcel, as shown in *Appendix F: Treatment Site Selection Matrix*. The five top ranked parcels were selected for use in further evaluations, as shown in Table 10 and Figure 16. Two sites are located within the downtown area, two sites are located out of downtown, and one site is located near Hideaway Village. The sites are owned by the Town, the State, and private owners and encompass a range of sizes.





TABLE 10. WASTEWATER TREATMENT SITES SELECTED FOR ANALYSIS

Site Number	Ownership	Size (acres)	Location
10	Private	4	Kramer Property (Hideaway Village)
16	Town	124	Scenic Highway (Out of Town)
21	Town	12	Deseret Drive (Out of Town)
39 E	State	2.6	Belmont Circle (Downtown)
С	Private	2 ¹	Sandford Property (Downtown)

Assume the Town works with the owner to secure 2 acres of property in a configuration that would work for siting a treatment plant.

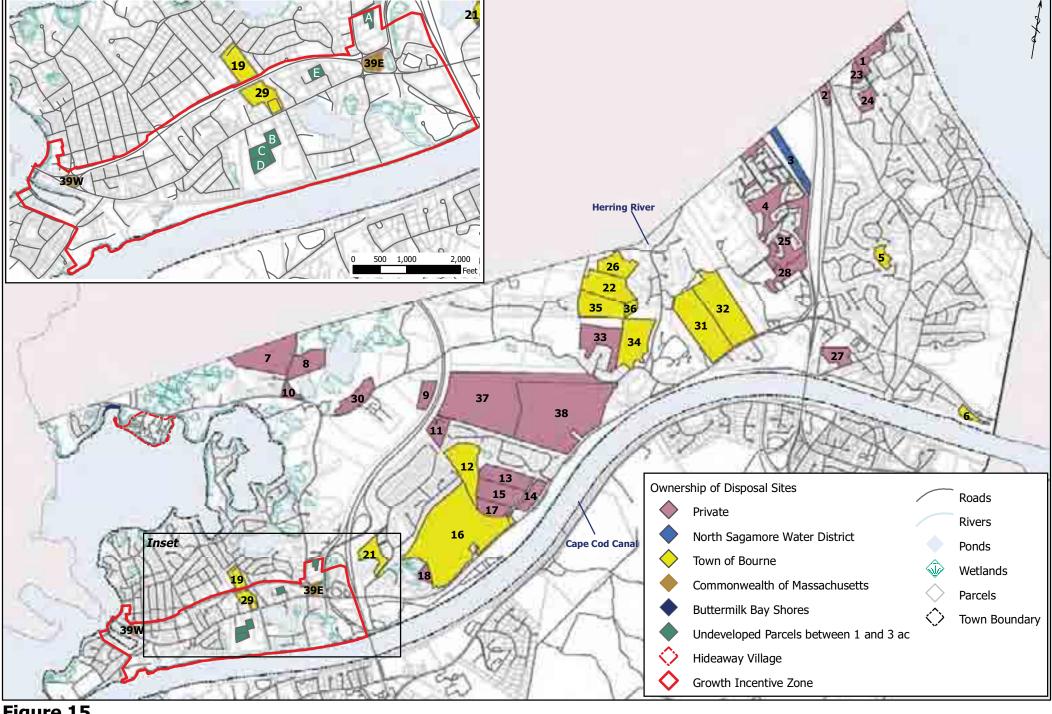


Figure 15. Potential Wastewater Treatment Sites



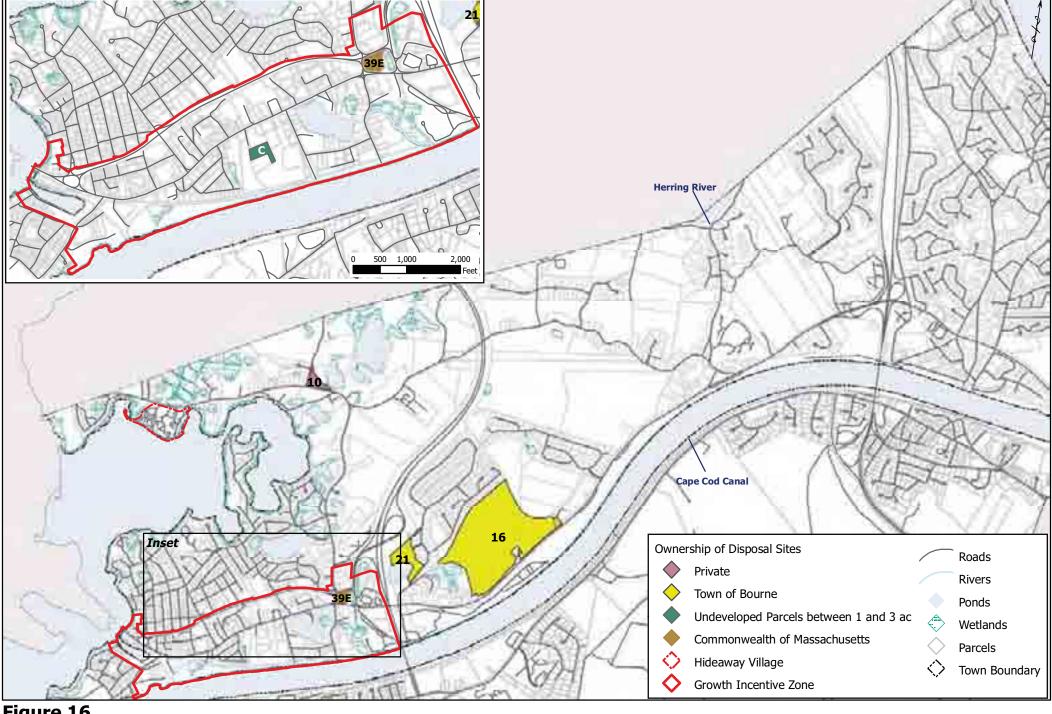


Figure 16. Wastewater Treatment Sites Selected for Analysis







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Task 7 - Evaluation of Wastewater Infrastructure Options

INCREMENTAL FLOWS

The planning period buildout wastewater flow for the downtown village of Downtown Bourne and Hideaway Village is 535,000 gallons per day (GPD), including the 200,000 GPD that is allocated at the Wareham WWTP. Downtown growth and the need for wastewater treatment capacity will happen incrementally. Therefore the Committee chose to evaluate wastewater services for a range of additional incremental flows from 25,000 GPD to 335,000 GPD, as shown in Table 11 to provide the flexibility to accommodate initial to full range.

TABLE 11. INCREMENTAL/MODULAR WASTEWATER FLOWS CONSIDERED (GPD)

25,000
50,000
100,000
335,000

WASTEWATER TREATMENT TECHNOLOGIES

As part of the analysis, various wastewater treatment technologies commonly used in Massachusetts for systems up to 500,000 GPD were considered. These technologies were evaluated for a range of criteria, resulting in the recommendation to consider three technologies in development of full wastewater management options. The three treatment technologies being carried forward are membrane bio reactors (MBRs), sequencing batch reactors (SBRs), and package plants as shown in Table 12.







TABLE 12. WASTEWATER TECHNOLOGIES CONSIDERED

Membrane Bio Reactor (MBR)
Sequencing Batch Reactor (SBR)
Package Plant

The ability to remove nutrients, specifically nitrogen, is an important consideration in a treatment technology. Appendix G: Treatment *Technology Information* provides more information on each technology, as well as a summary of the screening process that emphasizes odor control, treatment reliability, and nutrient removal through the weighting of criteria and a summary of the screening process that emphasizes costs through the weighting of criteria.

There are currently more than ten MBRs installed in Massachusetts. MBRs can be scaled to treat a wide range of flows, from 10,000 GPD to over 350,000 GPD. MBRs have a small footprint, a high degree of flexibility to be modified for biological nitrogen removal (BNR) to meet potential future regulations, and low potential for odor issues. They are highly reliable at meeting permit requirements, such as biological oxygen demand (BOD), total suspended solids (TSS), and total nitrogen (TN). MBRs are very capable of handling septage but are complex to operate. Capital and operations and maintenance (O&M) costs are also expensive.

Massachusetts has over twenty SBRs currently installed and operating. They can be scaled to meet a wide range of flows (10,000 to greater than 350,000 GPD). SBRs have a medium sized footprint and a good degree of ability to be able to be modified for BNR. However, they have little ability to handle septage and a high potential for odor issues. SBRs are moderately complicated to operate. They are reliable at meeting permit limits (BOD, TSS, and TN). SBRs are moderately expensive for both capital and O&M costs. The Massachusetts Maritime Academy (MMA) operates a SBR wastewater treatment plant with a capacity of 77,000 GPD.

Package plants have a small footprint and are generally not optimal for onsite flows over 50,000 GPD. Package plants can be used under the right conditions for flows less than 100,000 GPD. Package plants are relatively inexpensive for both capital and O&M costs and have good flexibility to be able to be modified for BNR. They are generally reliable at meeting permit limits (BOD, TSS). Package plants have little ability to handle septage, can





have a high potential for odor if not operated properly and can be complex to operate in certain applications.

All of the above technologies must be designed to adequately handle the seasonal variation of flow that will be experienced in Bourne.

WASTEWATER TREATMENT AND SUBSURFACE DISPOSAL SITE AREA REQUIREMENTS

Site area requirements (in acres) were developed for each treatment technology and incremental flow rate. The Committee selected groundwater subsurface disposal (subsurface disposal) as the most appropriate disposal method. Although rapid infiltration beds are less costly and take-up less space, the subsurface disposal method is covered and allows the top to be planted with soil and used for a variety of activities, including recreational. Site area requirements for each flow rate were developed for the subsurface wastewater disposal method. Table 13 shows the amount of acreage required for a parcel for each flow rate for each treatment technology and the selected disposal method.

TABLE 13. WASTEWATER TREATMENT AND SUBSURFACE DISPOSAL SITE AREA REQUIREMENTS

Flow (GPD)	Subsurface Disposal (acres) ¹	MBR (acres)	SBR (acres)	Package Plant (acres)
25,000	0.8	0.5	0.5	0.5
50,000	1.6	0.5	1	0.5
100,000	3	1	1.5	NA
335,000	10	2	3	NA

NA = Not applicable.

¹ = Based on 2.5 GPD/square foot trench surface area(2 ft wide x 2 ft deep x 4 ft above groundwater levels) (including bottom and side of the trench) per Title 5 and DEP 2004 guideline for soil with a minimum percolation rate of 5 min/in. Disposal is subsurface with groundwater separation of 4 ft from the bottom of the trench. 3 ft distance between trenches. Disposal is subsurface. 20% was added for buffer area and 100% redundancy for reserve space.

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Because package plants are generally not optimal for flows above 50,000 GPD, site area requirements are shown as Not Applicable (NA). Site area requirements for the selected wastewater treatment technologies were developed using previous experience laying out treatment plants on various sites and best professional judgment. The site area requirement for wastewater disposal was calculated using MADEP requirements and 2.5 GPD/linear foot as the loading rate, 20% for buffer area and 100% redundancy for reserve space. For more information, see *Appendix H: Subsurface Disposal Site Requirements*.

Based on treatment and disposal site requirements, Table 14 presents the appropriateness of the sites selected for analysis for different incremental flow levels. Using the selected wastewater treatment and disposal sites and their sizes (Table 8 and Table 10), selected treatment technologies (Table 12), the range of flows analyzed (Table 11), and the site area (acreage) requirements for the treatment options and the disposal method (Table 13), the selected sites that could accommodate each flow rate for wastewater treatment and subsurface disposal were identified. The flow that could be accommodated at each site, based on the site area requirements for treatment and disposal, are shown in Table 14. Sites that cannot accommodate a flow rate are shown as NA. Technologies that are not appropriate for flow rates are also shown as NA, as discussed previously discussed.



TABLE 14. APPROPRIATE WASTEWATER TREATMENT AND SUBSURFACE DISPOSAL SITES AND TECHNOLOGIES BY FLOW



		Flows					
		25,000	50,000	100,000	335,000		
		GPD	GPD	GPD	GPD		
	10	Х	Χ	Χ	Χ		
Treatment	16	Χ	Χ	Χ	Χ		
Sites*	39E	Х	Χ	Χ	Χ		
	С	Х	Х	Χ	Χ		
Disposal Sites							
	10	Χ	Χ	NA	NA		
	16	Х	Х	Χ	Χ		
Subsurface	19	Х	Х	Χ	NA		
Disposal Sites	29	Х	Х	Χ	NA		
	19 + 29 (combined)	Х	Х	Х	Х		
Treatment	Package Plant	Х	X	NA	NA		
Technologies	MBR	Х	Х	Х	Х		
	SBR	Х	Χ	Χ	Х		

X = Applicable

NA = Not applicable

Construction of infrastructure for water transmission from the collection to the treatment site to the subsurface disposal sites constitutes a significant capital cost. Capital transmission costs were tabulated based on the conceptual design presented in Figure 17. The capital transmission costs are presented in greater details for the preferred options presented in the following sections.

^{*}Site 21 (Deseret Drive) was eliminated from further consideration due to the site's proximately to Nightingale Pond and a residential development

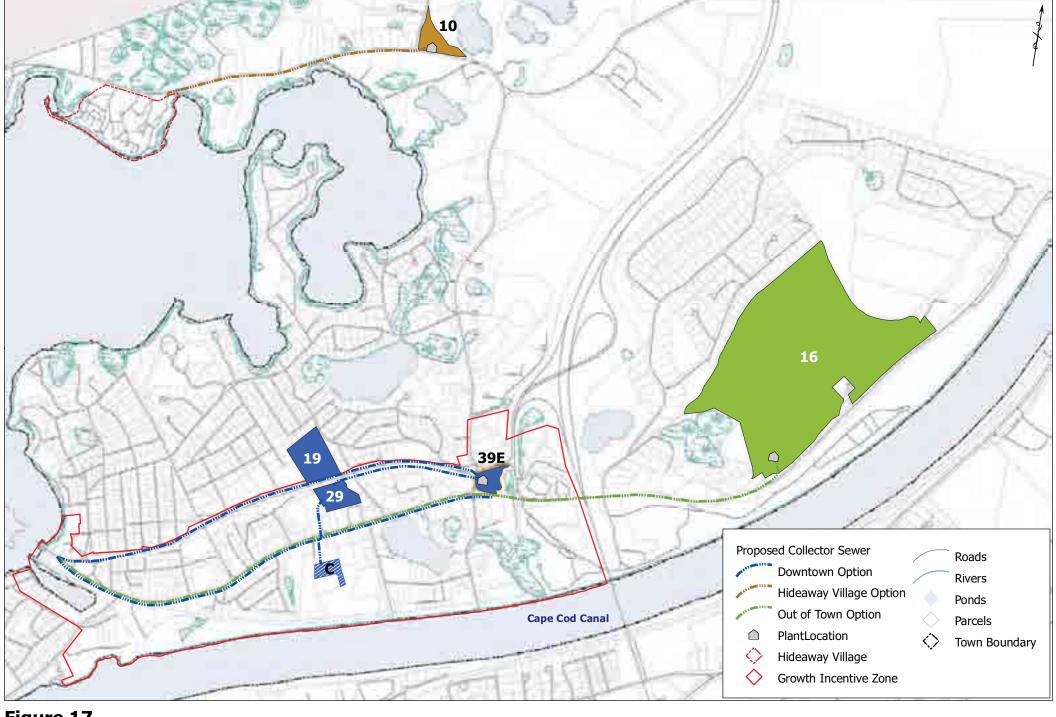
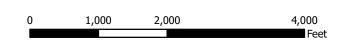


Figure 17. Wastewater Transmission Options









PREFERRED ALTERNATIVES FOR DOWNTOWN WASTEWATER FLOWS

Considering the treatment and subsurface disposal site selected for analysis, as shown in Table 8 and Table 10, and their appropriateness for different types of treatment, as presented BWAC developed a menu of preferred options to handle Downtown flows. These preferred sites and the preferred treatment technologies for a downtown and an out of town option are presented in Table 15.

TABLE 15. PREFERRED WASTEWATER TREATMENT AND SUBSURFACE DISPOSAL SITES AND TECHNOLOGIES FOR DOWNTOWN FLOWS

Facility Location	Treatment Technology	Treatment Site ID #	Disposal Site ID #	
Downtown	MBR	39E* or Site C**	19 (19+29 for 350,000 GPD)	
Out of Downtown	MBR	16	16	

^{*}state owned, potential conflict with possible Belmont Circle reconfiguration

Feasible Downtown options for treatment and disposal include construction of an MBR treatment facility on Site 39 E, Belmont Circle (Figure 18) or Site C, the Sandford Property (Figure 19), with subsurface disposal on Site 29, the Community Center, or Site 19, Queen Sewell Park (Figure 20). Both sites can accommodate up to 100,000 GPD of capacity, but if combined can accommodate the 335,000 GPD. It is envisioned that the planned recreation fields would be built over the subsurface disposal field on Site 19, as shown in Figure 21. It should be noted that a downtown wastewater treatment site would not be designed to receive septage due to traffic and public impacts.

^{**}privately owned, Town would need to work with owner to secure ownership or rights to part of the site

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Should development plans originate from private entities that own land suitable for required wastewater treatment and/or disposal facilities, such sites can be considered in lieu of those presented herein.

The preferred out of downtown siting option for all flows is to co-locate both wastewater treatment and subsurface disposal on Site 16 (Scenic Highway), as shown in Figure 22 and Figure 23, using an MBR technology. This would require pumping to the Scenic Highway site. The Site 16 wastewater treatment plant would receive flow from the elementary school, the Department of Public Works, and potentially, the Bourne Development Campus to eliminate operation of the on-site systems serving those facilities.



FIGURE 18. PREFERRED DOWNTOWN WASTEWATER TREATMENT OPTION (BELMONT CIRCLE) – 335,000 GPD MBR TREATMENT PLANT







FIGURE 19. PREFERRED DOWNTOWN WASTEWATER TREATMENT OPTION (SITE "C" - SANDFORD PROPERTY) - 335,000 GPD MBR TREATMENT PLANT







WASTEWATER DISPOSAL







FIGURE 21. PREFERRED DOWNTOWN WASTEWATER DISPOSAL OPTION - RECREATION FIELDS







FIGURE 22. PREFERRED OUT OF DOWNTOWN OPTION – 335,000 GPD MBR TREATMENT PLANT AND SUBSURFACE WASTEWATER DISPOSAL







FIGURE 23. CLOSEUP OF PREFERRED OUT OF DOWNTOWN OPTION – 335,000 GPD MBR TREATMENT PLANT AND SUBSURFACE WASTEWATER DISPOSAL









COSTS FOR DOWNTOWN WASTEWATER FLOW ALTERNATIVES

Capital costs, operations and maintenance costs and net present values for alternatives to handle Downtown Wastewater flows are shown in Table 16. The detailed costs are found in *Appendix I: Detailed Cost Analysis*.

All costs were calculated using information from *Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod Barnstable County Wastewater Cost Task Force (April 2010)*. Capital costs are presented for wastewater treatment, subsurface disposal and wastewater conveyance (piping and pumping) and include engineering and permitting costs at 10%, construction management at 8%, and contingency at 25%.

The total capital cost of accommodating wastewater treatment and discharge varies slightly by site with a range of \$6.3- \$7.1 million for 50,000 GPD, \$8.5- \$9.3 million for 100,000 GPD, and \$16.7 - \$17.8 million for the full 335.000 GPD.

If the town wishes to build the wastewater infrastructure incrementally, the most cost effective way would be to construct the subsurface disposal field, conveyance system, and permanent treatment structures sized for 335,000 GPD. Most treatment systems within the treatment facility could be constructed to handle only the flow level required with components added later to scale up the facility to 350,000 GPD. This way, the only required construction later on would be to expand the treatment facility within the facility's footprint and make any connections to new users. The total initial capital cost for such an expandable system that could initially handle 50,000 GPD and be later expanded to 335,000 GPD would be approximately \$10 million. The additional incremental costs of expanding the treatment facility would then be phased with future development.



TABLE 16. PREFERRED WASTEWATER TREATMENT AND SUBSURFACE DISPOSAL SITES COSTS DOWNTOWN FLOWS

Location of Treatment and Disposal		Downtown – Belmont Circle		Downtown – Sandford Property		Out of Downtown – Scenic Highway		COMMISSION
Tre	atment/ Disposal Site	Treatment ¹	Disposal ²	Treatment ¹	Disposal ²	Treatment	Disposal	CH2IVIHILL
25,000 GPD		NA		NA		NA		
	Site #	39E	19	С	19	16	16	
Q	Capital (\$)	\$3,735,000	\$354,000	\$3,735,000	\$354,000	\$3,735,000	\$354,000	
50,000 GPD	Capital- Transmission(\$)	\$2,402,000		\$2,169,000		\$3,011,000		
50,0	Total Capital (\$) ³	\$6,491,000		\$6,258,000		\$7,100,000		
	Annual O&M (\$)	\$444,000		\$444,000		\$444,000		
	Site #	39E	19	С	19	16	16	1
PD	Capital (\$)	\$5,722,000	\$531,000	\$5,722,000	\$531,000	\$5,722,000	\$531,000	
100,000 GPD	Capital- Transmission(\$)	\$2,446,000		\$2,213,000		\$3,055,000		
00	Total Capital (\$) ³	l Capital (\$) ³ \$8,699,000		\$8,466,000		\$9,308,000		
	Annual O&M (\$)	\$673,	.000	\$673,000		\$673,000		
	Site #	39E	19+29	С	19+29	16	16	
5,000 GPD	Capital (\$)	\$12,779,000	\$1,186,000	\$12,779,000	\$1,186,000	\$12,779,000	\$1,186,000	
	Capital- Transmission(\$)	\$3,039,000		\$2,748,000		\$3,800,000		
335	Total Capital (\$)	\$17,004,000		\$16,713,000		\$17,765,000		1
(")	Annual O&M (\$)	\$1,173,000		\$1,173,000		\$1,173,000		

Costs in March 2012 dollars.

Costs from Barnstable County Cost Report, April 2010

Preferred treatment technology for these downtown options is a Membrane Bio Reactor

Package plants are an option for small developer sites located in the Downtown Bourne area.

NA = Not applicable

Capital = capital cost (includes engineering and permitting of 10%, construction management of 8% and overall contingency of 25%)

O&M = operations and maintenance cost

Capital-Transmission = wastewater conveyance and pumping capital cost (includes engineering and permitting of 10%, construction management of 8% and overall contingency of 25%)

¹ = A downtown treatment site cannot take septage.

² = A downtown disposal site requires the redesign and construction of the existing park. Estimated construction cost is \$62,000.

³ = Capital costs would be higher if the facility was designed to be expandable to 335,000 GPD





PREFERRED ALTERNATIVE FOR HIDEAWAY VILLAGE FLOWS

The preferred alternative for handling wastewater flows from Hideaway Village is to continue pumping to the Wareham WWTP. A dedicated treatment and subsurface disposal option, as detailed below, was considered, but deemed financially infeasible given the historical flows.

The option initially considered involved utilizing the privately owned Kramer Site (Site 10) to accommodate treatment and subsurface disposal for up to 50,000 GPD, as shown in Figure 24. For this flow level a package plant or an MBR could be used. The costs associated with this option are presented in Table 17 and detailed in *Appendix I: Detailed Cost Analysis*. The total capital cost for these options is \$4.2 million for 25,000 GPD and \$5.7 million for 50,000 GPD. Given that actual flows have been in the 10,000 GPD to 13,000 GPD range over the last ten years, such an investment is not financially feasible to handle such low flows.

Given the historic flow patterns from Hideaway Village with the highest year (2004) averaging a daily flow of 13,089 GPD (see *Appendix C: Summary of Downtown Bourne Wastewater Pumping Reports*), the BWAC discussed reevaluating the IMA allocation which appears to be in excess of the likely need of the area. The committee recommends a review of documents and a study of Hideaway Village's potential need for increased wastewater flow.



FIGURE 24. OPTION OF HIDEAWAY VILLAGE WASTEWATER TREATMENT- 50,000 GPD PACKAGE PLANT AND SUBSURFACE DISPOSAL (NOT RECOMMENDED - FINANCIALLY INFEASIBLE)









TABLE 17. WASTEWATER TREATMENT AND SUBSURFACE DISPOSAL SITES AND TECHNOLOGY OPTIONS AND COSTS HIDEAWAY VILLAGE FLOWS

Location of Treatment and Disposal		Hideaway Village – Kramer Property				
Treatment Technology		Package	Plant	MBR		
Treatment/ Disposal Site		Treatment	Disposal	Treatment	Disposal	
25,000 GPD	Site #	10	10	10	10	
	Capital (\$)	\$2,384,000	\$621,000	\$2,384,000	\$621,000	
	Capital- Transmission(\$)	\$1,210	,000	\$1,210,000		
	Total Capital (\$)	\$4,215	,000	\$4,215,000		
	Annual O&M (\$)	\$323,	000	\$283,000		
50,000 GPD	Site #	10	10	10	10	
	Capital (\$)	\$3,735,000	\$754,000	\$3,735,000	\$754,000	
	Capital- Transmission(\$)	\$1,247,000		\$1,247,000		
	Total Capital (\$)	\$5,736,000		\$5,736,000		
	Annual O&M (\$)	\$444,000		\$444,000		

Costs in March 2012 dollars.

Costs from Barnstable County Cost Report, April 2010

Package plants are an option for small developer sites located in the Downtown Bourne area.

NA = Not applicable

Capital = capital cost (includes engineering, legal, administrative, and construction management of 18% and overall contingency of 25%)

O&M = operations and maintenance cost

Capital-Transmission = wastewater conveyance and pumping cost (includes engineering and permitting of 10%, construction management of 8% and overall contingency of 25%)

CAPE COD COMMISSION



REGIONAL OPTIONS

Regional wastewater treatment and/or disposal options can potentially reduce the overall costs to the parties involved. A number of regional options were explored as presented in Table 18. None of the regional options explored are feasible options within the Town's desired downtown growth planning horizon.

TABLE 18. REGIONAL WASTEWATER OPTIONS

Convey flow to	Infeasible. MMA is constrained on existing capacity and
MMA ¹ for	area to expand.
treatment and	Per discussion with Paul O'Keefe (MMA), Mike Lanahan
disposal	(MMA), and Elaine Lewis-Ryan (MMA) and Mike Domenica
	(CH2M HILL) and Priscilla Bloomfield (CH2M HILL) on
	February 29, 2012.
Convey flow to	No additional capacity is available at the existing
Wareham for	treatment plant. However, Wareham is considering
treatment and	building a new plant, which could be designed to
disposal	accommodate Bourne flows but is strictly in conceptual
	stages and outside of Bourne's timeframe.
	Per discussion with Guy Campinha (Wareham) and Mike
	Domenica (CH2M HILL) and Priscilla Bloomfield (CH2M
	HILL) on March 2, 2012.
Convey flow to	Permitted capacity is 300,000 GPD. MMR is currently
MMR ² for	using about 160,000 GPD. If MMR were to take outside
treatment	flows, it would be done regionally with Sandwich,
and/or disposal	Mashpee, Falmouth, and Bourne. Could possibly take a
	portion of Bourne's flow (50,000 GPD) if wastewater could
	be piped across the Cape Cod Canal. Cost to install a pipe
	under the Cape Cod Canal is \$6,636,000.
	Per discussion with Carter Hunt (Mass Development),
	Steve Tupper (CCC³) and Mike Domenica (CH2M HILL) and
	Priscilla Bloomfield (CH2M HILL) on March 6, 2012.
	chusetts Maritime Academy
	chusetts Military Reservation
³ CCC = Cape Co	d Commission

For a complete table of all possible treatment and disposal options for all flow rates, see *Appendix J: All Treatment and Disposal Options*.



Task 8 - Evaluation of Financing Options



The financial plan has four primary components:

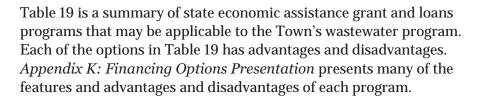
- A plan for financing the implementation of needed projects, including the planning design and construction of required facilities
- 2. A plan for repayment of debt incurred during the project implementation
- 3. A plan for funding on-going operations, maintenance and administrative costs associated with the wastewater system.
- 4. A "model" or approach to managing near-term and long-term financial commitments such that commercial and residential user rates remain affordable and support other non-wastewater Town commitments and responsibilities.

PROJECT IMPLEMENTATION FINANCING PLAN

The actual means of financing the planning, design and construction of new facilities will be dependent on the nature, timing and terms of proposals by commercial developers interested in projects in or near Downtown Bourne. Because the primary goal of the Town is economic development and not, at this time, service to existing residential communities, residential growth or water quality concerns, public — private partnerships for financing the necessary wastewater infrastructure will be the most effective means of leveraging the Town's financial capabilities.

The arrangements for public — private partnerships are generally customized based on specific objectives, schedules and resources of the developer. Recently, there has been increased flexibility in the use of proceeds from state loan programs to serve as the Town's share of the financing plan. In addition, the Massachusetts Executive Office of Housing and Economic Development (EOHED) through its MassWorks

programs and other initiatives have targeted its financing assistance packages toward programs that include private partners. The best financing plan for the Town will be based on a combination of the above factors and will likely be composed of a mix of multiple, integrated financing mechanisms.



It is noted that the conditions, requirements and offerings of the state programs change relatively frequently due to state budget decisions and other factors. For all of the below options, meetings with senior staff managing each program will be the first step to defining program requirements, feasibility and procedures for qualifying and securing the appropriate assistance.

It is recommended that the Town schedule meetings with senior representatives in each of the loan/grant programs shown in Table 19, beginning with MA DEP and the MA Water Pollution Abatement Trust (WPAT). The EOHED is a "clearinghouse" for a number of the other programs and should also be consulted regarding the details, current funding levels and timeframes for their programs.





TABLE 19. WASTEWATER SYSTEM IMPROVEMENT FINANCING OPTIONS

Agency	Program	Loan/Grant Amount (potential)	Comments
EOHED - Department of Housing & Community Development	CD Action Grants	\$1 million per project (Grant)	Private for-profit partner required; \$2,500,000 million private investment and \$500,000 public investment required. Competitive
EOHED - Department of Housing & Community Development	Economic Development Fund	\$1 million (maximum) per business (Loan)	Public financing option in conjunction with DIF; Private investment required under DIF program. Competitive
EOHED - Massachusetts Office of Business Development (MOBD)	MA Opportunity Relocation & Expansion (Jobs capital program)	\$100,000 - \$10,000,000 (Grant)	Financing for infrastructure improvements for business expansion. Private for- profit partner required; Jobs generation criteria for qualification
EOHED - Massachusetts Office of Business Development (MOBD)	Tax Increment Financing (TIF)	To Be Determined	Financing for commercial redevelopment; Property tax exemption program; Approved by Selectmen vote; TIF Zone designation required with EACC approval; Private for-profit partner beneficial
Massachusetts Office of Business Development MOBD)	District Improvement Financing (DIF)	TBD. Financing terms are negotiable and flexible.	Designated district (up to 25% of town land) and development program required. Private partner beneficial. Public hearings and approvals required. Application must be approved by Economic Assistance Coordination Council.
MassDevelopment Financing Assistance	To Be determined	To Be determined	To Be determined
US Department of Agriculture	Rural Development Grant – Community Facility Grants	75% or project cost (maximum) (Grant)	Population must be below 10,000. Previous Bourne application not renewed. Priorities to communities with less than 5,000. District formation may meet population limits. Highly leveraged with other funding. Used by Chatham recently.
MA State Revolving Fund	Massachusetts Water Pollution Abatement Trust - 0% Loan	100% of project eligible planning and construction costs. Can be used to purchase privately built facility. (Loan)	Zero-net-growth by-law, approved CWMP and nutrient reduction goals required.
MA State Revolving Fund	Massachusetts Water Pollution Abatement Trust - 2% Loan	100% of project eligible costs for planning and construction. Can be used to purchase privately built facility. (Loan)	May be used without CWMP for downtown Bourne.

CAPE COD COMMISSION

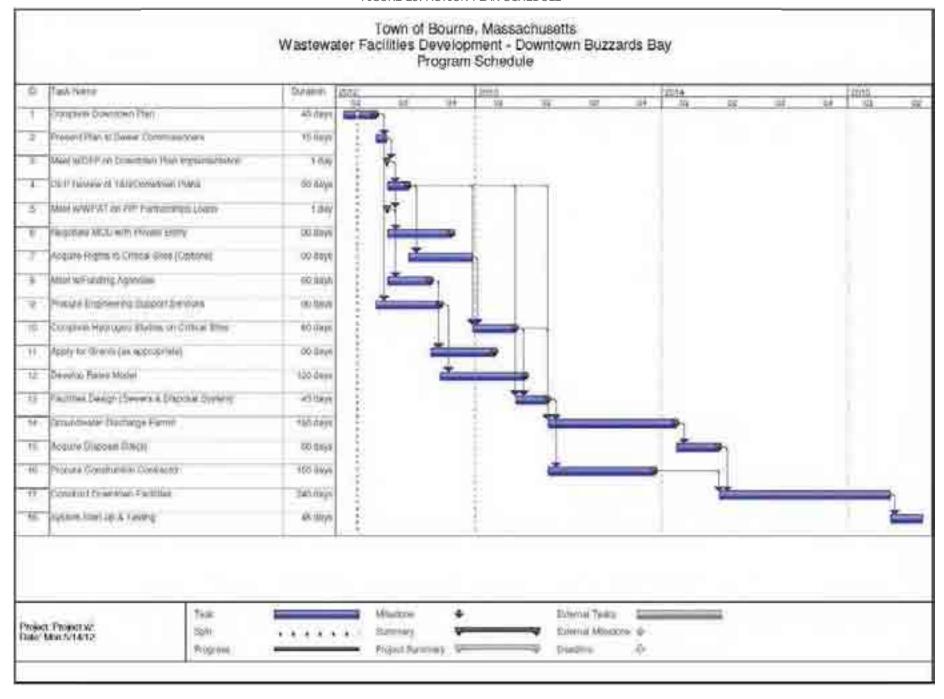
Task 9: Action Plan



The recommended, phased Wastewater Management Plan to provide critical wastewater services to meet needs of a range of future commercial development in downtown Bourne is summarized as follows:

- 1. Implement a phased approach
- 2. Utilize remaining capacity at Wareham WWTF
- 3. Request DEP Review and Comment on Bourne WWAC Downtown Plan with the ultimate goal of approval to implement
- 4. Continue discussions with private parties on commercial development plans and private financing options (e.g. Optimus project)
- 5. Develop and execute Memoranda of Understanding (MOUs) for private partnership
- 6. Select treatment and disposal sites that fit private development plans
- 7. Continue to maintain Scenic Highway site pending Downtown plan
- 8. Procure consulting support to undertake hydraulic studies, define condition and capacity of existing system, and on-going wastewater planning
 - Consider using current SRF planning funds
- 9. Conduct preliminary hydrogeologic studies of Queen Sewell Park and Community Center
- 10. Acquire rights to critical treatment and/or disposal sites
- 11. Obtain SRF funding to supplement private investment
- 12. Investigate and secure other public financing options
- 13. Develop public involvement process to support wastewater program

An overall schedule that lays out these timeline, milestones and interrelationship between recommendations is shown in Figure 25.









BDC – Bourne Development Campus

BNR - Biological Nitrogen Removal

BOD - Biological Oxygen Demand

BWAC - Bourne Wastewater Advisory Committee

DEP - Department of Environmental Protection

DIF - District Improvement Financing

GIZ - Growth Incentive Zone

GPD – Gallons per Day

IMA - Inter Municipal Agreement

MBR - Membrane Bioreactor

O&M – Operations and Maintenance

PLAAP - Priority Lands Acquisition Assessment Plan

RESET - Regional Economic Strategy Execution Team

SBR – Sequencing Batch Reactor

TN – Total Nitrogen

TSS – Total Suspended Solids

WWTP - Wastewater Treatment Plant



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Appendix A: Complete List of Documents Review

Title	Author	Date	Summary
Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod	Barnstable County Wastewater Cost Task Force – Wright Pierce	April 2010	Cost estimates for capital and O&M costs for individual, cluster, satellite, and centralized systems sized for Cape Cod
Community Funding for Wastewater	Robert J. Ciolek	7/20/11	There are four basic funding choices for Cape Cod towns:
Capital Programs			Funding from existing Town funding sources for capital and/or operating expenses Funding from betterment assessments for capital expenses Funding from a Proposition 2½ override or debt exclusion vote for capital expenses Funding from a system of rates and charges for operating and/or capital expenses
A Vision Plan for Bourne's Downtown	Stantec	March 2008	The Bourne Financial Development Corporation (BFDC) commissioned this study for the purpose of facilitating creative thinking beyond the current status of the Main Street District, including the rebirth of downtown through new zoning, different traffic patterns, greater density, mixed uses, and new infrastructure that will lead to the private commercial and residential development investment sought by the community.
Bourne Wastewater Funding Study for Downtown Area of Buzzards Bay (Modified Alternative 1B) - Potential Cost Allocation/Local Revenue Alternatives	Tighe and Bond	February 2009	Table with potential cost allocation/local revenue alternatives for funding wastewater infrastructure for downtown Bourne.
Bourne Development Campus Concept Master Plan Full Buildout	Tighe and Bond	May 2010	Bourne Development Campus master plan maps
Wastewater Flow Projection and Conceptual Costs for the Bourne Development Campus	Tighe and Bond	June 2008	The conceptual plan for development of the Bourne Development Campus (BDC) is projected to produce an average annual wastewater flow of approximately 48,000 gallons per day (GPD) from commercial and industrial sources. The BDC will require wastewater collection, treatment, and discharge under the Massachusetts Department of Environmental Protection's Groundwater Discharge Permit Program. Four alternatives for treatment and discharge were developed.
Downtown Zoning Bylaw for Town Meeting - Approved Fall TM 2008			The intent of the Downtown District (DTD) is to produce a mixed use zone that fulfills the goals, objectives and action strategies of the Town of Bourne Local Comprehensive Plan 2007.

Study of Flood Hazard Mitigation and Design for the Main Street Business District Wastewater Project for Downtown Area of Buzzards Bay - Funding Flow Chart Bourne Wastewater Funding Study for Downtown Area of Buzzards Bay (Modified Alternative 1B) - Conceptual Funding Scenarios for Modified Alternative 1B) - Bourne Wastewater Bourne Bourne Wastewater Bourne Wastewater Bourne Wastewater Bourne Wastewater Bourne Wastewater Bourne Wastewater Bourne Bourne Planning Way 2011 The Town of Bourne has compiled this document as a application to the Cape Cod	30-Year Facilities Master Plan	Horsely Witten		The Town of Bourne and Horsely Witten Group (HW) collaborated to perform three planning exercises, the results of which constitute a 30-year facilities master plan. The first exercise involved developing a needs assessment for 17 municipal or quasimunicipal agencies in the community over a 30-year planning horizon. The second planning exercise involved using the results of this assessment to develop a conceptual plan of the Canalside property with the assumption that it would be available to meet these municipal facilities needs. The concept was specifically tailored to meet municipal facility needs and considered potential funding sources for acquisition and development from several interested parties. The third exercise involved mapping the implementation of facility expansion across the community in an effort to better visualize the changes that would be required to meet the capacity needs of each department.
Buzzards Bay - Funding Flow Chart Bourne Wastewater Funding Study for Downtown Area of Buzzards Bay (Modified Alternative 1B) - Conceptual Funding Scenarios for Modified Alternative 1B Tighe and Bond February 2009 Conceptual funding scenarios for modified alternative 1B. February 2009 Februar		·	December 2007	Document and maps provide an inventory of existing flood hazard conditions and
Downtown Area of Buzzards Bay (Modified Alternative 1B) - Conceptual Funding Scenarios for Modified Alternative 1B	,	Tighe and Bond	February 2009	Funding flow chart.
2011 Growth Incentive Zone Application Bourne Planning May 2011 The Town of Bourne has compiled this document as a application to the Cape Cod	Downtown Area of Buzzards Bay (Modified Alternative 1B) - Conceptual Funding Scenarios for Modified Alternative	Tighe and Bond	February 2009	Conceptual funding scenarios for modified alternative 1B.
Department Commission requesting the designation of a Growth Incentive Zone (GIZ) in the Village of Buzzards Bay in the area now known as Bourne's Downtown. This designation will allow more local control by raising the Development of Regional Impact (DRI) thresholds in the areas shown in this application.	1			Commission requesting the designation of a Growth Incentive Zone (GIZ) in the Village of Buzzards Bay in the area now known as Bourne's Downtown. This designation will allow more local control by raising the Development of Regional Impact (DRI) thresholds in the
Wastewater Planning Update Memorandum Tighe and Bond February 2009 This update to the Wastewater Planning tasks includes three items - 1. Funding and financing options for the Phase 1 Downtown Bourne portion of the project, 2. Next step scope and budget, 3. NRD Textron Grant through MA Executive Office of Energy and Environmental Affairs		Tighe and Bond	,	financing options for the Phase 1 Downtown Bourne portion of the project, 2. Next step scope and budget, 3. NRD Textron Grant through MA Executive Office of Energy and Environmental Affairs
Wastewater Advisory Committee Meeting Wastewater December 6, Meeting minutes. Advisory Committee 2011	,			Meeting minutes.
The state of the s		•		Mosting minutes
Wastewater Advisory Committee Meeting Wastewater December 7, Minutes Advisory Committee 2012	,			ivieeting minutes.

Open Space and Recreation Plan 2008 - 2012	Beals and Thomas Inc	February 2008	The Town of Bourne's 2008 Open Space and Recreation Plan update has been prepared to serve as a guide to the many committees, boards, commissions and volunteer groups in the community. Much like the 1997 plan, this document was designed to encourage programs and policies that will have a lasting and constructive impact on the community in the future. As was mentioned at the Public Forum and within the Focus Groups that were held as a part of the project, the existing open space and recreation amenities and opportunities in Bourne are unique, from the Cape Cod Canal to the small pocket parks that exist in almost every village. Keeping these characteristics and continuing to think about open space, recreation and natural resources in a meaningful manner is an essential piece to quality of life in this seaside community.
Report to Board of Sewer Commissioners	Wastewater Advisory Committee	March 2008	In August 2007, the Wastewater Advisory Committee met with the Bourne Board of Sewer Commissioners to discuss the concept of responding to the urgent economic, infrastructural, and environmental need to expand wastewater treatment capacity for Bourne's Downtown, the Village of Buzzards Bay. The Committee recommended the further study of a central treatment and groundwater discharge facility on Town-owned land in Bournedale (Alternative 1B in Tighe & Bond's Wastewater Management Study forwarded to Sewer Commissioners in December). At that meeting, the Commissioners endorsed the concept as presented in a report from the Wastewater Advisory Committee and encouraged the Committee, along with Tighe & Bond, to continue the study.
Wastewater Management Planning for Bourne's Downtown Scope of Work	Cape Cod Commission	June 2007	The Cape Cod Commission will evaluate water supply and wastewater issues as part of a comprehensive water supply/wastewater assessment of the Downtown Bourne area (including Hideaway Village and the Bourne Development Campus).
Draft Wastewater Management Study	Tighe and Bond	October 2007	The purpose of the Bourne Wastewater Management Study is to identify wastewater management solutions that will facilitate the revitalization of Main Street Buzzards Bay and provide a framework for long-term wastewater management in greater Bourne.
Task 1 Report - Bourne Wastewater Management Study Section 3	Tighe and Bond		Future conditions and flow projection for wastewater study.
Buzzards Bay Water District Pumping Totals		2010	Water district pumping totals for 2008-2010.
DRAFT Market Analysis for the Main Street Business District in the Village of Buzzards Bay, MA	RKG Associates	November 2006	The study assesses the sustainable economic redevelopment options/possibilities for the Main Street business district of the Village of Buzzards Bay, Massachusetts.

Build Out Analysis Final Write-up	Cape Cod Commission		The purpose of the build out study was to identify future growth potential, primarily in Buzzards Bay, and to project associated wastewater flows necessary to support this potential growth scenario. The build out analysis was conducted in tandem with other preliminary capital infrastructure and wastewater planning efforts the Commission RESET Team has been engaged in with the Town of Bourne.
Bourne Wastewater Management	Cape Cod	September 9,	Discussion of task 3.
Planning: Task 3: Water Supply and Demands Assessment Presentation	Commission	2011	
Bourne Wastewater Management	Cape Cod	September 30,	Discussion of tasks 3 and 4.
Planning: Task 3: Water Supply and Demands Assessment & Task 4: Assess Existing Wastewater Infrastructure	Commission	2011	
Bourne Wastewater Management Planning	Cape Cod	December 6,	Discussion of tasks 3 and 4 and 5.
_	Commission	2011	
Buzzards Bay Area Required for Disposal -	Cape Cod	December 7,	Area calculations required for disposal - 365,000 Title 5 peak flow and 182,500 average
365,000 Title 5 Peak Flow	Commission	2012	flow.
Bourne Panhandle Site - Combined	MassGIS	October 2008	Мар
Resources			
Bourne Panhandle Site	MassGIS	October 2008	Мар
Downtown Zoning Map	Bourne Planning Department	January 2010	Мар
Bourne Potential Wastewater Disposal Areas Analysis Mapping	Cape Cod Commission	12/23/11	Мар
Ownership of Disposal Sites	Cape Cod Commission	12/23/11	Мар
Figure 1 - Wastewater Management	Cape Cod	9/27/11	Мар
Planning Study Areas	Commission		
plaap_north_MapSeries1_v5_PP_20111018	Cape Cod Commission	10/18/11	Map - Version 5
plaap_north_MapSeries2_v4_PP_20111018	Cape Cod Commission	10/18/11	Map - Version 4

plaap_north_MapSeries3_v5_PP_20111018	Cape Cod Commission	10/18/11	Map - Version 5
plaap_north_MapSeries4_v3_PP_20110916	Cape Cod Commission	9/16/11	Map - Version 4
plaap_north_MapSeries5_v5_PP_20111018	Cape Cod Commission	10/18/11	Map - Version 5
plaap_north_MapSeries6_v5_PP_20110927	Cape Cod Commission	9/27/11	Map - Version 5
plaap_north_MapSeries7_v3_PP_20110929	Cape Cod Commission	9/29/11	Map - Version 3
·	Cape Cod Commission	12/7/11	Мар
•	Cape Cod Commission	12/7/11	Мар

Appendix B: Summary of Buzzards Bay Water Pumping Reports

		STATION 1 #1-cm G	STATION 2 #2-02G	STATION 3 #3-03G	STATION 4 #4-04G	NNW/ Monthly Totals	Maximum Day	Average Day	KOH Total Gallons
	January	1,916,100	3,096,200	2,332,010	3,861,750	11,206,060	456,860	361,486	515.4
	February	768,900	2,647,300	3,689,600	3,456,520	10,562,320	503,530	377,226	482.7
	March	1,447,900	2,422,100	4,626,720	3,351,940	11,848,660	527,170	382,215	532.4
	April	2,374,300	2,646,200	3,915,970	2,442,530	11,379,000	484,150	379,300	507
20	May	2,343,200	4,505,300	6,146,440	3,846,860	16,841,800	856,170	543,284	767.9
2007	June	3,327,000	5,485,900	5,885,730	6,323,250	21,021,880	1,132,125	700,729	967.1
	July	3,338,200	6,078,300	7,421,950	7,304,410	24,142,860	1,092,910	778,802	696.5
	August	4,118,500	6,447,700	10,332,010	3,441,820	24,340,030	1,187,870	785,162	1064
	September	3,356,400	5,116,400	7,209,100	3,673,050	19,354,950	1,061,690	645,165	881
	October	2,558,600	3,314,200	4,391,870	3,826,470	14,091,140	727,550	454,553	659.5
	November	1,185,900	2,492,400	3,526,160	3,343,770	10,548,230	509,210	351,608	514.2
	December	1,270,800	1,941,700	4,108,400	2,759,270	10,080,170	466,590	325,167	531
	TOTALS	28,005,800	46,193,700	63,585,960	47,631,640	185,417,100	1,187,870	507,992	8118.7
						NNW/			кон
		STATION 1 #1-cm G	STATION 2 #2-02G	STATION 3 #3-03G	STATION 4 #4-04G	Monthly Totals	Maximum Day	Average Day	Total Gallons
	January					Monthly			Total
	January February	#1-cm G	#2-02G	#3-03G	#4-04G	Monthly Totals	Day	Day	Total Gallons
	,	#1-cm G 662,600	#2-02G 1,912,900	#3-03G 4,588,380	#4-04G 2,519,140	Monthly Totals 9,683,020	Day 465,400	Day 312,355	Total Gallons 463.5
	February	#1-cm G 662,600 777,800	#2-02G 1,912,900 2,058,100	#3-03G 4,588,380 2,943,520	#4-04G 2,519,140 2,964,070	Monthly Totals 9,683,020 8,743,490	Day 465,400 443,060	312,355 312,268	Total Gallons 463.5 435.5
80	February March	#1-cm G 662,600 777,800 2,241,800	#2-02G 1,912,900 2,058,100 1,971,000	#3-03G 4,588,380 2,943,520 3,647,600	#4-04G 2,519,140 2,964,070 2,783,350	Monthly Totals 9,683,020 8,743,490 10,643,750	Day 465,400 443,060 452,660	312,355 312,268 343,347	Total Gallons 463.5 435.5 546
2008	February March April	#1-cm G 662,600 777,800 2,241,800 2,303,000	#2-02G 1,912,900 2,058,100 1,971,000 2,341,500	#3-03G 4,588,380 2,943,520 3,647,600 3,952,530	#4-04G 2,519,140 2,964,070 2,783,350 3,325,300	Monthly Totals 9,683,020 8,743,490 10,643,750 11,922,330	Day 465,400 443,060 452,660 537,250	312,355 312,268 343,347 397,411	Total Gallons 463.5 435.5 546 616.5
2008	February March April May	#1-cm G 662,600 777,800 2,241,800 2,303,000 2,737,800	#2-02G 1,912,900 2,058,100 1,971,000 2,341,500 2,982,200	#3-03G 4,588,380 2,943,520 3,647,600 3,952,530 4,572,930	#4-04G 2,519,140 2,964,070 2,783,350 3,325,300 3,562,010	Monthly Totals 9,683,020 8,743,490 10,643,750 11,922,330 13,854,940	Day 465,400 443,060 452,660 537,250 723,970	Day 312,355 312,268 343,347 397,411 446,934	Total Gallons 463.5 435.5 546 616.5 689.5
2008	February March April May June	#1-cm G 662,600 777,800 2,241,800 2,303,000 2,737,800 4,234,200	#2-02G 1,912,900 2,058,100 1,971,000 2,341,500 2,982,200 3,597,800	#3-03G 4,588,380 2,943,520 3,647,600 3,952,530 4,572,930 7,060,310	#4-04G 2,519,140 2,964,070 2,783,350 3,325,300 3,562,010 5,028,890	Monthly Totals 9,683,020 8,743,490 10,643,750 11,922,330 13,854,940 19,921,200	Day 465,400 443,060 452,660 537,250 723,970 949,690	Day 312,355 312,268 343,347 397,411 446,934 664,040	Total Gallons 463.5 435.5 546 616.5 689.5 1002.2
2008	February March April May June July	#1-cm G 662,600 777,800 2,241,800 2,303,000 2,737,800 4,234,200 4,830,900	#2-02G 1,912,900 2,058,100 1,971,000 2,341,500 2,982,200 3,597,800 4,658,200	#3-03G 4,588,380 2,943,520 3,647,600 3,952,530 4,572,930 7,060,310 8,462,340	#4-04G 2,519,140 2,964,070 2,783,350 3,325,300 3,562,010 5,028,890 5,573,260	Monthly Totals 9,683,020 8,743,490 10,643,750 11,922,330 13,854,940 19,921,200 23,524,700	Day 465,400 443,060 452,660 537,250 723,970 949,690 1,078,570	Day 312,355 312,268 343,347 397,411 446,934 664,040 758,861	Total Gallons 463.5 435.5 546 616.5 689.5 1002.2 1182.5
2008	February March April May June July August	#1-cm G 662,600 777,800 2,241,800 2,303,000 2,737,800 4,234,200 4,830,900 4,406,300	#2-02G 1,912,900 2,058,100 1,971,000 2,341,500 2,982,200 3,597,800 4,658,200 3,257,900	#3-03G 4,588,380 2,943,520 3,647,600 3,952,530 4,572,930 7,060,310 8,462,340 6,870,820	#4-04G 2,519,140 2,964,070 2,783,350 3,325,300 3,562,010 5,028,890 5,573,260 4,717,900	Monthly Totals 9,683,020 8,743,490 10,643,750 11,922,330 13,854,940 19,921,200 23,524,700 19,252,920	Day 465,400 443,060 452,660 537,250 723,970 949,690 1,078,570 833,010	Day 312,355 312,268 343,347 397,411 446,934 664,040 758,861 621,062	Total Gallons 463.5 435.5 546 616.5 689.5 1002.2 1182.5 970
2008	February March April May June July August September	#1-cm G 662,600 777,800 2,241,800 2,303,000 2,737,800 4,234,200 4,830,900 4,406,300 3,645,600	#2-02G 1,912,900 2,058,100 1,971,000 2,341,500 2,982,200 3,597,800 4,658,200 3,257,900 2,395,900	#3-03G 4,588,380 2,943,520 3,647,600 3,952,530 4,572,930 7,060,310 8,462,340 6,870,820 4,908,670	#4-04G 2,519,140 2,964,070 2,783,350 3,325,300 3,562,010 5,028,890 5,573,260 4,717,900 4,256,460	Monthly Totals 9,683,020 8,743,490 10,643,750 11,922,330 13,854,940 19,921,200 23,524,700 19,252,920 15,206,630	Day 465,400 443,060 452,660 537,250 723,970 949,690 1,078,570 833,010 809,650	Day 312,355 312,268 343,347 397,411 446,934 664,040 758,861 621,062 506,888	Total Gallons 463.5 435.5 546 616.5 689.5 1002.2 1182.5 970 767
2008	February March April May June July August September October	#1-cm G 662,600 777,800 2,241,800 2,303,000 2,737,800 4,234,200 4,830,900 4,406,300 3,645,600 2,977,600	#2-02G 1,912,900 2,058,100 1,971,000 2,341,500 2,982,200 3,597,800 4,658,200 3,257,900 2,395,900 2,059,300	#3-03G 4,588,380 2,943,520 3,647,600 3,952,530 4,572,930 7,060,310 8,462,340 6,870,820 4,908,670 4,201,370	#4-04G 2,519,140 2,964,070 2,783,350 3,325,300 3,562,010 5,028,890 5,573,260 4,717,900 4,256,460 3,483,040	Monthly Totals 9,683,020 8,743,490 10,643,750 11,922,330 13,854,940 19,921,200 23,524,700 19,252,920 15,206,630 12,721,310	Day 465,400 443,060 452,660 537,250 723,970 949,690 1,078,570 833,010 809,650 555,320	312,355 312,268 343,347 397,411 446,934 664,040 758,861 621,062 506,888 410,365	Total Gallons 463.5 435.5 546 616.5 689.5 1002.2 1182.5 970 767 651

		STATION 1 #1-cm G	STATION 2 #2-02G	STATION 3 #3-03G	STATION 4 #4-04G	NNW/ Monthly Totals	Maximum Day	Average Day	KOH Total Gallons
	January	2,125,200	2,068,100	3,894,930	3,163,520	11,251,750	681,080	362,960	582.5
	February	1,950,200	713,900	3,718,430	2,880,150	9,262,680	467,530	330,810	486.5
	March	3,111,500	0	3,680,360	4,480,870	11,272,730	479,820	363,636	603.5
	April	3,249,800	1,067,500	3,827,050	3,509,500	11,653,850	585,600	388,462	588.5
2009	May	2,588,600	3,932,700	3,429,000	4,370,920	14,321,220	717,340	461,975	686
20	June	3,366,000	3,526,900	4,984,520	3,319,400	15,196,820	698,070	506,561	688
	July	3,682,500	4,722,500	7,047,980	2,049,590	17,502,570	791,190	564,599	612.5
	August	3,355,900	4,210,100	6,212,990	5,708,480	19,487,470	851,730	628,628	847.5
	September	2,612,200	3,105,300	4,842,000	4,158,430	14,717,930	659,430	490,598	625.5
	October	2,239,000	2,411,100	4,069,590	3,205,100	11,924,790	527,880	384,671	516
	November	1,716,000	2,338,900	3,220,860	3,123,180	10,398,940	469,760	346,631	458
	December	2,147,900	2,635,100	3,245,330	2,923,320	10,951,650	574,300	353,279	479
	TOTALS	32,144,800	30,732,100	52,173,040	42,892,460	157,942,400	851,730	432,719	7173.5
		STATION 1 #1-cm G	STATION 2 #2-02G	STATION 3 #3-03G	STATION 4 #4-04G	NNW/ Monthly Totals	Maximum Day	Average Day	KOH Total Gallons
	January					Monthly			Total
		#1-cm G	#2-02G	#3-03G	#4-04G	Monthly Totals	Day	Day	Total Gallons
	January February March	#1-cm G 1,576,200	#2-02G 2,258,100	#3-03G 3,012,650	#4-04G 3,058,790	Monthly Totals 9,905,740	Day 500,840	Day 319,540	Total Gallons 437
	February	#1-cm G 1,576,200 1,449,700	#2-02G 2,258,100 1,895,800	#3-03G 3,012,650 2,787,080	#4-04G 3,058,790 2,571,560	Monthly Totals 9,905,740 8,704,140	Day 500,840 464,770	Day 319,540 310,862	Total Gallons 437 384
01	February March	#1-cm G 1,576,200 1,449,700 1,863,600	#2-02G 2,258,100 1,895,800 2,211,600	#3-03G 3,012,650 2,787,080 3,582,850	#4-04G 3,058,790 2,571,560 2,987,750	Monthly Totals 9,905,740 8,704,140 10,645,800	500,840 464,770 447,360	Day 319,540 310,862 343,413	Total Gallons 437 384 479
2010	February March April	#1-cm G 1,576,200 1,449,700 1,863,600 2,207,700	#2-02G 2,258,100 1,895,800 2,211,600 2,148,700	#3-03G 3,012,650 2,787,080 3,582,850 3,735,980	#4-04G 3,058,790 2,571,560 2,987,750 3,403,400	Monthly Totals 9,905,740 8,704,140 10,645,800 11,495,780	500,840 464,770 447,360 511,800	319,540 310,862 343,413 383,193	Total Gallons 437 384 479 518.5
2010	February March April May	#1-cm G 1,576,200 1,449,700 1,863,600 2,207,700 2,832,600	#2-02G 2,258,100 1,895,800 2,211,600 2,148,700 3,693,800	#3-03G 3,012,650 2,787,080 3,582,850 3,735,980 5,477,280	#4-04G 3,058,790 2,571,560 2,987,750 3,403,400 4,964,470	Monthly Totals 9,905,740 8,704,140 10,645,800 11,495,780 16,968,150	500,840 464,770 447,360 511,800 840,470	Day 319,540 310,862 343,413 383,193 547,360	Total Gallons 437 384 479 518.5 779.5
2010	February March April May June	#1-cm G 1,576,200 1,449,700 1,863,600 2,207,700 2,832,600 3,652,900	#2-02G 2,258,100 1,895,800 2,211,600 2,148,700 3,693,800 3,489,900	#3-03G 3,012,650 2,787,080 3,582,850 3,735,980 5,477,280 7,034,690	#4-04G 3,058,790 2,571,560 2,987,750 3,403,400 4,964,470 4,689,140	Monthly Totals 9,905,740 8,704,140 10,645,800 11,495,780 16,968,150 18,866,630	Day 500,840 464,770 447,360 511,800 840,470 863,540	Day 319,540 310,862 343,413 383,193 547,360 628,888	Total Gallons 437 384 479 518.5 779.5 880.5
2010	February March April May June July	#1-cm G 1,576,200 1,449,700 1,863,600 2,207,700 2,832,600 3,652,900 5,157,000	#2-02G 2,258,100 1,895,800 2,211,600 2,148,700 3,693,800 3,489,900 5,318,700	#3-03G 3,012,650 2,787,080 3,582,850 3,735,980 5,477,280 7,034,690 9,133,540	#4-04G 3,058,790 2,571,560 2,987,750 3,403,400 4,964,470 4,689,140 6,988,910	Monthly Totals 9,905,740 8,704,140 10,645,800 11,495,780 16,968,150 18,866,630 26,598,150	500,840 464,770 447,360 511,800 840,470 863,540 1,239,950	Day 319,540 310,862 343,413 383,193 547,360 628,888 858,005	Total Gallons 437 384 479 518.5 779.5 880.5 899.5
2010	February March April May June July August	#1-cm G 1,576,200 1,449,700 1,863,600 2,207,700 2,832,600 3,652,900 5,157,000 3,678,200	#2-02G 2,258,100 1,895,800 2,211,600 2,148,700 3,693,800 3,489,900 5,318,700 4,389,500	#3-03G 3,012,650 2,787,080 3,582,850 3,735,980 5,477,280 7,034,690 9,133,540 7,275,360	#4-04G 3,058,790 2,571,560 2,987,750 3,403,400 4,964,470 4,689,140 6,988,910 5,635,450	Monthly Totals 9,905,740 8,704,140 10,645,800 11,495,780 16,968,150 18,866,630 26,598,150 20,978,510	500,840 464,770 447,360 511,800 840,470 863,540 1,239,950 909,640	Day 319,540 310,862 343,413 383,193 547,360 628,888 858,005 676,726	Total Gallons 437 384 479 518.5 779.5 880.5 899.5 998.5
2010	February March April May June July August September	#1-cm G 1,576,200 1,449,700 1,863,600 2,207,700 2,832,600 3,652,900 5,157,000 3,678,200 2,882,700	#2-02G 2,258,100 1,895,800 2,211,600 2,148,700 3,693,800 3,489,900 5,318,700 4,389,500 3,836,800	#3-03G 3,012,650 2,787,080 3,582,850 3,735,980 5,477,280 7,034,690 9,133,540 7,275,360 5,431,140	#4-04G 3,058,790 2,571,560 2,987,750 3,403,400 4,964,470 4,689,140 6,988,910 5,635,450 5,066,530	Monthly Totals 9,905,740 8,704,140 10,645,800 11,495,780 16,968,150 18,866,630 26,598,150 20,978,510 17,217,170	500,840 464,770 447,360 511,800 840,470 863,540 1,239,950 909,640 766,520	Day 319,540 310,862 343,413 383,193 547,360 628,888 858,005 676,726 573,906	Total Gallons 437 384 479 518.5 779.5 880.5 899.5 998.5 830
2010	February March April May June July August September October	#1-cm G 1,576,200 1,449,700 1,863,600 2,207,700 2,832,600 3,652,900 5,157,000 3,678,200 2,882,700 2,236,600	#2-02G 2,258,100 1,895,800 2,211,600 2,148,700 3,693,800 3,489,900 5,318,700 4,389,500 3,836,800 2,740,300	#3-03G 3,012,650 2,787,080 3,582,850 3,735,980 5,477,280 7,034,690 9,133,540 7,275,360 5,431,140 4,227,230	#4-04G 3,058,790 2,571,560 2,987,750 3,403,400 4,964,470 4,689,140 6,988,910 5,635,450 5,066,530 3,602,110	Monthly Totals 9,905,740 8,704,140 10,645,800 11,495,780 16,968,150 18,866,630 26,598,150 20,978,510 17,217,170 12,806,240	Day 500,840 464,770 447,360 511,800 840,470 863,540 1,239,950 909,640 766,520 487,400	Day 319,540 310,862 343,413 383,193 547,360 628,888 858,005 676,726 573,906 413,105	Total Gallons 437 384 479 518.5 779.5 880.5 899.5 998.5 830 622

Appendix C: Summary of Downtown Bourne Wastewater Pumping Reports

Downtown Wastewater Pumping Records (Main Street Pumping Station) [GPD]

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January	90,865	80,942	73,454	95,841	88,760	94,474	87,860	81,511	85,441	83,158	62,990	73,184
February	87,660	80,304	76,145	82,646	84,162	89,762	85,690	74,580	89,705	57,190	67,708	70,195
March	97,203	96,182	82,383	91,035	81,836	94,394	77,461	80,867	91,032	58,265	102,816	68,635
April	104,822	106,759	90,163	98,461	89,160	99,818	81,524	92,025	94,130	76,339	88,341	72,078
May	114,497	78,833	95,145	91,461	88,599	105,389	90,372	90,903	96,037	79,802	75,989	76,332
June	104,210	62,507	107,132	95,785	90,896	103,558	112,820	89,705	90,819	81,274	85,353	77,074
July	106,101	48,835	105,082	100,266	99,048	104,150	99,296	92,206	99,821	87,123	82,245	82,245
August	103,124	64,324	106,175	103,062	95,393	100,244	95,663	89,704	95,690	87,711	77,973	77,973
September	91,600	97,262	99,808	93,149	89,692	96,861	89,451	85,466	90,186	87,998	82,502	82,502
October	84,490	88,359	95,452	87,651	90,542	97,743	82,186	79,182	88,935	70,353	86,229	68,626
November	83,394	84,976	86,170	84,153	83,410	88,295	85,168	75,732	84,721	68,394	74,103	63,487
December	81,214	80,197	92,876	96,447	82,424	87,641	83,487	90,508	87,794	70,672	72,118	64,410
Annual	95,807	80,716	92,597	93,422	88,689	96,916	89,245	85,281	01 214	75,811	79,934	73,077
Average	33,007	00,710	92,391	93,422	00,009	30,310	09,243	03,201	91,214	13,011	13,334	13,011

Hideaway Village Pumping Records (Hideaway Village Pumping Station) [GPD]

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January	7,381	8,400	9,016	10,129	13,048	10,329	8,226	8,710	8,448	9,255	8,997	7,506
February	7,514	7,789	7,771	9,311	9,445	9,632	8,396	9,089	8,462	9,482	8,179	7,296
March	6,765	9,326	8,368	10,977	8,968	10,319	8,155	9,548	8,703	8,945	10,177	6,555
April	8,590	8,790	9,877	10,820	11,203	11,323	9,003	10,513	8,927	15,383	9,283	7,650
May	11,084	11,519	11,039	11,829	12,177	12,935	11,929	15,965	13,542	11,519	10,303	10,206
June	13,783	14,433	14,800	15,963	15,377	14,870	16,663	14,623	13,040	13,220	12,373	9,307
July	20,213	22,152	20,242	19,997	21,300	20,729	22,539	21,032	19,213	20,158	16,294	15,742
August	19,255	19,829	19,545	22,448	19,235	16,990	17,423	17,742	18,868	17,648	14,906	14,729
September	13,810	13,310	12,637	12,820	14,140	14,027	14,613	15,067	11,770	14,100	11,430	10,447
October	10,300	10,239	9,739	10,955	11,729	11,352	11,542	10,958	12,671	11,132	9,781	8,358
November	10,287	8,540	8,977	9,433	10,217	9,780	10,327	9,157	9,997	10,160	8,387	7,257
December	8,826	8,806	10,084	10,290	9,942	8,432	8,258	8,784	9,019	9,629	8,184	7,342
Annual Average	11,504	11,969	11,878	12,951	13,089	12,585	12,284	12,631	11,917	12,571	10,715	9,391

Total Flow to Wareham (Main Street Pumping Station + Hideaway Village Pumping Station) [GPD]

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
January	98,245	89,342	82,470	105,970	101,809	104,803	96,086	90,220	93,889	92,413	71,986	80,690
February	95,173	88,094	83,916	91,957	93,607	99,394	94,086	83,669	98,167	66,672	75,886	77,491
March	103,967	105,507	90,750	102,012	90,804	104,713	85,615	90,415	99,735	67,211	112,993	75,190
April	113,412	115,549	100,040	109,281	100,363	111,141	90,527	102,539	103,057	91,723	97,625	79,728
May	125,581	90,352	106,184	103,290	100,776	118,325	102,301	106,868	109,579	91,321	86,292	86,538
June	117,994	76,941	121,932	111,749	106,273	118,428	129,483	104,328	103,859	94,494	97,727	86,381
July	126,314	70,986	125,324	120,263	120,348	124,879	121,835	113,239	119,034	107,281	98,538	97,987
August	122,379	84,153	125,720	125,510	114,628	117,235	113,086	107,446	114,558	105,359	92,879	92,702
September	105,410	110,572	112,444	105,969	103,832	110,888	104,065	100,533	101,956	102,098	93,932	92,949
October	94,790	98,598	105,190	98,606	102,271	109,095	93,728	90,140	101,606	81,485	96,009	76,984
November	93,681	93,516	95,147	93,586	93,627	98,075	95,495	84,889	94,717	78,554	82,490	70,744
December	90,039	89,004	102,960	106,737	92,365	96,073	91,745	99,292	96,814	80,301	80,302	71,752
Annual Average	107,311	92,685	104,474	106,374	101,777	109,501	101,528	97,911	103,132	88,382	90,649	82,468

Appendix D: Buildout Analysis

Fixed Inputs		Source
EAD.	2	Zanina
FAR	2	Zoning
Lot Coverage	80%	Zoning
Open Space	20%	Zoning
Building Height	52	Zoning
Stories	4	Zoning
Parking (by use):		
# spaces/1000 sf restaurant	10	Zoning
# spaces/1000 sf office	3	Zoning
# spaces/1000 sf retail	3	Zoning
# spaces per residential unit	1.5	Zoning
# spaces per hotel/motel unit	1	Zoning
Minimum Lot Size (sf)	3500	Zoning
Minimum DTN Lot Size (sf)	40000	Zoning

BFDC Development Potential

	Tighe & Bond	Revised (2011)
Commercial	250,000	125,000
Storage	25,000	12,500
Office	100,000	50,000
Industrial	125,000	62,500
Total	500,000	250,000

Assumptions		Source
Assumptions		Recommended by
% site used for ancilliary uses	5%	EOEEA
Shared Parking Reduction	070	2022/1
Credit	30%	Town planner/CCC
Residential Unit (GFA)	1333	
Average Residential Unit Size	1000	
Average sf/parking space	400	
Mix of Uses:		
DTG:		
% of area commercial		Town Planner/CCC
% of area residential		Town Planner/CCC
% restaurant		Town Planner/CCC
% office		Town Planner/CCC
% retail		Town Planner/CCC
DTC:		
% of area commercial		Town Planner/CCC
% of area residential		Town Planner/CCC
% restaurant		Town Planner/CCC
% office		Town Planner/CCC
% retail		Town Planner/CCC
DTW:		
% of area commercial		Town Planner/CCC
% of area residential		Town Planner/CCC
% restaurant		Town Planner/CCC
% office		Town Planner/CCC
% retail		Town Planner/CCC
DTN:		
% residential		Town Planner/CCC

District Source Clata
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Miletan.	000	1000	40000	- Apple	din.	STORESTS.	18.40	addmin.	MARKEDAN	(Complete)	OWNE	name (THE REAL PROPERTY.	Admiczanto	20.00	**	1	(max)	95 10	MACA	25,210
*	12 HAMBROWNE		964	168	100.	6.	155,29600	3710	m		82		1		3.71	8/900.90	nife.		7	#IME27	114
311	133 MARLS		154	110	10.	ч	P14_1 = 00	3310	11		6/	9	CROS	4	2.65	11905-6	me		_X	1121.00	100
390	THE MARKET LET		IRU.	100	00.	4	PEA-SIX.00	-6(10)	10		M4E:	< 3			0.41	1/8/5/6/	DIE:		= 1	30000	91A
14.	HE MARKET		BA:	HR.	407	4	PROTESTIVE.	obave	41	t -	N.	. 3	1		. 0.40	2799931	ins.		=#	394.11	604
37	SE WARRIES OF		19.8	10.2	de:	e.	385/6,828	37380	10	4	6.0	- 9	LIV.		5.58	2,0943,67	26		$=$ $^{+}$	494.78	N/A
110	POSITION AND THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLU		tha.	TPV.	90.	a.	MEDIANA	5300	ы	1	44	1	ŧ		more	HANCY	lide:		- 1	1975.00	-814
推	DE HARRISON AVV.		164	ten.	94	4	10.4_100.00	3,3(0)		YΞ	61_	- 2	1.75	-	040	13799.29	mr.		$=$ \mathbb{H}	4000.67	11.4
21	2173440000094675		tta:	118	00	e i	PLA THEOR	91100	0(W-1	1			4031	0000.27	Diffe		- 1	1003.53	0.0
-21	ELIMANNINANE:		25A	8.44	10.	6-11	MA J PL00	1 2 190	00		(62	- 0	LPv.		0.30	-438833	MIC.	=	_V	30,10	404
20	SECREMENTAL AND		25.6	192	100	d.	214.365.00	3000	16.3		82				9.94	900.23	me.		- #	19.00	MA.
35	SCHOOL STATE		19-8	ist.	100	8.	SER PARTY.	8/4/2	10	Ø	62	- 6			440	411.00	015		- 1	4.00	454
360	Salarimmon/Ard		80.6	170	16.	ërrin	FEE 177.00	3 100	er i	17	RJ.	1.9	-		0.00	1616-16	infe-		-Xi	300.0	664
31	U 48A0E (I		98.2	3000	90		22.2 396,00	8 9 8	XO.		84	- 4			9.00	40060	Die:		- 6	0.00	1118
380	NT HORBID QN AVE.		159	184	00:	4	19 4 1 m 00	8011	10	-	N 2	- 4	1		0.090	EEMA.54	(orti-		_X	4409.14	20A
390	List Asken (1		box.	199	100	e .	19.1.100.09	a 140	60		62_	- 3	1:		0.00	4/500000	pti:		=	1/04.14	404.
16	THREE WILL		Mit.	199	90	a .	103_050r	3 800	m .	ķ	10				3121	2001.01	III.		-45	2104.00	10A
11	prinside/unit-buil-		4.91	tale.	(B)	W	V1-6 (800.60)	41960	w .	2	82	- 3		2	5.84	10091	MC.		- #	WW-W	904
34	DESIGNATION AND		15.6	376	m:	a.	744.27E86	3 140	m.	5	80	- 3	1		811	HINEAL	nts:		- 1	1010.00	814
34	2534480000,000		114	H.O.	80	8	104,335.00	31,600	00		Ki .	- 3	1.000		366	20557.18	HE.		=1	194.93	304
310	32 CHIT (VI)		70.0	jew.	10.	et i i i	10.3 (10.00	90476	10		#2		1_		8.7%	19400.81	010		=x	H(50.1)	100A
M	HEADARCH		19.6	hut.	960	4	16A,343.00	-60400	m -	1	160	- 4	h)	H I	34346	849625	00fc		- 1	3435,46	104
44	SCHOOLSENS:		\$5.4	SIT	00:		29.4 275.00	5,100	10		AJ	- 12	1		738	.09010	HIE.		- 1	1100.11	754
M	J. H. GARREST		20.1	191	(85.	E :	20.8 NO DO	ecan)	w.	b	82	- 3	1	1	0.00	36596,18	310			7985.01	BIA.
19.	6010000000000		10.5	1665	Nr.	8.	168,86586	1700	m s	1	83	- 3	1.0	Y	621	394586	itre		- #	200.00	818
41)	AT HAMESON ALE		164	167	500	9	10.4, 142.00	5,100	10.		61	-3	4.		0.14	500.98	DTL		- N	100000	100
305	WILLHAMPSCOK PARK		110	liet.	100		104.360.00	9000	m :	i -	NZ .	- 4			100	2016	ine		- 1	2000-000	HA.
41	EXTERNOSMOST CO.		113.7	106	90:	id .	73.9 380 00:	90100	00	6	84	9.	1.		0.01	1278536	Iric?		- 46	1434176	46.6
34	LIF MARK II		ASA:	101	19:	W) 1.4	23.1.100.09	30100	90.	1	41	1.0	1		7.8%	#RED.13	DIS.		_X	379055	18
40	24 WARRENGE		163	104	160.	0.	23.3 356.00	aceta	n l		AJ .	- 3	1.		2.96	AFMASS	Dec.		- 4	148.0	60A
140	RETURNING ON YOU.		15.4	MIL	107.	e.	154 All 00	2110		2	NO.	- 1	1 -		time	349233	mrs.		- 31	1000.00	80A
31	ISCHOOL WE		18.2	1900	90	ε	111 3440	2 100	10	1	81	- 3	2.0		3030	3300.21	me_		-4	100000	864
#1	DELMANUE		14.0	1111	00:-	4	163_0309	2199	will	1	163		0.00		1099	999011	DTE.	=	= VI	-065.(%	104
40	JCNASS ST		101	1995	MC.	0	14.3,491.00	90100	10	1	14	10.6	0		1.10	A6543.35	Diff.		- 46	.0000	314.
24	9 101800/07/04		11.00	10	00:	400	253,115.00	2 101	181.	2	10	110	1	-	3/5/6	25,000.00	UNE .		-4	didiate	-94
×	SHIMMEN.		14.8	1118	MR:	w.	253_31630	4000	w.		82	- 3	t		0.380	. 9707.81	310		- 4	2984.10	SA.
M	COCMANDO.		ní:	177	Im: .	R.	111.30160	0119	m	81	80	- 0			604	(5mm)(mé		= ¥	(7) 600	8.6
10	11 HARROWALL		at a	me:	100	6.11	111,580.00	1 160	E I	10	61	- 3	1.75.		6.27	119533	nte		1	7566.00	104
34	21711100 and		14.5	200		4	PKT (007.00)	9(3%	00		83	- 0	1000		0.665	00.000.43	me:		- 65	0.00	104
166	Inn. HARVIT		143	11.0	900	Mr.	22.2 217.00	Chino	101	9	0.0	1.4	12	1	10.04	549340.00	Die		46	1.000.00	404
W	2010/04/05		23.0	1116	16	u, c	75.8 TUESD:	3 100	0		69	- 1	1.1		.036	3390:11	-		- 4	1073.99	604
귦	J. SHARLAS HAS		113	102	MF.	0	132,312.00	3,100	10	2	ÚJ.	- 3	1	1	443	27 887 32	DIE.			2300.00	SIA.
팏	Secretary Secretary		11.7	113	96	er.	152 31100	-aixin	0		81	- 4	1	6	6.79	11300/6	nte		- 4	3439.65	8.4

District Source Cuts
Page 2 of III

1000	1000	100	4000	Markey Markey	STATE OF THE PERSON NAMED IN	investorii Amerikan		80	1	Spen Sheet	75 76	NOW CHA	26.78
ST JOSEPHWEE	114.5	11/7 190	6 113_331.00	90,1700	11 (82	31	0.0	2010/03/2	O WITE		- 1	3039631	4.4
SIG. 2007 MAJEL CV	293	114 (0	133,3800	2 11000	7 767	29 (4 18	240 000461	titte		- 4	100.6	0.4
BY JR II MANUACTURE	357	169:16	10. (23.6 (985.0))	-072300	E 162	936	0 3	to Disease	10000		$=$ \times	0.99	9.4
GE TESMALIER GO	112	361.10	4 212 36500	1.111111	A 397	3 1.75	1 3	29 27000	or line.		=#	300.60	9.4
68 EXCOMPGE AVE	13.5	365 10	10 23.1 cm (6)	9/98000	4 98	34.5	8 4	23 34/13.5	s etc.		=4	M8131	9.6
CAL TECHNOLOGY (NO.	19.3	700-100	F 143 YEAR	3 4mm	261	111	7 8	21 September 1	of inter-		_ 1	2014/30	-0.4
65 290368881F	184	124 60	N 254 325.00	5/0340	3 99	2.3	9 7	21 909-1	4000		- 4	2107.95	114
SEC BANASCE	314.3	(100)	# 14.1 (MILE)	9(1000	1 100	10	0 2	30 33300	# mbi		- 16	11.000	114
67 25 ST NAMES OF STATE	104.	DEC 10	9 71.1 296.00	9910	1 (4)	2.1	10 1/4	10 1660	et and		=#	\$4450.74	- 4 A
NE . 35 PENN AGE	14.1	(865)80	G 18.1,801.00.	H 1366	1. 201	31.	15.0	41 397500	A TINE		- 47	- Admires	4.4
SH SWIGHTER	201-0	\$23. 90	FE 24.5 525.00	601256	V 762	31	9 2	185 \$5,500.0	s mr.		= #	3.825.68	U/A
III. THE RESIDENCE OF THE PARTY	563	185 190	17 1 14 16 m	3,7100	3 944	1111	A 1	275 200000	date.			(0.05) (0.00)	64
PE 00:00 MANUFACTURE PLANT	181.6	(8m) (6)	in 22.1 (sime)	6(4)70	3 34	3.4	0 0	66 20400	AUTE			201136	404
TT DRI MARKETT	(11.0	1118 90	6 ITA_171.00	951100	3 20	311.75	1 0	FF WAR	2 ate		- 10	3337.63	304
PET SELF Annual ST	214	1801 196	FAX 167.00	0.1150	1 102	111	0 0	162191	J OVE			139670	- 6 A
THE ENDOMAINST	(19.9	174 10	11.7 (15.00)	1 1000	1 30	- 31	1 1	19 81473	2105		- 1	200,63	- 8/A
PU SE WHAVEF SEE	24.2	799 (6)	6 /12 mm	- VILLE	2 30	37		11 1100	LIVE.		=#	2504.21	104
ter decouperant	101.0	1622 160	9 152 YOUR	- interm	0 30	313	3 2	10 6/11	orene		-4	686.33	818
TO STREET, STR	1117	1.00	0 23.1 FW-10	3/1000	2 30	3.1	1 1	10 4000	entre:			6073,04	144
N DEMARKS	10.8	128 66	6 23.1 120.03	4011000	1 31	-	3	817 807733	01E		- 4	0.00	EA.
PRI ADJANCE WEE	111.7	196 100	FE 78.0 DBLOG	1/1/100	3 . 30	- 0.4	0 0		A Utic		147	Library	.014
NO. TO ANALYSIS.	10.2	7910 140	E 22.1 (100 M)	4,1000	1 (8.2	111	3 3	W 01111	4 000		=#	1105.07	104
at the same?	21.2	111 100		401360	2 32	11.	1 1	SW CORES	a troi		-4	1007.74	SIA.
SE SECTIONS OF THE	26.9	1014 100	01.000.00	37000	3 30	3.1			2 1110		- 1	911.50	600
DE TEMPOREM AND	013	lor w	Fig. 115.8 (955.40)	a 1000	100	38		1700	OLOTE		- 37	310434	956
BE STERNET WE	THE	late 160	w 102 miles	979000	100	4.0	1 1	17 1900	or are			1004.00	HA.
66 TROCOMMONT BUT	114.0	000 100	H 23.1 H00.00	40100	à 18.0	90128			NUME .		- 4	240.00	GA.
SEC. SELEMANDECTES	33.6	364 19	13.1 (FE 00.	6/1400	4 103	111	1 1	PV 8200.1	4 916		- 1	376630	114
RE WHILETARD AND BUT	1953	1015 100	G 31.1 911.00	0.000	3 82	3 4.5	A B	11000	THE REAL PROPERTY.		- 37	3415.00	EA.
PRO TRANSPORTE	(83)	78.60 199	e 174.1mm	9(37/0	0.00	min	0 0	10 1900	0.070		- 16	0.00	8.4
SHE T, MARK ET	003	200.00	0.100.000	9(43/30	1 41	101	1 1	110751	0.070		- 1	1103.66	104
WE TRUTTOMOST AND	(11.0	late: 40	6 FLX 807.00	27,1000	160	9.9	1 11	100.00	# I//u		-1	30709	10.4
NO CONTRACTOR	114.0	in in	E 11.2 996.70	0.4000	8. 85	3 1.35	4 8	32,789.5	ntin:		- 4	3,600,44	254
THE PROPERTY AND	19.6	Jane 100	1 21.1 Pilnor	2 1010	2 90	33.		107 227990	Time.		-	901.76	- 44
VL IF GOVERN	14.3	7002 160	6 751.9949	912988	2 (8)	- 1	- 4	22384	eus.		-2	0.00	614
of September 2	10.7	942 Inc		00100	5 Md	51		10000	mane		-2	0.864	6.4
50 Juliani at	10.2	115 100	0 23123360	4079	1 64	51.		2000	-		1	EN0.75	114
W 82 (40) 199	13.6	100 100	9 (0.1 111.00	964300	100	9.8		31 3640.0	THE REAL PROPERTY.		=2	0.00	104
(A) CHICLESOCKAP NO.	313	241 (40)	10 23.2 Del 101	818000	194	111			0.16		-1	1600,00	-014
IN DUCHARDS	111	Ser las	4 23.7 SERI.	10110	1 10	23		200 1000.0				179,40	84-
WE SERVICE THE SERVICE STREET	183	Just 160	E 13.1 200.00	9 43.50	91	9 4.4	-17		JUNE.		-1	2019.25	EA.
PRI 10 AMERITATI AND	103.5	200 100	N 103 000 00	s/airm.	200	91.0		an Piek	-	-	-1	100101	9.4

District Source Cuts
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Nations.	9000	1631	-	Hans	400	411-010	100	Majoratio.	(Vampe)	HOME	v merskini	- money	A DECEMBER	200	454	1	Sen Sent	20. 10	Marca.	26,550
1994	PERSONAL PARTY AND		18.0	1455	110.	6	717,91800	3:1000		83	- 9			7.18	1865.70	inte.		- 6	0.000	894
HOI	16 RESIDENCE AND	- 1	IRT.	per :	(0	N	24 t 300:00	6(4800	1	67		-		-Gare	\$7547.77	106		- 1	0.004	7.0
100	PL 13444007 XVIII	- 1	10	166	100	et :	PLY 1966-00	717900		82	. 1			0.10	1966.44	NO.		- #	1,04.91	954
200	TANASTITA SIS		13.	just-	(III	WIT.	11.0 (0.0) 100	3,1000	ŧΞ	At .	- 3	125		0.30	- 80K1	ille:		=#	161.00	9.4
306	SECRETE LE	- 4	18.2	188	18.	£ .	25.2 456.00	8(4)/9	41	82	- 1			mah	25767.56	216		=	(954.65)	WA.
70	TO DO BOOK TITE	- (1	16.6	1008	in.	6	16.7 2000.00	278000	7	64	1.5	100		3000	700778	inter:			Tables	0.4
10%	mrsowniay avv	- 1	164	ines.	60.	¥	252,591.00	30000		63	- 5			941	17/9552	mrc-		- 4	933,7M	104
1110	0.000 BCE WE	- 0	ILT:	ine.	in .	16	13.7 (96.0)	3]1010		01	- 1	11		TIGH.	868.71	inte.		-4	TOPEM	104
114	\$500MMSE IN		11.5	2005	10-		(1.2 944 00	2 110,00	1	62	- 1			6.07	milita	int.		- 1	955,89	g/A.
211	EX) WASHING TOWN NOTE.		10.	2014	10	0.57	77.1 WH DR	1,1010		5.0	1.3	t .	t	10135	E391.62	IIIC.		10	71139	64
111	SECURAMIST AND	- 4	ne.	ina	160	E	21.1 946.00	5.1300	4	52	- 0.	1 -		538	787.5	test.		-4	1/23/81	48.
0140	SECONNELL AND		0.3	intis.	16	0	11.0 (070.00)	3 4000		61	- 3	18.0		802	6450.00	nre-	-	- 1	907.10	68
234	ALLBEATETTS ASSE	- 5	11.7	inte	100:		24.1 316.00	0.1101		83	1.0			0.94	5,000.00	DIE		- 6	0.000	404
710	TH ECHNISH I WAY	- 6	ti.	1922	00:	4	15.7 327.00	9 1010		01	- 3	1.2%		033	1016.79	ate		- 10	800.11	806
1111	1360MARKET	- 11	114	100	100	0	153,145.00	518766		62	- 1	1		3036	24788.00	010			2000044	404
110	KETCHANGEY AUG		12	lafe:	100.	4:	75.7 1016.00	919000		11	- 1		=	0.00	2910 18	ijti.		- 4	1.00	01A
1116	Sec Substitution	- 4	14.2	1405	Min	i.	PLI SWING	20000	2	81	- 94	1		633	5,665,75	UHE		- 3	1351.00	10.8
Live	10 WASHINGTON DAY	- 1	13.5	385	im.	4	19.2 20120	3 (9900)		61	- 1	15.		9.33	1716.54	nie		- 1	400.00	6.6
381	SESCOMMUNET AND	_	10.5	ins.	50	6.1	214 RM 60	311/36		13	- 5	-		1035	=0.190	tite.			7040.03	104
MI	22740013 WIL		i.r	106	100	d'	11.1 130.00	3,3000		81	- 1	13.		0.016	2796.76	(01C		-1	90.33	WA.
1.00	JECCHANNET JOY		14.0	loud-	960		74.1 (Bill.00)	904200		64			1	3-31	461.00	WE.		-	F184.99	84.
375	ELEMANNETH AND		11.0	311	166		43.1 (00) (0)	7 1000		8.7	- 1	1.23		0.34	26110	ins		=;	107149	104
231	ALCOHADAY BUIL	- 1	13	100	160.	0.	PE2-368-00	601330		61				0.41	19019-00	SHE.		- 10	- State	WA.
216	TREATMENT	- Li	1.5	int.	in.	4	13.1 300.00	ACTOM:		61	- 7			Tribbs	1711101	nie			2000	600
300	With Real Property Co.		11.2	362	100		DER SEEDO.	9(000		1	- 3	1		3.00	65333.08	nin			1110000	956
inc	al WASHINGTON AND		111	ion	in		13.1 (100)	9,000		82	- 1	1.5		1000	289v 22	are.			20091.30	11.6
390	R WALLOCK BUILD		18.3	aud.	86:	4.	7.5 is less 100	4/4710		As		-		10.04	11000.70	-		-	34(14,5in)	46.6
334	1.COMEST INF		11:	No.	100		23.1 379-00	5 1400	1	12	- 10	í .		3133	379833	ans.			- 721.00	104
-	STANSON LF		113	SUL.	100		ALI 975.00	8/91/01		4.5	- 6			9.7%	88157.79	inte.	=	-2	0.450	8.4
116	THENDET		11.2	1990	00.		11.2 344.00	933790			- 1			801	EDM: 01	nne		- 10	W07 11	8.4
114	THE CONNECTOR AND		12	196	90		11.1 pag 60	2 1000	9	66	- 1	f		300	7100.77			- 1	7396.0	MA.
-144	No. of the Control		14.5	1100	00.		V63 58600	37000		K)	- 1		-	mm	13371-96			= ;	700,110	900
165	\$5,40(3.80).	- 6	18.8	Att	E		16.1 118.80	34/1010		5.7	17.6	6		1.00	20014.45	-		- 4	1011.86	214
210	TO LICENSON VALUE	_	14.0	lier	-	9	212 00000	311000		99	-			11117	7111.04				1650-75	10.6
111	pe consocier and		11.0	1984	ut-		21.2 Ski.10	171000		6.3	- 1			33,5785	1946-11				URRE	8A
7160	21366610		4.5	bes.	m.	or .	10.1 360.60	Alther		40		1		nen	9900 61	-		-	20140	84
3100	ELICIDIONI EV TOR.	-	11.5	less.	60	4	TEX 594.00	2 1000		81		_		3100	476.0			- 1	1000.00	104
1440	100 MARKET		M	lan-	100		VX.2 -040.69	900118		63				801	04403.00	Pricon.			GAELING	WA.
966	WILDHARD TRIE		4.8	2048	iat .		11.1 (04.00)	411000		21	1	1.0	4	428	22293.65	-		- 1	1005733	ula:
100	DECEMBER OF	-	110	165	00	1	112 11100	1000		60		-		1121	1035730	-			4900,74	64
684	A WARRANTIN AND		113	1960	in .		112.96.10	0019000		81				931	103.0				0.000	SA.
244	DE MANUATE	-	13.5	193	100		15.2 WH 00	-8,000		93	-			Trans.	17234 96				1998.05	8.0

District Source Clats
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Metros.	000	nicol	100000	- Joseph	- june	ATT-STEE	i i	Nothern.	WATELANG.	(1) mayor (HAPPE	empiremi	THE REAL PROPERTY.	Admiconita	30	*	Ì	Cont. Sec.	94. 14	BHC38	100
985	12.7 MARK 87	116	1 3	M7. T	10.	6	11.1 pm:00	- 40	355		11	- 3	1		231	15440,75	nine.		- 31	4802.77	104
946	HICONOMICS TANK	(11	133	238	0	N	11.1 (6=0)	130	IIII	9 3	63	- 30	1,75	4	:826	111003	DIE		_ 1	988.67	(f)m
147	TTS ANAPONT	25	1.1	9	10	d	FET 316.00	40	1999		11	- 3	1		mar	56279.99	inte	=1	- 1	290734	91A
34%	\$14 MARK 17	11	1.3	44.	in .	a .	333.34686	- 46	1441	0.0		- 30	1.		3139	2011.04	IRE.		=11	1,07710	68.
8497	SSS SAME ST	(4)	2.5	177	6.	6	J.L. 077100	90	620	4	65	- 9			E18	18600.66	HH.	=1	=4	#HS11.795	WA.
#100	133 200 (mm m)	24.	S : 50	mi.)	m. 1	er .	19.3-20170	60	100		64	- 4			Trials	2000.00	mr:		- 46	0.00	0.4
134	#)WASHINGTON AVE	186	1: 1	41-	10.	6	75.41385.00	3.0	000		11	- 3	1 .	b	837	7101.74	MEC.		- 1	3601.31	SIA.
The.	DESTABLISHED	(1)	1.3	100	00		13.1 (270.00)	- 80	100		ti.	- 16			Time	21347.00	Other		- 4	1000.10	10.6
194	DESCRIPTION OF THE PROPERTY OF	116	A CS	40		M	11.2 (96) 00	40	1130		0	- 9	1		1.06	1955.09	det:		- 1	2100.66	UA.
154	BE SPAIN OF	111.	£:3	NE.	10	à.	15,1 966,00	- 40	100		tt I	- 3	LD.		30.000	SSppr 81	HIE.		-4	471130	20.6
TW	25 MARKET	(4)	E N	Mar I	W .	0.1	253-34236:	- 60	U16	v .	11	3.	i.		6145	51501.76	910		-4	2536.81	94
1960	a Calest we were	(1)	10	B.	6.	0.1	13.6 171.00.	90	100	1	63	- 5	6		800	25465.39	me.		-	8.00	664
217	DE MANIEUR	- 10	- 1	165	90.	80	12.1 20100	81	1000	1		- 3	1		0.01	1001	ime		- 11	14000388	406
118	MCMARKET.		200	005	10:	4	CEA 30000	90	270	()	11	- 3			0111	2279.58	ate		- 10	1191.00	906
2190	Pri Angele Ed.	116	£ : 10	irs.	W.	6	ELE #75.00	9.0	1101		16	- 1	1.5		0.23	18Mile ()	pic:		-1	392,716	404
341	ACCREMICIT	[15.	2.3	ut:	0.		19.2; 944.67	190	499		11	- 1	ii i		803	1100775	HE.		- 1	71(mil 5%)	RA.
13.1	DEFEND NO.	24.	2	m.	in	4	21.7 3 (6.50)		tar -	2	82	- 1	1		541	2579.31	UNI.		- 4	AMPLEY	10.6
360	WICKSEL WITH MIT	(1)		ts.	m.	6	19.7 172.00	- 90	100	5-	60	- 1	1		8356	22757-64	ithi:		-4	901.10	414
361	46,460,7 9.0	111		100	80	6	E3.4 110.00.	100	100		63	- 3			0.64	(1980) M	ttre		- 17	13,066.01	106
Dist	TOTAL BOOK ALL TOP WITH THE	(1)		in.	100	4	127 1500	1.92	1010		10	- 1	1		nut	23077 87	016		- 31	3234.27	WA.
100	1 PLANER IT	144	2. 1	100	M. 7	6	78.6 333.00		10000	6.	10	- 0.	4.00		201	200.00	WE		- 4	33(m, 55)	-104
The C	\$19 MARK \$4	(1):	-	100	W.		43.1 389.00	- 40	uuu		u I	- 1	1		5.40	1954.0	ius:		=#	739144	104
40	ESTABLISHED	24.	1 3	-		0.	223 13636	- 40	date		0	- 0	,		0.0%	1966/75	DITC.		-4	1762.17	WA.
379	Name and Address of the Control of t	20.	2.0	41	m.	8	161 TEM	1.60	ine .		65	- 0	1		856	intrat	itte		- 4	5686.86	Dia.
1	STOWNSHIE WAY	160	1:10	n i	46.5		MANAGEMENT	10	D10			- 3	1.77		nhet	23014.03	min.		- 1/	311.75	- 4
- 3	IN SPERMANNALINE	144	. 1	000	in i		JEL 100'00	40	1910		ei I	- 1	136		3.196	44431.84	ire.		- 1	T100.554	16
- 44	FIREBANN IN	210		at:	100	6	ph 6 (cro.co)	-	1000	4.	bi I	0	1		3.46	85745-00			- 4	416m CG	. 40
- 4	ECSPERIMENTAL N	- 34	10	127	0.1	4	(N.T. 130.00)	140	1000		12	10	1		9.93	1903.61	DIS.		-1	/Bain-152	- 0
-4	HE MARKET	110	6.74	NA.	00		2012 338.00	- 40	0.00		82	- 3	1.6 . 3		0.96	34436.18	700	-1	- 41	700.46	- 6
-2	111 WART	10.	6.14	m	m.	6	10.1 rim og	790	rm		10	- 1	1		1.01	55077.00	one	_	- 16	9377.49	- 1
- 1	2012/66/00/17	146	20	der	90		10L1 (SU/46)		010	Y		- 1	1.		0.64	2107500		=1	- 11	4405.41	- 10
- 11	SALANAM SE	(1)		190	90'.		194,75639	90	min.		62	10			230	0800.20	Ime	=1	111	minin	
10	DAIL MANNESS	2340	1. 4	Bal .	Mb:		101, 59,00	-40	1,000		62	1.6	1		11.11	5,6400,65	DPE:		4	2700791	46
100	Dark MARKETTS	100	10	89	160		ra'l proce	-	171.71			- 4			3019	9319.03	_		- 17	0.00	- 4
16	271 6968 M	115		55	=		184 25186	1 4	1888		82	- 3	,		925	12348-13	MIS.		- 8	1293,62	- 4
16	normal section in the	100			m .		pp.1 10040	-	om	-	10	- 7	15		nes	24,000,00			-7	1940.10	a
10	TO MARKET	16		100	90	N	104,1860		000	10	84	- 3	1		0.01	20225.84				1000.00	- 16
-71	311 MARKET	200	0-41	327	100		Est.319.00	-	ana		63	- 0	1		0.00	1701 =	0.000		- 1	2310.00	16
94	2015402014	719	-4	-	90.	0	10 A JABLES		10:00		li li	1 2	10	4	426	11444.70			-	0.00	
40	2000 MARK 10"	. 11			165	100	she rares		030	_	60	-	11.0	-	3.56	2818.50	-		-1	1800.904	- 10
304	21 1990(N# IDE	- 10		1013-119	0.0		14.1 211.00		total .			- 1			11.34	\$4900.11				1124.75	- 0
300	13 MAN ST	(4)			m 1		351.311.00		1000	_	10	-	=1		BOTT	7600 77		= 1		558.67	- 4

mechi.	00.00	19501	100	- tras	ATMENDS	100,000	-timper	MARKOOS	136003	CMING	NUMBER SERVICES	Hamples	иппосини	4.0	458	1	len beet	27 55	Name (S	WILLSO.
108	DEL MARKET	39,5	/re-	late:	6	20.1,396.00	9(14	00		13	- 3	1		0.01	25897.52	OTE.		- 1	1081.05	
Hill	DOD MANUALY	90.0	000	00:	H	1015 THE 00	1100	m	0	0)	- 0	6.8 .	14	0.01	19903.00	H)III		4	(MIX N	
												Tes	W OTC	DIE N	***1200.00					
-	CONTRACTOR OF THE PARTY OF THE			W 1 TO							tote	enra	-	NAME:	MICHAEL IN					100
294	2 decision revenue Agreements	105.8	Jan.	768.	×	2015,362.8E	8.64	91.	2	42	1	1		110	\$59845.79	01%		_4	248% N	44
MIN	DRI SCERIC MOR.	196.4	Jes.	m	in .	hox.min.mr	2 93	m.		64	- 3	-		111	9030048	nte .		_1	1307.00	14
PHI.	DE MARKET	39.4	100	100	1	10.4 300.00	8114	10		61	- 3	1.13.		440	19276579	mw.		_A	1177,311	48
893	THE MARKEUT	140-3	155	90	le .	10.1 125.00	9 40	10		-	- 1	1		9.50	28600.06	Inte.		11	.710.00	108
296	SUBLINEASE ST	186X	100	199	4	10.4 130.00	3 0	10		42	- 4	1.75		428	BUNCH	0744		_8	38007.68	4.4
395	DESIGNATED.	10.1	100	141	id.	HR.1. L17.00	100	100	4	44	- 3	1		1.24	5601111	History.		- 1	3250.47	0.4
346	SCHOOL UT	128.4	152	15.		29.5 (12.8E	9149	49	1.	62	- 9	-		440	P83.66	MNU			8.00	914
age:	THOUSE CO.	196.5	1116	G .	711	h01 tik0).	3/34	98.		81	9	6		0.00	78344.81	mec.		_ni	36/8 (1	64
116	SIGN MARKETS	19.3	Jus.	100		363C340-0K	9(14	00		11	- 3	1		0.70	30466-03	DOW		$=$ $^{\rm H}$	3109.48	898
211	THE MARKET	200.0	157	10	m.	193,117.00	9(1)	90		80	- 1	H_		2.50	99222.13	1000		- 80	37335.00	118
214	Tool solve of	18.4	100	166-	0.1	29.3.375-00	3[13	10		11	- 1	1		0.20	(0.017.33	016		- 1	339663	WA.
maj:	DECREASES	343	110	16.	0:1	10:1 110:01	3 40	10	4 - 3	62	- 1	it		11.00	29788.43	irre.		- 1	.189645	00.6
121	to reduced any	1900	100	100		2010 NOW BUT	3.10	dti	9	62	- 4	16.	4	1.38	564ML01	DVC.		- 94	8.00	- 81
276	45700CH10	200.00	itten.	in-	6.	ten pinns.	-001	m	3 7	kj	- 6			6.00	96765.61	nne		- 46	0.00	- 81
1PH	EEDIDORNA WHISSE AVTROACH.	390.4	3901	90:	4	ISIA PERIOD.	500	nn		60	- 3	1.	H I	1701	616075.72	D066		- 31	30922.00	- 1
216	AT TRAVE OF THE BAPTED.	229.6	late	10:	e	TES DIM OO	\$210	10	1:	NAG :	- 10	1.75		0.62	DESCRIPTION.	me.		- 3	440.76	- 00
100	DOMAR OF THE BOYARS	100.0	1000	100		FU IE 200-200	5.540	do	()	NAS-	. 0	6		0.06	1112046	1,0146		- 4	-63M/16E	46
1190	THE REAL PROPERTY AND THE PARTY NAMED IN	384	1675	100	it.	\$8.0 STUDO	3,10	10		64	- 1	1.13.		11,047	27503.17	titia.		-1	\$100.00	- 4
spe.	4-1630 OF DIE 8-07-80	736.8	Jul 3	tab.		20.5 (06),00	9012	22	2 7	8.7	- 0	2		1.61	79am C	11%		- 4	13338.61	- 6
1980	2 1670 CF H4 839 RE	39.8	ides	100	0	JULY DESIGN	900	10	h: -	10	- 30	1		0.00	15mm dv	HID		- 47	100000	- 10
181	THE ART OF THE BATE OF	(36.1	JIM.	100	9	TILE 278.00	3.10	10	10	66	- 3			0.40	17300.00	me		- 31	1400.03	- 4
101	ROBOTERS BROOK APPROACH	126.1	les.	100		10.1 106.06	6(4)	m I		íi .	- 4	1		807	80177.00	10%		- 1	7798.4%	0
1000	WOOLAND REMOGRAPHMONEY	239.4	ma.	100	10	10.E 306.00	60 30	00	b . 6	3,0	- 10	3.		0.42	36322.63	one.			2500.05	- 44
184	ERE MANUE ET	(16.6	3013	00	0.1	EUL) 375E-00	9010	10	F	12	110	i i		0.73	11564.21	mis.		-1	4612.46	10
187	16 KINDS E WAS	344	NO.	188	0	PU.E :077 DE	4014	60		63	- 8			8.75	ARREAS	ING.		-4	10011.00	- 4
1006	(B) MARKS	36.1	2005	res.	0	16.1 (88.00	9(1)	20	1	41	- 2	1		320	THE REAL PROPERTY.	mes.		- 4	masm	-1
180	IN WATER F WAY	(36)1	lim	10.		201.000.01	3(1)	00		11	- 15			100	18977.61	10000		- 16	0.000	18
tou:	STICAPARETS	200	Topo	46		19.1 (60.00)	4617	10		6)	- 1	1.9		6.00	76mm 07	Trrise .		-1	9873.00	- 6
108	13t MARKET	38.5	Dat.	io.	181	10.2 340.00	- 4010	00		6.7	0	0		0.41	23750.18	pien.		- 1	243314.0	
216	174 MARKETT	100.0	1000	in-	40	1011 WELLOO	2781	-	-	9/		$\overline{}$		1111	980.51	-		- 41	1100.00	10
291	STEMPERS.	39.1	lies	we		2012 988.00	3.10			83	- 3		,	2.17	307.10			-	1421.22	-
260	Sea Maria	2018	Ines.	in:	in .	10-1 380-00	0(10			8.0	- 1	, -		824	THESE NA	-		=#	3735	-2-
NAT.	THE BASE TE	25.4	104	90		703 3 m do:	5122	_		0	- 2	$\overline{}$		140	7100.47	-		- 4	3/3139	4
290	DIR MANUS CT	20.3	ding	30		PEX 110.00	4 10	ACC 11		80	7			3.86	55,979.21	ma			#103.86	
artic.	HOOCHEATH LIT	28.5	210	lan.		10.1 (111.00	9(1)		-	N/	- 6	1		426	(Welture)	-		- 1	2211.00	-0.
ier.	DET MANIE TO	100	last	100	4	32.X 385.00	ajm			E2	- 3	_	=	0.00	ADSTE	-		-1	-063.77	- 1
au l	INC MARIE IV	10.5	128	w		ANY 19810	4(4)			12	- 1		\rightarrow	8.71	11119.00			-1	MARK DO	-
201	Ewstareway	200.7	10.50	m.		307 79680	900			8.5		7—1	\rightarrow	833	-4011.71	K1 (50mm)	-	-5	5.00	-7-

macon.	0.0	10001	state	start!	- true	SCOREGGE	100	Materials -	Comments.	Dates	CANDERGRAM	THE REAL PROPERTY.	Appropriate	A S	+ + +	ì	Seed Seed	20.00	WIII.	25.106	1001
304	# WATHER WAY		TRUE .	1907	im.		28.5 361.00	9(1000	1	2.2	- 6			mari	57933	proie.		- 5	10,000	- 8	
346	II) WALRES WAT		in a	ORE .	901	H :	DEX DIE OF	90000	1	901				1139	11940.30	106		- 10	0.000		
1000	THE MARK ST.	==	16.2	1965	100	0.	1003 (MC06	40,4295	1	(82	- 9	1.		709	14296.07	nts.		- 1	3000 00	- 9	
210	THE MARK LET		10.6	uet.	W.	4.	TALL DISTUR	911181	ķ.	382	- 1	1	N I	JUD9	130333	troe		- #	395240	- 10	
212	willing agency mo		20.2	1885	46.		20.1 113.60	424800	2	36.2	- 3	1		537	7886,74	215		4	\$100.51	- 8	
710	TT WASHER WAY		ab i i	m7x	m	q:	h6.1. g00.100	864360	1	364	- 14			3.11	8917158	nte		-4	11.00	- 1	
237	A ROUGE SHOOL APPROACH.		39.3	364	10:	4	100,4 Table 001	3,1119	T.	91	- 3	1		3.000	4199k3Y	374		- 4	1011047	- 4	
110	RISORRIW SERGE APPROACH	- 3	16.1	pert.	00:	10	30 x 301 00:	90,13390	1	No	- 8	1		3.70	32299.30	me.		- 4	HOCT	- 10	
4190	F BOSONE WHOSE APPROACH	=	M.L.	1965	100	4	100.0 (04-5.00)	911,000	li.	16.2	- 1	1.75		1.00	45687.23	074			JAME AND	- 4	
												Tim	at 1750	ses W	10022416.02						
											Best	pros	898	NAME:	317748.2S						
and.	YOU DESCRIPTION	-	MX.	Tree.	w.	14	263.000	- 0000	Saic	Maria	1.14	1.94		and	\$3400 nd	orw -	- 1	- 4	2790.16	- 100	
238	HI DOT BARRIES TO		10.5	100	100	e.	10.1 130.00	211000	11	540				0.98	6381.08	DOM:			1701.45	- 6	
21	TE DOI BROWN HD		10.0	III	00:-		103_17100	371010	1	1440	- 1	1.1	1	0.00	2900.00	TOW .		- #	1000.71	100	
201	CITORD WHERE'S NO		16.8	100	196		29.3 322.69	1210.00	1	Jule:	- 1	1		-0.47	18947.97	D/DM		- 1	1907.95	40	
3,96	XA GIR BREEKE HE		mi:	111	100	10.1	1911 Links	1,1000	11	18.60	- 1	1	-	13,794	\$1633.40	imu -		11.	1609-57	. 60	
357	A PERMIT WAY		18.8	107	ian:	0	20.5 SHI 60.	3,3100	1	Print:	3	1	u .	0.13	4617130	1719		42	3502.63	90	
2740	WEIGHT WHING WIT		100	126	te :	6	hax rmini	11800	10	(intelligence)		1.7%	4	10.10	35700.86	mra .		- 8	100.00	- 00	
210	NEOD MINE IO		14.5	met	100	11	24.2 341.00	3(1000	1	F100	3	11		3.60	240041.01	min.	-		2900.6E	- 15	60
2310	WITHHIT WALL	- 1	105	pie.	100	e	16.1 108.00	271999	1	lute	- (r)	1		0.26	33355.75	DTH		- 1	TIME ()	100	
214	PRODUCT MARRIED NO.		iax.	434.	100	10	10.5 Kim 66	0.0000	4.	1946	. 0	CO.		0.00	8803.65	1000		101	EDW/M	46	0
344	ACUID BRESS III:	_	16.7	18.67	10:	0	203,32789	1 1010	i.	1940	- 2	1 .		30.00	41789.55	2220		- 1	1901.00	- 10	1
JEE	26PERM AND		70.1	460	tab:	1	20 5 SEE 00.	- 2 1120	1	840:	- 4	3.		9.96	CUTTER	ime:		- 4	1987.90	80	
216	24 coor seasons mr		18.5	ME.	Title:	0	161,0999	171010	1	WE.	- 1	100	1	min	THIST	HER.		- 4	109-11	- 80	
TES.	ALL COLUMN TO GRANT TO STATE	_	10.0	lux.	60	10	26.5 397.00	2 500	1	1940	- 3	1		0.00	753mil.04	DOTA :		- 11	3000,000	- 45	
4160	AZ TITO GROSCE TOT	\neg	14.3	leve.	100		16.6 (96.00)	10/1070	1	11166	- 9	ŭ .		238	12093-00	artin.		- 11	1000000	40	
Ut/	28 MS ORBIGE BD		14.)	1444	100	10	PAY 340.00	313600	4.7	(harris	- 4	A	4	76.06	13560.W	2074		4	1,005,160	. 80	6.
216	alteresett no		19.3	Sept.	W.		23.2 (238.00)	111000	11	946	it	ž.		9019	1960344	11110		- 11	7000	10	-
2145	SEPTEMBER 11 NO		14.1	1013	188	0	24.1 311.06	371000	4	1846	. 3		4	4.66	Jailto KK	mw.		4	1463.32	- 80	
2660	SECURITY SEC		11.1	HILE.	m.	e .	34 3 311.00	114000	1	940	- 1	1 -	1	mon	£1900 TH	ithe :		- 4	2000.00	. 80	
341	TTJAARELL 300	_	811	100	100.		301.0303.000	1,1010	1.	19.00	- 1	100	1	8.65	29616.87	TOTAL .	-	- 1	1896.00	- 85	
ditt.	\$100 FEBRUARY WILL		HT.	inta*	801	e.	10.1-010.00	321000	1	A40	- 3	7	+	1004	19755-94	DITH		- 4	4983,478	100	
241	STORESTY AU-		14.3	2946	MC.		54.1 (E) (E.00)	0.1010	4.	(840)	. 9	1.		0.03	1198 30	DOTM		A)	1300.54	.00	671
200	/Y conservation		18.1	Ann.	(0)	id.	24.3: SP1.00	3 1000	1	NAC		LPL:		3024	(800,76	1700		- 37	970-10	-10	65.7
315	SZCHORACTY MAI		11.1	7915	in.	0	28.2 (28138)	3,1000	4.	(9.40)	- 3	1.75		0:30	\$1003.70	UTM	_	- 4	2156.66	100	63
380	consistent m		14.0	MR.	(tre	Nr.	16.1 33080	2 1000	1	bet	. 9	1.11	1	821	SHIRLIN	nin.		- 1	Human	- 10	
347	se our amenic mis		81	inti	100		111.741.60	2 32 80	1	816	1.5	1		0.61	20400.12	1000		- 11	2504.71	- 4	60
ènc	ancivenerrali:		14.5	mg's	90.		14.1 (07.00	\$ 1000	1	100	- 9	1		0.27	31797.76	TITTE .		- 4	D#6.40	- 16	
948	34 UNE BROOM IN		14.3.	Tak!	(4)	16	AA.E. 207.00	(1)1010	4::	R40.	0.	3:		30.945	237407.00			- 1	1800.58	- 40	
236	ALCOHOTO BILL		18.2	MOX:	00.	u	74.1 312.00	1/1000	1	130	- 3	1.75	1	9.66	26773.03	1004		.41	2001201	- 16	
216	27 OURSESSE HD		H3:	1114	160	0	24.1 (04.00	3.3000	14	AAG	- 8	1.6	,u	6.63	700317.70	Ute.		- 1	2006:46	- 4	
251	SE DID REPORT HT	- 1	M.S.	MET	dia.	la.	18.1 341.00	3 time	Ju	Adm		1.77		0.096	16760-81	PT-1-200119		7	1000.15	- 4	677

District Source Data
Page 7 of 6

merry.	0000	1000	******	Sec. of	(0.0)	STORES	ant ye	Marient Mariates	TAXABLE .	1000 NUL	emelection	THE REAL PROPERTY.	Admicrosoph	979	4.0	1	See See	96. 10	8000	100
310	18, FVEXETT: NO.	- 5	18.3	400	100		18.1 317.00	913900	1	PH0 :	. 3	1.		man	19307-81	THE .		- 1	(1903/66)	614
710	(4) EVER (I III)		RT.) er s.	10	N	64.E (0/0.00E	311000	0	1000	- 9	0.00		0.000	45810.71	me		- 1	319661	Na
E553	V2NOCO NO	- 1	4.6	HEF	100	4	24.1 307.00	2111000	1	AND:	1.4	2.0		1.89	Addd 71	DOM:	=	= 1	3101.00	91A
SW.	4000303130		4.1	HIR.	10	4.	14.1 300107	2.900	ti-	No.	- 3	k-1		950	2.59(9).43	drost .		- 11	1100.00	6.4
450	STWINGT SE	- 1	6.5	1688	16.	6	261-00326	8/80000	1	446	-3	175		680	12707-01	31196		$=$ *	189.57	SIA.
216	WORNT IN	- 1	43	204	911-	Ø::::	183.07506	2.23800	1	440	- 2			0.58	2511144	nim :		-#	1465.11	814
216	-69100 IT NO.	- 5	11.	ine	160.		74.2 5mmm	3,3000	1	F40.	- 3	1		0.61	21114.00	DOM:		- 1	210674	10A
30	# D3MMED TT	- 1	1.3	1100	00		13.1 100.00	0,000		line:	- 1			0.09	20400.01	OTH		- 4	1907.00	104
264	15 WHEN DE	- 1	11.	2584	16-		24.1.30(00)	2,71000	100	MHE:	1			1,11	10033.64	019		- 4	315599	9/A
201	207,0000567.180		(1)	1856	100	4.	18.1 (94.00)	231010	1	940	- 3	£ .		10.00	#15W-55	104		- 1	4100.53	10.6
All:	2294884T18		44	White:	180		24.1 305.00	1.78030	1.0	1930	- 3.	1		225	788.70	LITTE .		- 1	5 MIT: 14	-10
304	10/5/86/T1W	- 4	10.0	Air.	16		18.1 (010.00.	miste		040	- 5	Life.		000	- Armi M	inte-c		=#	2789 55	66.6
365	200000037		42.	147	100		28.2 122.80	915788	1	No.	- 8			0.000	.7015.64	2009		- 6	0.000	104
anc.	10/01/09/07 200	- 5	1.1	DUV	00:	6	P#.T_291.00	9 1010	1	bio.	- 9	LEC.		0.00	TMART	1016		- 41	1005.04	866
364	GET TARRETT THE	- 1	16.0	TROUGH	100	0	24.1 W10.06	111000	1	PME.	. 1	1.4		7021	204690	0004		=#	KENLIN	BA.
340	1070/00/116		1.2	911	00	à.	FA 1, 201 AV	5 900	1	1940	1.3	1		0.00	38037%	376			7.514.67	40A
2015	FCUMBER ST	- 4	N.	179	(d)	ų	PÉZ STRAN	Sistem	1	940	3	4.5		E36	make 64	916		- 4	807.24	904
>nc	12:0:0MHEET	- 14	1.5	154	m	6	19.2 (19.00)	3.000	6	No.	3	1 -		3106	19927,146	nre.		- 4	1101.54	808
In:	DESCRIPTION OF THE	- 6	12.	ne	ile:	6.1	154,310.00	3,3000		No.	- 3	1		801	3199.00	21176		- 1	THEFT	904
111	EE/WAMBOTT	- 6	13	1997	100	M .	\$1-1 TM/00	3,7000		946	1.8	1		0.380	7964.08	TOTAL .		- 1	1901/49	aca.
200	DICTHERMACANE		4.3	176	14.		75.1 (1900)	3.140000	4.	PAC	. 9	4		400	900.60	WINE.		- 14	3,007,002	104
214	271MMMER37		11.0	111	140		411,111.00	9 3 3 3 3 3 3		946	- 1			31.14	4,017,00	030		- 8		104
31%	23 HAMMAN S	- 14	4.0	1943	un.	W /	23.3 Alli 00	3.125500		2840°		4		6.04	AUTE	110w.		- 4	494.15	0)A
disc	ST SHIPMING SE	- 1	KS:	10	in.	di.	197 32240	9/1/000	1	No.	- 6			828	766.0	1719		160	200	138
MIT.	ETYCANAL YOUR REPORTED	- U	0.3	166	100	9000	257 565.00	1 1000	1.	540	- 3	1		0.34	1594.11	2009		- 31	1191.59	104
2190	117C0944C0009F8F	- (1	4.6	123	100		13.1_DH 00	979000	1	940	- 4	1		mur	#177.6 <i>d</i>	TOTAL .		- 1	20000	10.6
2790	25 CAMAL 11/20 AM	- 1	13.1	mbo:	861	W	75.3 MELOS:	311000		hati.	3.	4:		0.07	:2509.11	2000M		16	+0134	464
PRC.	ART CARRY, VISCOURS		11.	133	(F	W0.1	153:33500	471000	4	NAC.	1.0	1		3.01	99019.22	21046		- W	.1009.47	Ha-
281	66 (230cH, 516W RD	- 1	6.0	104	167	0.	25.1 MADO	313000		ME:	- 7	1.7%	-	834	10123.86	27746		- 1	2534.54	SIA
dev	SECRETAL VISCAL BIS	- 1	13:	955	100		TYX RESP.	9.9000	1	dele	: 3	X		800	2010.28	1176		-6	TERRIT	6(A)
384	SE CARIO VIEW ED		EE.	196	90.	W	311.4 30m.00	5 3000	1.	N/E	- 1	f.Ft.	=	633	2547.00	me.		.X2	1911.79	264
2946	TOO CASHAL SOCIAL MIS.	- 1	107	had.	100		PEX_36E00:	371000	1.	John .	- 9	100		TOR	90077	DOW		- 10	2294.04	104
266	DOCAMAC SHEW AIR	Ç1	13:	144	MC.	6.	1.C.1.166.00	9,14000	6.	A.Mr.	1.6	1		433	90179	20746		A)	2801.00	. 35 A.
ALC:	240 custor manicipal		9.4	100	an:	M.C.	23.3 (80.00)	3 4mm		No.		1.25		16.29	701837	LITTER C			3300000	94
200	DESCRIBATE STREET RES	- 1	10.0	170	140		MULTINE	3.4000	4	930	- 4	1		11.04	\$2500.00	216.		- 1	HEUSE	904
im	INJUSTICATION IN		nd:	101	m	er i	10-7,749.60	3.400	8.	940	. 9	1.		110	41118-61	VITR.		- 1	140.77	N/A
780	DESCRIPTION OF SAME		10.0	100	90.	600	151,11090	1 1010	1.0	146	1.0	1. 1		10.0	56361,70	mmr.		- 4	339679	alw.
awn -	BURNITH SAME STREET	- 1	NT:	134	90	4	13.1_131.00	571000	1	He:	- 0	1		0.07	1777K-06	1004		- 1	1071.49	iiiv
2961	WORLD THANKS WHE	- 1	13.	130	9017	6.	10.1 (10.00)	3/3000	t.	Ne	1.4	0		9.36	190.70			4	3,005/64	MY.
F93)	SA DESTRUMENTAL WAY		111	100	00:	ii.	22.4.134,00-	111010	4	160	- 1	1.29		3.00	307511	Ime .		- 1	384.07	NV.
291	AL BUTCHBOOK WAS		11	134	w	4	22.2 324.60	3 1000	4	NA:	- 3	1		9.06	DER. CL	UNIA.		- 1	1119/30	494
en	Southout to	- 14	0.3	187	W.	w.	153,345.00	titem .		Mar.	- 1	1.		8.0%	96931	1200000		- 1	100000	AN .

Detrot Source Data Page 8 of 5

Descript.	900	6000	Page 1	- con-	SCHOOL S	196 -006	Noomile	MARKEDOS	(man)	NAME OF STREET	HINDRED	Management	8	*	Ĭ	See Asset	2	William St	20,716
268	T-44/MIOR.P1	24.5	113	im:	6	13.1,342.00	3 100	1	940	- 3	1	4	71.185	1907.61	ULM		- 1	:1177.50	BV
295	BOOKHTTERANER WARR	113	131	100:	e	13.1_(12.00	121010	0.10	1996	9	1	1	1000	644.0	DOM		- 1	2011/0	100
296	DISTANCED IN	ts.t.	1139	100	et.	73.3,336,00	117700	1	Ake	. 1	t	t .	39.075	234433	10146		- 31	33,99,67	304
396	SE WORLD SE	18.8	133	167	4	\$13,33780	3 4114	6.0	346	-11	14.	+	.0134	7111.76	HTTE:		=#	ipat 17	100
276	SECTION OF SECTION SEC	29.5	130	16.		23.1 3.00.00	373800	1	446	- 5	í.	th.	531	9566.81	0194-		. 4	Umst	_ 5(Y.
299	pe anterent s.m.	111	136	m	m	Par simm	3 4100		316		12.	1	THE	2000.le	atter :		_1	139.49	100
300	ballweight (#:	24.5	1144	50.	0	10.4_940.00	1 1000	1	1940	- 1	1.0	1	.0.34	5891.12	2019		- 1	310(6.44)	3/Y
1037	10 049KH 18	23.3	144	00	le .	13.1_144.00	3(3010	1	1000	- 3	1		0.30	2011.45	OTH		- 4	102133	100
100	di secondi sec	11.3	1143	166:	4	73.1 295.06	1000		A40	- 2			0.964	849923	T007H	=	- 11	100(0.0)	97
201	HACADDADE DR.	11.1	345	10.	ù.	11 1 BUILDS.	9(48)	1.16	MAG	6			0.03	MORESE	DOM:		- 85	5,465	.016
TOPE	II commen	23.3.	110	= (21.1 (MILO)	3 1600	1.	9.86	- 8	14.		6.10	7900.22	TATE OF		- 2	1339.58	674
mis	miterios an	344	1955	100	9	111 385/6	3 4000	1	200	11.9	1.76	-	3.65	28234 (0	inte :		- 41	4 (fré. 2)	- DIY
300	# 12HOE MI	11.1	iner	100	e.	E11 38100	3,1000	11	740	- 3	1.79	1	0.61	3866.03	DOM:		-4	1303,00	- RV
1077	SET TAYOU ON THE	11.3	im.	00.	ie :	FE:1_0%.00	1 1010		946	- 1	1.1	-	0.00	27309.03	1770		- 1	1103/67	109
3080	If LANCOR BUT	14.1	3655	90:		73.1 355.00	3 3000	1	PMI	9	1.75		2.04	BHIN50.55	(0)000		- 1	3507.00	10
_									15	link.		315	HERM.	189011-9			.,		
mil	DETERMINE:	W.T.	late.	in-	ě.	PER SHIPM	- 8/4 ren	1 10	560	- 96			1001	THE PERSON NAMED IN	inte:		- 11	- WXX.81	Die
214	K PREMINE	14.2	INK.	100	11	24.2 SIE.00.	504.080		M	- 5			0.00	804.00	1010		_X	6.000	- 614
310	\$24 (MARK) 1	HI:	136	10	6	£3.1_£16.00	40170		300	- 1	1	_	3.58	00413.77	01W		- 1	5913:000	10.6
118	600(MARCH)	14.3	HAZ	00		72.3 ARE 00:	611.00	6	360	5.4	1		0.00	9006.43	LUTUR		16	(641,44)	16.4
311	4 MARK 17	45.1	340	148	41	22.2 041.01	1,010		18.0	- 3	1		3.66	28959.79	territe -		- 1	105.0	NW.
315	20 MARKET	79.4	(34)	160	W	25.1 (60) 00	97,793.0	1.0	78.7	- 1			600	78,613	trem		- 16	0.00	6 V
117	22756NW ST	14.0	intr.	19.	0	19.1 DO M	SCHALL	1 2	383	- 6			0.064	7966.03	nne:		- 86	0.00	80v
310	ALTOHOR MI	313	194	100	9	212 186 00	2 1040	1	314e	-: 5	1.1	1	3031	1,2369,33	DW.		- 11	1132.36	fly
ālinī	10 VPS (HE)	11.3	un.	00: -		23.1 199,00	111000		996	- 4	Ĭ.	-	0.00	33799.89	(IITHE		- 31	909.22	N/W
20)	DICHERUMAN (III)	14.3	146.7	000	et.	F1.11.2907.00	9 3000	1 60	her	h	4.8		0.08	3,5944,70	(01m)		4	1122.00	alv
										200			APE OF	LIMPSON PER					



The second second second second second

3000

AODOU

650

Cross of area per traditional unit

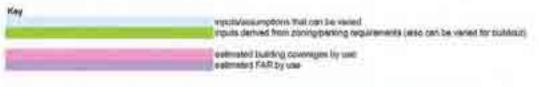
Minorium List Dive Hor density)

DITHEMMA LOW TRANS (M. 40)

Billional Corresponded FAS	_	a Page 1971	-	
	TTO:	0.79	arw	
Financial Research			(15.00)	
Total Floor Area dootprint x stones	A0000	40000	40000	
Building parking ratio	DTC	019	BOW.	
Profiting species (nest monthly)	27.0	27.0	31.80	
Parking spaces (restaurant)	29.0	20.0	40.00	
Parting spaces (office)	.00	9.6	5.8	
Ferning spaces (retail)	10.0	5.0	3.0	
Fursing spaces (hotel)	8.2	8.2	21	
Farting spaces (Invitations)	8.0	12.0	2.4	
Fishing spaces (Consumer Services)	5.0	2.6	3.0	
	90	32	91	
Total Spaces		37	63	
Reduced parking requirement of applicables	50			
Spece needed for parking	22445.0	20985 0	26583.7	
Total Ingervious sine	30443.0	32403.0	25365.7	
% partooy	192%	59.6%	- 317%	
% footprint	353/6	35.4%	28.2%	
Marine FAR	- OTC	ora:	OTW	
open simply	20%	20%	20%	
Andliany areas	276	5%	3%	
% parking.	52%	52%	34%	
N Building colorage	23%	23%	21%	
Emmint (ma EAR	57,60%	91,000	11,03%	
F.68	11.05	BE 000-	1005	
FAR research	Too	¥ 000m		Note: Impuls from Welnet 2 FAR completion based on process flow porter
FAR other	13.00W	(1.000)	# 00%	home sales contidued to the beautiful parties to from a son beautiful.
FAUT trains	11 00%	00%	W 50%	
FAITHGUI	13300%			
		F# (000)	E300H	
FAH ICIDEROOF	T 2000mm	14 0mil	1.000%	
FAR CONTINUE OF THE STATE OF TH	5.500 to	2,400%	3-977	
Principles (Section Sections)	DTC:	DTG.	0164	
LOT AVER	0.321.851	17,200	196307	4.635,967 st
		THE REAL PROPERTY.	- 17	
Extracted Budgled - enemigrating	OTC	010	: grw	TOTAL
Restauted	346.518	64,259	25,000	338,333 par
Office	346,516	100,000	7,679	
Retail	628,248	64,209	27,819	604.276 st
Hotel	628.246	128,418	11.819	100.465 w/
Peditional Company	246.518	128,618	3.910	. 300.642(w)
Consumer Sensory	246.518	27.618	11,819	285.853 at
Residential (at)	5.009.063	198.852	175,318	4.963.223 #
Residential units theoretical (1553 Miletin)	2.375	592	132	
Residential density per storing	-1.72	12	12	11.50
Regidential ories per assing	1.00m	287	56	128
CONTRACTOR OF THE PARTY OF THE	200000	-		
Resiliantia (sects)	1.006	207	58	5.225 with
Totalincital of	3 043 558	253.671	24.856	7 8 7 5 CH 3 15

Wastawater Flows by Use: (gpd)	TovV	DYC	big	DTW	CHE
Reduction (SS/sest)	35	197,212	81,367	29,467	250,000
Office (75/1000st): Medical Office 250(D): Chart	.75	18,468	7.567	501	26,647
Medical Office 256/Dr China	250	2	10000	900000	N.V. 4
Result (50/1000 str.	50	25,412	5210	391	30,214
Hotel (110/bedraom)	110	29,399	21.732	2.500	113,128
thethylioner Minning Ferror 1500beck	150	34,588	18,070	832	53,580
Consumer Bandons (beauty accord 100sp.mr)	100	248.518	27.518	15,810	285,853
Residential (110/bedroom)	220	221.581	37,657	2362	291,400
Total	1 1	834,074	187,122	48,702]	1,040,898

WW Occupancy Factors Bestweet (street) Meistel Office isformet Hotel Institution Nursing Home 82/60 Consider Service Penalty Sales #25/69	43.75 600 110 1000 500	
Calcutations	#301 pai/1000#7 Rentaurant 0.8 pai/ff 0.07298 seei/ft2 43.71 #2/heal 175 ft 4 person table	8.814378278 8 on e equide. 13.22875656 8 on e equide.



A STATE OF THE STA	DIG DIG DIW
Dimensional Limitations	The state of the s
A Committee	200 100 200
Lot Could age (manage + parting)	300
No.	TO THE WAY
Pengris Sense Javas (Dauf)	
and hearth has	
Parking	
Average area reveded per specir (sf)	- 400 Assets always manages area.
spinores/1000 of restaurant	The same of a spine on the dispension per amore fill a
species/1000 at office & mattulioner	and power or I asses on 110 of long of 1 offices one and from 1900.
species/1000 of rotal & consumer services	22 reset on a course provided from foreign Plants
spieces per missiontial unit	T I have been been been an entered and some manners
speces per hotel/motel unit	E continue contact on the part to account
Pinderig Reduction for alarmal packing	CONTRACTOR AS CONTRACTOR

	Ty Refer to			
Assumed mix of uses	ato	gra	OTW	
N- of area commercial N-of area residential	#0.0% 80.0%	#0.0% 60.0%	30.0% 70.0%	
ts ressurant	5.0%	5.0%	30.0%	
% reflat	10.0%	60%	5.0%	
% Hattutorer	10.0% 5.0%	10.0%	5.0%	
Je soutenies services	5.0% 100.0%	100.0%	100.0%	
Site Assumptions 15-67s used for ancitury uses	When the street is to		- INTOCATAL	

OTIC assumed OT nix of comm. no seem	G described Effect of a	Tues park
000	0.00	9.1
0.10	0.00	0.06
0.00	0 10	0.00
0.40	0.40	0.3

Residential Use Areamptions Average unit was safe Gross of area per residential unit.	1000 to the section of the section o
Gross of area per hobitimond unit	(SS) (SS) (SS) (SS) (SS) (SS) (SS)
Minusum Lot Size (for density) DTN Min. Lot Size (N-40)	4000 Stramment and analytical and analytical and analytical and analytical and analytical and analytical analy

Estimated Governm and FAR		of the same of		
CONTRACTOR OF THE OWNER	010	ora	DITA	
Businetive footprint 10000				
Total Floor Avea (footpirtrit x stories)	40000	40000	40000	
Building parking ratio	010	076	OTW	
Parking spisces (Pesidontial)	27.0	27.0	31.5	
Perforg spraces (restaurant)	20.0	20.0	80:05	
Parking spaces (office)	6.0	9.6	3.65	
Parking spaces (result)	50.0	5.0	6.0	
Parking spaces (hobil)	62	6.2	8.11	
Parking spaces (institional)	6.0	120	2.4	
Wing species (Committee Services)	10	20	5.0	
ote Spaces	60	82	301	
fadoced parking requirement (# applicable)	56	57	100	
loace needed for parking	22465.0	22861.0	25083.7	
otal impervocus area	32445.0	32003.0	35363.7	
i putting	(10).2%	60.0%	71.7%	
A Sopprint	30.0%	10.4%	28.3%	
n. Acception	20.0%	39.479	20-039	
Medico FAR	DIC	Dig	OTW	
peri resea	29%	20%	20%	
dollary exem	2%	8%	6N	
L parting	52%	52%	54%	
Challeng townspr	22%	23%	21%	
THE RESERVE OF THE PARTY OF THE	CMIL	\$1,20%	14.515	
All femilifies	00 6879	5472%	79.38%	
ACL (MICROPHY)	. \$42%	24009	6.60%	
All office	4.87%	2,50%	254%	
AFL Three!	\$25	4 0000	4,089	
AN fatel	19.26%	8329	9.0029	
AFI sentama	£102%	34779	7.80734	
AR teceumer solution	8 922749	5 800954	147405	
	DIE	016	IDWI:	TOTAL
et Ares	2000,040	C108.484	-	1,874,730
-	111 61			200 2114
almosed Sunting -assaine printing	810	Ltg.	grw.	TOTAL
Contract Contract - Secure Contract	26,331	50,399		76,735
Office	26.331	80,638	6	106.970
SHOW,	52.863	50,399	ě-	103.062
1000 ·	52,663	100,799	6	153,481
cottlybonat .	26.331	100,795	ä	150,461
340 414 41 45 50 1 4 5 4 5		122112	3-	46,491
Consumet Sentons	26,834	20,160	3	920.765
Residential (sf)	315.977	004.788		
Residential units Esporetical (1333 siltunit)	三37	456	. 0	- 691
headensw density per zoning	. 12	12	32	750
bradenkal units per 201mg	181	330	0	475
Residential (Units)	183	310	0	478
Citat communicated as	210,652	403:102	a d	213.045

Wastewater Flores by Use. (gpd)	Title V	OTC	DIG	ptw	GPD
Hostacrant (Street)	- 35	21,065	40,319	D	B1,384
Office (75/1000sf) : Medical Office 250/Dr - Chart	76	1,275	-8.048	:0	8.023
Medical Office 25000 Chim	250		- 2	- 7	0
Recel (50/1000 ef)	50	2,633	2.520	- 0	5,153
Hotel (110/begroom)	110	8,9121	17,068	- 0	25,970
institutional (Nursing Home (50/bed))	150	\$.705	14.184	0	17,899
Comsureer Services (beauty water 100rchair)	100	28.331	20.166	.0	46,401
Responder (110/bedroom)	220	35.500	80,469	.0	105,260
Total	r r	100.4221	189,757	0	270.175

WW Occupancy Factors Restaurant (stitueur) Morkool Office (stitueur) Hotel Institutione: Neuroing Home (128d) Communer Services: Reauty Septer (126d)	43.75 100 110 1006 1006	
Galculations	800 gal/1000f2 Restaurant 0.6 galft 35 0.02256 seet02 43.75 f2/sest 1754 4 person table	6.614378278 ft on a sup side 13.22876666 ft on a sig side

Total Buildout

	COTE:	1,115.	DIW	TOTAL
				Ò
		By Piglic (F)		
1 2	DTC	DTG	DTW	TOTAL
	272,847	114,606	25,608	413,063
	272,847	181,538	7.879	402.264
	580,911	114,608	11,819	707,338
	580,911	229,216	11,819	821,946
	272,847	229,216	6,910	507,972
	272,847	47,678	11.619	332.344
	3,415,031	1,393,639	175,318	4,983,988
	2,562		132	3.739
		to the second second	12	37
	a	0	0	0
	1.159	578	56	1.803
	2,753.209	916,862	74,855	3,244,927
Title:V	- EHC	01G	WED	GPD:
35	218.278	91,680	20,487	330,451
	20,484	13,615	591	34,670
250		- 8	- 9	0
50	29,046	15,730	351	35,367
210	98.308	38,790	2,000	139,098
150	38,393	32.254	882	71,478
100	272,047	W7,678	11,019	332,344
110	257,181	127,126	12382	396,669
	934,496	356,879	49,702	1,340,077
		Calculations		1
43.75		600 ga	/1000ft2	
100		Re	stautent	
110		0,8 (4)	/It	
		35	-73172-8	
100			rt/ft2	
177.5		43.75 ft2		6.614375276 ft on a
		(43.15HTz)	seat:	D.01#370270.IL0021
	35 75 250 50 110 160 100 110	TRIE V (17C) 35 218.278 75 20,464 250 9 29,046 110 99,308 100 272,647 110 257,161 43.75 100 1100 1066	By Posts (F)	By Page (F)

Appendix E: Subsurface Disposal Site Selection Matrix

Preferred Disposal Sites

Site #	Site Title			
Site 29	Town of Bourne - Main St			
Site 16	Town of Bourne - Scenic Hwy 2			
Site 19	Town of Bourne - Queen Sewel Park			
Site 10	Kramer			
Full matr	Full matrix of sites presented on the following page			

		Down G																					
S		of Wells	,																				
Sites		Bodies, Vernal		Proximity to		Cost of Acquisition/Valu e of Property		Competing Uses for Land		Number of Abutters		Compatibility with Adjacent Land Uses		Area to Expand/Reserve Area/Future Flexibility/Phasing			Accessibility for Maintenance and Operations		Wooded Area		Proximity to Downtown Buzzards Bay		
S		Pools/		Historical and																			
Ę		Wetlands, or		Archeological																			
ected		Environr	mentall	Areas			,										·			l		,	
a)	a	y Sensitive																					
Ň	Criteria	Hahi		4		3		9		8		7		5		6		10		2			
	Weighting					low (1),				-						-							
		yes (1) -	Score	1 (far) - 5	Score	med (3),	Score	1 (none) -	Score	1 (few) - 5	Score	1 (good) -	Score	I .	many (1) -	Score	1 (good) -	Score	1 (minimal) -	Score	close (1) -	Score	TOTAL
	Rating/ Score	no (5)	500.0	(near)	500.0	high (5)	000.0	10 (many)	000.0	(many)	500.0	10 (poor)	500.0	3	few (10)	000.0	10 (poor)	500.0	5 (very)	500.0	far (5)	500.0	SCORE
Site #	Site Title					mgn (3)																	
	Town of Bourne - Main St	1	1	1	4	1	3	1	9	2	16	1	7	1.75	8	40	1	6	1	10	1	2	98
	Town of Bourne - Scenic Hwy 2	1	1	1	4	1	3	2	18	1	8	1	7	121	1	5	1	6	5	50	3	6	108
	Town of Bourne - Queen Sewel Park	1	1	1	4	1	3	1	9	4	32	5	35	5	3	15	1	6	2	20	1	2	127
	Kramer	5	5	1	4	3	9	2	18	2	16	2	14	1	9	45	1	6	2	20	3	6	143
	Cape Aggregates - Scenic Hwy 2	1	1	1	4	5	15	8	72	2	16	2	14	122	1	5	1	6	1	10	3	6	149
	Route 25 Median	1	1	1	4	1	3	7	63	5	40	2	14	6	2	10	1	6	1	10	1	2	153
	Cape Aggregates - Ernest Valeri Rd 1	1	1	1	4	5	15	5	45	2	16	1	7	15	1	5	1	6	5	50	3	6	155
	Cape Aggregates - Ernest Valeri Rd 2	1	1	1	4	5	15	5	45	2	16	1	7	18	1	5	1	6	5	50	3	6	155
	Cape Aggregates - Ernest Valeri Rd 3	1	1	1	4	5	15	5	45	2	16	1	7	7	1	5	1	6	5	50	3	6	155
	Cape Aggregates - Scenic Hwy 1	1	1	1	4	5	15	5	45	2	16	1	7	6	2	10	1	6	5	50	3	6	160
	Buzzards Bay Bypass Rd	1	1	1	4	1	3	7	63	5	40	5	35	7	1	5	1	6	1	10	1	2	169
	Town of Bourne - Deseret Dr	5	5	1	4	1	3	1	9	3	24	10	70	9	1	5	2	12	4	40	3	6	178
	Ingersoll - Bournedale Rd 3	1	1	1	4	5	15	5	45	1	8	2	14	112	1	5	8	48	4	40	3	6	186
Site 9	Ingersoll - Bournedale Rd 1	2	2	1	4	5	15	10	90	1	8	1	7	5	3	15	1	6	5	50	4	8	205
Site 3	N Sagamore Water District	1	1	1	4	5	15	10	90	1	8	3	21	10	1	5	5	30	3	30	5	10	214
	Town of Bourne - Clarissa Jo Rd 1	3	3	1	4	1	3	5	45	2	16	10	70	23	1	5	2	12	5	50	5	10	218
	Town of Bourne - Scenic Hwy 1	1	1	1	4	1	3	10	90	3	24	5	35	24	1	5	1	6	5	50	3	6	224
	Sorenti Bros - Scenic Hwy	1	1	1	4	5	15	5	45	3	24	5	35	6	2	10	9	54	3	30	4	8	226
	Town of Bourne - Clarissa Jo Rd 2	1	1	1	4	1	3	10	90	2	16	8	56	20	1	5	2	12	3	30	5	10	227
Site 2	Sorenti Bros - State Rd	1	1	1	4	5	15	10	90	2	16	1	7	0	10	50	1	6	3	30	5	10	229
	Town of Bourne - Scenic Hwy 3	1	1	1	4	1	3	10	90	3	24	8	56	45	1	5	1	6	3	30	5	10	229
	Town of Bourne - Scenic Hwy 4	1	1	1	4	1	3	10	90	3	24	8	56	48	1	5	1	6	3	30	5	10	229
Site 34	Town of Bourne - Bournedale Rd	3	3	1	4	1	3	10	90	3	24	8	56	27	1	5	2	12	3	30	5	10	237
Site 30	Ingersoll - Bournedale Rd 2	2	2	1	4	5	15	10	90	1	8	10	70	11	1	5	2	12	3	30	3	6	242
Site 6	Town of Bourne - Scusset Beach Rd	1	1	1	4	1	3	10	90	2	16	2	14	1	10	50	1	6	5	50	5	10	244
Site 7	Plymouth Bourne Cns Trt	5	5	1	4	5	15	10	90	1	8	10	70	35	1	5	1	6	5	50	3	6	259
Site 8	Ingersoll - Plymouth Lane	5	5	1	4	5	15	10	90	1	8	10	70	14	1	5	1	6	5	50	3	6	259
	Ladd	1	1	1	4	5	15	10	90	3	24	10	70	10	1	5	2	12	3	30	5	10	261
	Stolte	1	1	1	4	5	15	10	90	3	24	10	70	7	1	5	3	18	3	30	5	10	267
Site 26	Town of Bourne - Little Sandy Pond Rd	1	1	1	4	1	3	10	90	3	24	10	70	12	1	5	3	18	5	50	5	10	275
Site 4	Weldon Park - Winston Ave 1	1	1	1	4	5	15	10	90	5	40	10	70	20	1	5	2	12	3	30	5	10	277
	Tassinari	4	4	1	4	4	12	8	72	2	16	5	35	0	10	50	8	48	3	30	3	6	277
Site 1	Cliffside Estates	1	1	1	4	5	15	10	90	5	40	10	70	11	1	5	2	12	5	50	5	10	297
	Town of Bourne - Herring Pond Rd	1	1	1	4	1	3	10	90	2	16	8	56	0	10	50	8	48	3	30	5	10	308
	Quinn	1	1	1	4	5	15	10	90	5	40	10	70	22	1	5	8	48	3	30	5	10	313
	Cape Sagamore - Ridgehill Ln 2	1	1	1	4	5	15	10	90	5	40	10	70	4	4	20	5	30	5	50	5	10	330
Site 5	Town of Bourne - Pinnacle Rd	1	1	1	4	1	3	10	90	3	24	10	70	2	8	40	10	60	3	30	5	10	332
	Weldon Park - Winston Ave 1	1	1	1	4	5	15	10	90	5	40	10	70	33	1	5	8	48	5	50	5	10	333
	Cape Sagamore - Ridgehill Ln 1	1	1	1	4	5	15	10	90	5	40	10	70	1	10	50	5	30	5	50	5	10	360

Appendix F: Treatment Site Selection Matrix

Preferred Treatment Sites

Site #	Site Title				
Site 16	Town of Bourne - Scenic Hwy 2				
Site 21	Site 21 Town of Bourne – Deseret Drive				
Site 10 Kramer					
Site 39E	Buzzards Bay Bypass (Belmont Circle)				
Site C	Sandford Properties – Main St 1				
Full matr	ix of sites presented on the following page				

		I														1		1		
Sites										Compat	ibility									
										with Ad	,									
Selected			Proximity to	Cost of						Land l	Jses									
ţ	No sites on east side, limit 1 3 ac		Historical and	Acquisition	/Va					(inclu	ding	Area to	Expand/Reserv	e Accessi	bility for			Proxir	nity to	
<u> </u>	parcels to downtown and hideaway		Archeological	lue of		Compet	ing	Numbe	er of	odors, t	rucks,		rea/Future	Mainten	ance and	I		Dowr	ntown	
Š	village	Criteria	Areas	Property	′	Uses for L	.and	Abutt	ers	septage	, etc))	Flex	bility/Phasing	Oper	ations	Wooded	Area	Buzzar	ds Bay	
	land less than 3 ac = 8 or >	Weighting	8	2		6		3		1			5		4	9			7	
			4 (5)	low (1),		1 (none)		1 (few)		4 (1)			(4)	4 / 1)		4 /		. (4)		
		Metric/	1 (far)	med		10		5		1 (good)		# acres	many (1)	1 (good)		1 (minimal)		in (1)		TOTAL
	3 10 ac, = 4, < than 10 ac = 1	Score	5 (near) Score	(3), Sc	ore	(many)	core	(many)	Score	10 (poor)	Score	>1	few (10) Scor	e 10 (poor) Score	5 (very)	Score	out (5)	Score	SCORE
Site Number			4 0		2		40		-			400		-	4 4		45	_	24	10
Site 16	Town of Bourne Scenic Hwy 2		1 8	1	2	2	12	1		1	_	123		_	1 4	5			3 21	
Site 21	Town of Bourne Deseret Dr		1 8	1	2	1	6	3	_	8				_	2 8	3				
Site 38	Cape Aggregates Scenic Hwy 2		1 8	_	10	8	48	2		1		124			1 4	1				
Site 10	Kramer		1 8	3	6	2	12	2		3		2.0			1 4	2				
Site 29	Town of Bourne Main St (Community C		1 8	_	2	10	60	2		9		,			1 4	1				7 145
Site 39 E	Buzzards Bay Bypass Rd (Belmont Circle)	1 8	_	2	7	42	5		3	_				1 4	1	. ,	1		130
Site 15	Cape Aggregates Ernest Valeri Rd 2		1 8	-	10	5	30	2		4	·	20			1 4	ł 5			3 21	_
Site 13	Cape Aggregates Ernest Valeri Rd 1		1 8		10	5	30	2		6					1 4	5			3 21	_
Site 19	Town of Bourne Queen Sewel Park		1 8	1	2	10	60	4		10					1 4	1 2			L 7	7 136
Site 22	Town of Bourne Clarissa Jo Rd 1		1 8	1	2	5	30	2	6	2				_	2 8	5			35	
Site E	Clark Robert Wagner Way		1 8	5	10	7	42	3	9	2		0.1			1 4	1	. 9	1		7 141
Site 14	Cape Aggregates Scenic Hwy 1		1 8	5	10	5	30	2	6	3		8.1			1 4	5			3 21	
Site 17	Cape Aggregates Ernest Valeri Rd 3		1 8	5	10	5	30	2		3					1 4	ł 5				_
Site 30	Ingersoll Bournedale Rd 2		1 8	5	10	10	60	1	3	2					2 8	3			3 21	
Site 39 W	Buzzards Bay Bypass Rd (Memorial Circl	e)	1 8	_	2	7	42	5		8					1 4	1	. 9	1		
Site 37	Ingersoll Bournedale Rd 3		1 8		10	5	30	1	3	2		111.0		_	8 32	2	- 50		3 21	_
Site 35	Town of Bourne Clarissa Jo Rd 2		1 8	_	2	10	60	2	6	3					2 8	3				
Site 7	Plymouth Bourne Cns Trt		1 8	5	10	10	60	1	3	1		37.1		_	1 4	ł 5	45		3 21	_
Site 8	Ingersoll Plymouth Lane		1 8	5	10	10	60	1	3	1		16.5		_	1 4	ł 5	45	3		_
Site 34	Town of Bourne Bournedale Rd		1 8	_	2	10	60	3	9	5		29.9			2 8	3				
Site 12	Town of Bourne Scenic Hwy 1		1 8	1	2	10	60	3	9	6		26.8			1 4	ł 5			3 21	_
Site 11	Sorenti Bros Scenic Hwy		1 8		10	5	30	3	9	8	8 8				9 36	3		4		_
Site 9	Ingersoll Bournedale Rd 1		1 8	5	10	10	60	1	3	1		7.9			1 4	'l '		4		
Site 26	Town of Bourne Little Sandy Pond Rd		1 8	1	2	10	60	3		2					3 12					_
Site 18	Tassinari		1 8	4	8	8	48	2		5	5 5	2.7			8 32				3 21	
Site C	Sanford Properties Main St 1		1 8		10	10	60	3	_	6	6	_			3 12		45			7 197
Site D	Sanford Properties Main St 2		1 8		10	10	60	3		ε		0.5			3 12				L 7	7 197
Site 33	Quinn		1 8	5	10	10	60	5		7		24.4			8 32				35	_
Site A	Martin Finch Lane		1 8	5	10	7	42	5		10	10				3 12				. 7	7 199
Site B	Byron Chris Main St		1 8	5	10	10	60	3		6	6	0.0			3 12			1		7 202
Site 36	Town of Bourne Herring Pond Rd		1 8	1	2	10	60	2	6	4	4	2.6	8	40	8 32	2 3	27		35	5 214

Appendix G: Treatment Technology Information

	M/ - I I	5 ! . 5 . ! ! /		et dans	A Little Live			Nl f	T. C. LEL		Tre	eatment	Reliabili	ty		Relati	ve Cost
	Wastewater Treatment	Example Equipment/ Process Names		Flexibility to be Modified	Ability to Handle	Odor	Operational	Number of Installations	Typical Flow Ranges	BOD [mg/l]	T:	SS	Т	N		
	Technologies	(Manufacturer)	Size	for BNR ¹	Septage	Potential	Complexity	in MA	[GPD ²]	30 mg/L	10 mg/L	30 mg/L	5 mg/L	10 mg/L	5 mg/L	Capital	O&M ³
	Conventional Activated Sludge	Sequox (Aero-Mod), JET (Jet Aerobic Treatment System), Modulair (Norweco), ADI System (ADI System Inc), Acculinks System (Brentwood Industries)		-			1	> 10	10,000 to > 350,000	all	al	all	•00	•000	•000	\$\$	\$\$
Suspended Growth	Sequencing Batch Reactors (SBR)	Aqua SBR (Aqua Aerobics), Cromaglass (Cromaglass Corporation), Ashbrook SBR (Ashbrook), Fluidyne SBR (Fluidyne Corporation)					-	> 20	10,000 to > 350,000	all	al	al	ell	ali	.0]]	\$\$\$	\$\$\$
sns	Oxidation Ditches	Lakeside (Lakeside), Wes Tech (Wes Tech)						< 5	> 300,000	all	d	d	000	. 0]]	000	\$\$\$	\$\$
	Membrane Bioreactors (MBR)	Zenon (GE Water), Enviroquip (OVIVO Water), Sanitar (Sanitar), NEOSEP (Kruger)		1	1	1		> 10	10,000 to > 350,000	all	al.	al.	all	di	al	\$\$\$\$	\$\$\$\$
	Rotating Biological Contactors (RBC)	RBC (Walker/ Ashbrook, US Filter/Davco /Envirex), Rotordisk						> 90	10,000 to > 350,000	all	.00	all	ad)	ad)	•000	\$\$\$\$	\$\$\$
F xed F m	Trickling Filter System	Bioclere (Aquapoint), SeptiTech (SeptiTech), Waterloo BioFilter (Waterloo Biofilter System, Inc), STM Aerotor (Wes Tech)		→		1		> 30	10,000 to < 100,000	all	all	all	all	all	•00	\$\$\$	\$\$
	Package System	Amphidrome (F. R. Mahony), Geo-Reactor (Parkson Corp.), AIRR (SPEC Industries, Inc)			1	1		> 30	10,000 to < 100,000	all	.00	, id	.00]	all.	•000	\$\$	\$\$

Treatment Technology Screening Process – Ranked by Odor, Reliability, Nutrient Removal

		Activ	ntional vated idge	Ва	encing tch ictor		lation nnels		brane eactor	Biolo	ating ogical actor	Treat	kage tment ant ¹
Criteria	Weight	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating
Site Area Requirements	2	1	2	6	12	2	4	7	14	3	6	4	8
Flexibility for BNR	6	1	6	6	36	4	24	7	42	3	18	5	30
Capital Cost	4	6	24	5	20	4	16	2	8	1	4	7	28
O&M Costs	5	7	35	5	25	6	30	1	5	2	10	3	15
Septage Handling	1	4	4	6	6	5	5	7	7	3	3	2	2
Odor Control	8	1	8	4	32	3	24	7	56	5	40	2	16
Operational Complexity	3	7	21	1	3	5	15	3	9	6	18	2	6
Treatment Reliability	7	1	7	6	42	2	14	7	49	4	28	5	35
Total Score			107		176		132		190		127		140
Rank			6 th		2 nd		4 th		1 st		5 th		3 rd

¹ = Package treatment plants include trickling filter technology for flows less than 100,000 GPD.

Weight ranges from 8 (most import) to 1 (least important)

Score ranges from 10 (favorable technology for given criteria) to 1 (poor technology for given criteria)

Rating = Weight × Rating

Ranking based on highest Total Score

BRN = biological nutrient removal

O&M = operations and maintenance

Treatment Technology Screening Process – Ranked by Costs

		Activ	ntional vated dge	Ba	encing tch ictor		lation nnels		brane eactor	Biolo	ating ogical actor	Treat	kage tment ant ¹
Criteria	Weight	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating
Site Area Requirements	2	1	2	6	12	2	4	7	14	3	6	4	8
Flexibility for BNR	4	1	4	6	24	4	16	7	28	3	12	5	20
Capital Cost	8	6	48	5	40	4	32	2	16	1	8	7	56
O&M Costs	7	7	49	5	35	6	42	1	7	2	14	3	21
Septage Handling	1	4	4	6	6	5	5	7	7	3	3	2	2
Odor Control	6	1	6	4	24	3	18	7	42	5	30	2	12
Operational Complexity	3	7	21	1	3	5	15	3	9	6	18	2	6
Treatment Reliability	5	1	5	6	30	2	10	7	35	4	20	5	25
Total Score			139		174		142		158		111		150
Rank			5 th		1 st		4 th		2 nd		6 th		3 rd

¹ = Package treatment plants include trickling filter technology for flows less than 100,000 GPD.

Weight ranges from 8 (most import) to 1 (least important)

Score ranges from 10 (favorable technology for given criteria) to 1 (poor technology for given criteria)

Rating = Weight × Rating

Ranking based on highest Total Score

BRN = biological nutrient removal

O&M = operations and maintenance

Appendix H: Subsurface Disposal Site Requirements

Below are notes on the calculation of the area needed for subsurface disposal. Greater detail is provide in the memorandum on the following pages.

Title 5 leaching field:

According to 310 CMR 15.242, Septic Tank Effluent Loading Rate with Pressure Distribution System, the maximum loading rate (for Class I soil (Sand or Loamy Sand, with Perc. Rate < 5 min./inch) is 0.74 GPD/square foot (sqft). Using a standard design of a 2 ft wide x 2 ft deep trench, the total loading surface area per linear feet of distribution pipe is 6 sqft (two side surfaces (2 sqft/ea) + bottom surface). Each linear foot of distribution piping is equal to 2 sqft of leaching area. Therefore, each square foot of area can take 0.74 GPD/sqft x 6 sqft / 2 sqft = 2.22 GPD/sqft.

WWTF effluent disposal field (Under GWDP reg. 314 CMR 5.00):

Based on the MADEP 2004 guideline, "Guidelines for Design, Construction, Operation, and Maintenance of Small Wastewater Treatment Facilities with Land Disposal", the maximum loading rate (Perc. Rate <= 5 min./inch) is 2.5 GPD/sqft (for hydrogeologic investigation based on percolation tests, which is the most often used technology). However, if infiltration measurement techniques (e.g. double-ring infiltrometer or guelph permeameter) were used for the hydrogeological study to determine the hydraulic conductivity (or infiltration rate), the maximum loading rate (for infiltration rate < 2 min/inch) can be 3.0 GPD/sq. ft. Typically, engineers will use more conservative maximum design rate of 2.5 GPD/sqft and MADEP's hydrogeologist won't have problem with this rate since it is very close to title 5 rate (see discussion above) (for septic water with high BOD and TSS that could clog the adsorption field because of microbio slim generated in the void space of soil particles).

Memorandum



To:

File

From:

Steven Tupper, Glenn Cannon

Subject:

Calculation of Required Area for Buzzards Bay Wastewater Disposal Site

Date:

March 5, 2012

The purpose of this memo is to clarify the methodology used to calculate the area required for a Buzzard Bay wastewater disposal site.

Initial calculations performed by Cape Cod Commission staff were meant to serve as an initial screening tool for potential disposal sites. Different infiltration systems, including various subsurface systems and rapid infiltration beds, were considered. A design loading rate of 3.0 gpd/sf was used for subsurface infiltration and 5.0 gpd/sf for RIB. A reserve area of 25% was assumed along with buffers of 100 ft. and 150 ft. for subsurface and RIB, respectively. The tabulation is presented below for a flow rate of **365,000 gpd**:

365,000 gpd	Subsurface	RIB
Loading Rate (gpd/sq-ft)	3	5
Reserve Area (%)	25	25
Buffer (Ft)	100	150
Gross Area Needed (sq-ft)	240079.06	204372.84
Gross Area Needed (acre)	5.51	4.69

Subsequent calculations performed by CH2MHill staff were based on a pressure distribution system with infiltration trenches. A design loading rate of 2.5 gpd/sf was used along with an additional area of 20% for pressure distribution and a reserve area of 100%. The trenches were designed with an effective depth of 2 feet, and a width of 2 feet. A spacing of 6 feet between the trenches was used (see note below). The tabulation is presented below for a flow rate of 350,000 gpd:

350,000 gpd	Pressure Distribution using Infiltration Trenches						
Require soaking area	140,000	sq. ft					
Leaching trench soaking area (2ft wide x 2ft tall)	6	sq. ft/linear ft of trench					
Total Trench length	23,333	Linear Ft					
Typical trench length/pressure distribution lateral	200	ft					
# of trench need	118						
Typical trench width	2	ft					
Typical space between edge of the trench	3	ft					
Leach field width	938	ft					
Leaching field area	187,600	sq. ft					
Additional area needed for pressure distribution	20%						
Area needed	225,120	sq. ft					
	5.2	Acres					
Total area with 100% reserved	10.3	Acres					

Note: Title 5 minimum trench separation is 4 feet for a 2 ft by 2 ft trenches. With 6 foot separation, Title 5 would allow the space between the trenches to be counted as reserve area. This option was not used in these calculations.

Calculation of Required Area for Buzzards Bay Wastewater Disposal Site March 5, 2012

As the calculations by CH2MHill staff are more conservative, this methodology is recommended for use in subsequent analysis. However, if a rapid infiltration system is used or a higher design loading rate is found to be appropriate, the required area for the disposal site will decrease.

Attached is a calculation sheet following the methodology used by CH2MHill for various flow rates under consideration for the project.

CC

Glenn Cannon, Cape Cod Commission Tom Cambareri, Cape Cod Commission Tabitha Harkin, Cape Cod Commission Priscilla Bloomfield, CH2MHill Mike Dominica, CH2MHill Calculation of Required Area for Buzzards Bay Wastewater Disposal Site March 5, 2012

Buzzards Bay Disposal Area Calculation Sheet Prepared by: Steven Tupper

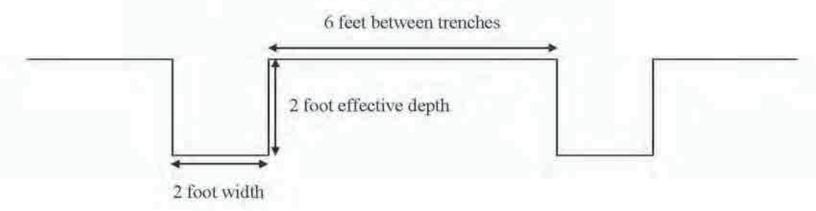
Flow Rates for Analysis:

25,000 gpd 50,000 gpd 100,000 gpd 335,000 gpd 1,300,000 gpd

Assumptions:

Design Loading Rate	2.5 gpd/sf
Leaching Trench Width	2 ft
Leaching Trench Effective Depth	2 ft
Space Between Edge of Trenches	3 ft
Trench Length	200 ft
Additional Area for Pressure Distribution	20%
Reserve Area	100%

Typical Leaching Field Configuration:



Calculation of Required Area for Buzzards Bay Wastewater Disposal Site March 5, 2012

Sample Calculation:

Required soaking area

$$= \frac{Max flow rate}{Design loding rate}$$
$$= \frac{335,000 gpd}{2.5 gpd/ft^2} = 134,000 ft^2$$

Trench soaking area per linear ft

=
$$bottoms + sides$$

= $2ft + 2ft + 2ft = 6 ft^2/lin.ft$

Total Trench length required

$$= \frac{Required \ soaking \ area}{Trench \ soaking \ area \ per \ lin. \ ft}$$
$$= \frac{134,000 \ ft^2}{6 \ ft^2/lin. \ ft} = 22,333 \ ft$$

Number of trenches

$$= \frac{Total\ trench\ length\ required}{Trench\ length}$$
$$= \frac{22,333\ ft}{200ft} = 113$$

Leaching field width

= Number of trench × Trench width + (Number of trench - 1)
× Width between trenches
=
$$113 \times 2$$
 ft + $(113 - 1) \times 6$ ft²/lin. ft = 898 ft

Leaching filed area

- = Leaching field width × trench length
- $= 899ft \times 200ft = 179,600ft^2$

Presure distribution area

- = Leaching field area \times 20%
- $= 179,600 ft^2 \times 20\% = 35,920 ft^2$

Reserve area

= (Leaching filed area + Presure distribution area) \times 100% = (179,600 ft^2 + 35,920 ft^2) \times 100% = 215,520 ft^2

Total area with reserve

= Leaching filed area + Presure distribution area + Reserve area
$$= \frac{179,600ft^2 + 35,920ft^2 + 179,600ft^2}{43,560ft^2/acre} = \frac{9.9acres}{43,560ft^2/acre}$$

Tabulation of Required Area for Subsurface Disposal at Various Maximum Flow Rates

Max Flow (gpd)	25,000	50,000	100,000	335,000	335,000 1,300,000)
Require soaking area	10,000	20,000	40,000	134,000	520,000	sq.ft
Leaching trench soaking area per linear ft	9	9	9	9	9	sq ft/lin.
Total trench length required	1,667	3,333	6,667	22,333	299'98	Linear F
Number of trenches need	6	18	34	113	434	
Leaching field width	99	138	266	868	3,466	Ĥ
Leaching field area	13,200	27,600	53,200	179,600	693,200	sq. ft
Area for for pressure distriubtion	2,640	5,520	10,640	35,920	138,640	
Area needed	15,840	33,120	63,840	215,520	831,840	sq. ft
	0.4	8.0	1.5	4.9	1.61	Acres
Total area with 100% reserved	2.0	1.5	2.9	6.6	38.2	Acres

Appendix I: Detailed Cost Analysis

Late 2009 ENR from Barnstable	8600
County Cost Report	
March 2012 ENR	9267
Engineering & Permitting	10%
Engineering Services During	8%
Construction	
Contingency	25%

	MBR	_		SBR			Package Plant	
Flow (GPD)	Barnstable County Report Construction Cost 2009 (\$/GPD)	Barnstable County Report O&M Cost 2009 (\$/GPD)	Flow (GPD)	Barnstable County Report Construction Cost 2009 (\$/GPD)	Barnstable County Report O&M Cost 2009 (\$/GPD)	Flow (GPD)	Barnstable County Report Construction Cost 2009 (\$/GPD)	Barnstable County Report O&M Cost 2009 (\$/GPD)
25,000	\$60	\$12.00	25,000	\$90	\$10.50	25,000	\$60	\$10.50
50,000	\$47	\$8.25	50,000	\$80	\$8.25	50,000	\$47	\$8.25
100,000	\$36	\$6.25	100,000	\$ 60	\$6.25		•	•
335,000	\$24	\$3.25	335,000	\$24	\$3.25			

Disposal	Construction
	Disposal
Flow Rate	Construction
(GPD)	Cost 2012
	(\$/GPD)
25,000	\$5
50,000	\$4
100,000	\$3
335,000	\$2

Forcemain Construction								
Flow Rate (GPD)	Forcemain Construction Cost 2012 (\$/If)							
25,000	\$160							
50,000	\$160							
100,000	\$160							
335,000	\$200							

Cost per acre of land	\$100,000
Site 10 Land Cost (4 acres)	\$400,000

Wastewater Pumping								
Flow Rate (GPD)	Wastewater Pumping Construction Cost 2012 (\$/GPD)							
25,000	\$195,000							
50,000	\$220,000							
100,000	\$250,000							
335,000	\$300,000							

		Capital Costs - Wastewater Treatment											
		N	IBR			S		Package Plant					
Design Flow Rate (GPD)	25,000	50,000	100,000	335,000	25,000	50,000	100,000	335,000	25,000	50,000			
Construction 2012 Unit Cost	64.65	\$50.65	\$38.79	\$25.86	\$96.98	\$86.20	\$64.65	\$25.86	\$64.65	\$50.65			
Construction	\$1,616,337	\$2,532,262	\$3,879,209	\$8,663,567	\$2,424,506	\$4,310,233	\$6,465,349	\$8,663,567	\$1,616,337	\$2,532,262			
Engineering & Permitting	\$161,634	\$253,226	\$387,921	\$866,357	\$242,451	\$431,023	\$646,535	\$866,357	\$161,634	\$253,226			
Services During Construction	\$129,307	\$202,581	\$310,337	\$693,085	\$193,960	\$344,819	\$517,228	\$693,085	\$129,307	\$202,581			
Subtotal	\$1,907,278	\$2,988,069	\$4,577,467	\$10,223,010	\$2,860,917	\$5,086,074	\$7,629,112	\$10,223,010	\$1,907,278	\$2,988,069			
Contingency	\$476,819	\$747,017	\$1,144,367	\$2,555,752	\$715,229	\$1,271,519	\$1,907,278	\$2,555,752	\$476,819	\$747,017			
TOTAL CAPITAL COST	\$2,384,097	\$3,735,086	\$5,721,834	\$12,778,762	\$3,576,146	\$6,357,593	\$9,536,390	\$12,778,762	\$2,384,097	\$3,735,086			

		Capita	l Costs - Treated	Wastewater Disp	oosal						
	Site	10		Site 16, 19 and 29							
Design Flow Rate (GPD)	25,000	50,000	25,000	50,000	100,000	335,000					
2012 Construction Unit Cost	\$5.00	\$4.00	\$5.00	\$4.00	\$3.00	\$2.00					
Construction	\$125,000	\$200,000	\$125,000	\$200,000	\$300,000	\$670,000					
Engineering & Permitting	\$12,500	\$20,000	\$12,500	\$20,000	\$30,000	\$67,000					
Services During Construction	\$10,000	\$16,000	\$10,000	\$16,000	\$24,000	\$53,600					
Land Cost	\$400,000	\$400,000	\$ -	\$ -	\$ -	\$ -					
Subtotal	\$547,500	\$636,000	\$147,500	\$236,000	\$354,000	\$790,600					
Contingency	\$36,875	\$59,000	\$36,875	\$59,000	\$88,500	\$197,650					
TOTAL COST	\$584,375	\$695,000	\$184,375	\$295,000	\$442,500	\$988,250					
TOTAL	\$621,250	\$754,000	\$221,250	\$354,000	\$531,000	\$1,185,900					

			Capital Costs -	Wastewater C	Conveyance and Pumping						
Flow Rate (GPD)		25000)		50000						
Option	Hideaway Village	Downtown (39E)	Downtown (C)	Out of Town	Hideaway Village	Downtown (39E)	Downtown (C)	Out of Town			
Pipe Length (ft)	3908	8801	7816	11382	3908	8801	7816	11382			
Force Main Construction Unit Cost	\$160	\$160	\$160	\$160	\$160	\$160	\$ 160	\$160			
Pump Station Construction	\$195,000	\$195,000	\$195,000	\$195,000	\$220,000	\$220,000	\$220,000	\$220,000			
Construction	\$820,280	\$1,603,160	\$1,445,560	\$2,016,120	\$845,280	\$1,628,160	\$1,470,560	\$2,041,120			
Engineering & Permitting	\$82,028	\$160,316	\$144,556	\$201,612	\$84,528	\$162,816	\$147,056	\$204,112			
Services During Construction	\$65,622	\$128,253	\$115,645	\$161,290	\$67,622	\$130,253	\$117,645	\$163,290			
Subtotal	\$967,930	\$1,891,729	\$1,705,761	\$2,379,022	\$997,430	\$1,921,229	\$1,735,261	\$2,408,522			
Contingency Cost	\$241,983	\$472,932	\$426,440	\$594,755	\$249,358	\$480,307	\$433,815	\$602,130			
TOTAL CAPITAL COST	\$1,209,913	\$2,364,661	\$2,132,201	\$2,973,777	\$1,246,788	\$2,401,536	\$2,169,076	\$3,010,652			

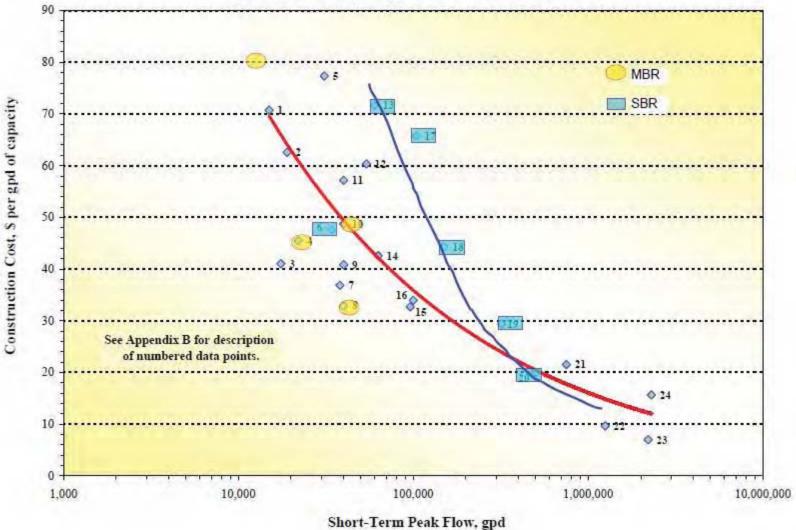
Capital Costs - Wastewater Conveyance and Pumping

Flow Rate (GPD)		100000			335000	
Option	Downtown (39E)	Downtown (C)	Out of Town	Downtown (39E)	Downtown (C)	Out of Town
Pipe Length (ft)	8801	7816	11382	8801	7816	11382
Force Main Construction Unit Cost	\$160	\$160	\$160	\$200	\$200	\$200
Pump Station Construction	\$250,000	\$250,000	\$250,000	\$300,000	\$300,000	\$300,000
Construction	\$1,658,160	\$1,500,560	\$2,071,120	\$2,060,200	\$1,863,200	\$2,576,400
Engineering & Permitting	\$165,816	\$150,056	\$207,112	\$206,020	\$186,320	\$257,640
Services During Construction	\$132,653	\$120,045	\$165,690	\$164,816	\$149,056	\$206,112
Subtotal	\$1,956,629	\$1,770,661	\$2,443,922	\$2,431,036	\$2,198,576	\$3,040,152
Contingency Cost	\$489,157	\$442,665	\$610,980	\$607,759	\$549,644	\$760,038
TOTAL CAPITAL COST	\$2,445,786	\$2,213,326	\$3,054,902	\$3,038,795	\$2,748,220	\$3,800,190

		Operation & Maintenance Costs												
		M	BR					Package	e Plant					
Flow Rate (GPD)	25,000	50,000	100,000	335,000	25,000	50,000	100,000	335,000	25,000	50,000				
2012 O&M Cost Rate	\$12.93	\$8.89	\$6.73	\$3.50	\$11.31	\$8.89	\$6.73	\$3.50	\$11.31	\$8.89				
ANNUAL O&M COST	\$323,267	\$444,493	\$673,474	\$1,173,191	\$282,859	\$444,493	\$673,474	\$1,173,191	\$282,859	\$444,493				

	Costs to Send Flow to MMR												
MMR Disposal Option	Directional Drill Distance (ft.)	Directional Drill Unit Cost (\$/ft.)	Directional Drill Cost	Pump Station at WWTP (LS)	Forcemain Length from WWTF (ft)	Forcemain Unit Cost (\$/ft.)	Forcemain Cost	Price for Disposal Capacity	Contingency (%)	Estimated Cost			
2012 Estimated Cost	1900	1500	\$2,850,000	\$300,000	13,000	\$160	\$2,080,000	\$300,000	20	\$6,636,000			

FIGURE 3 RESULTS OF CONSTRUCTION COST SURVEY



Inflation	0%							NPV Analys	sis Page 1 of 2
Discount	1.7%								
Period (years)	20								
					Year0	Year 1	Year 2	Continued out at the same	
						Start of O&M		rate each year to 2035	
	NPV	2012	2013	2014		2015	2016		2035
MBR O&M Annual Cost									
25,000	\$ 5,442,165	\$ 323,267	\$ 323,267	\$ 323,267	\$	\$ 323,267	\$ 323,267		\$ 323,267
50,000	\$ 7,482,977	\$ 444,493	\$ 444,493	\$ 444,493	\$	\$ 444,493	\$ 444,493		\$ 444,493
100,000	\$ 11,337,844	\$ 673,474	\$ 673,474	\$ 673,474	\$	\$ 673,474	\$ 673,474		\$ 673,474
335,000	\$ 19,750,524	\$ 1,173,191	\$ 1,173,191	\$ 1,173,191	\$	\$ 1,173,191	\$ 1,173,191		\$1,173,191
SBR O&M Annual Cost									
25,000	\$ 4,761,894	\$ 282,859	\$ 282,859	\$ 282,859	\$	\$ 282,859	\$ 282,859		\$ 282,859
50,000	\$ 7,482,977	\$ 444,493	\$ 444,493		\$	\$ 444,493			\$ 444,493
100,000	\$ 11,337,844	\$ 673,474	\$ 673,474		\$		\$ 673,474		\$ 673,474
335,000	\$ 19,750,524	\$ 1,173,191			\$		\$ 1,173,191		\$1,173,191
Package Plant O&M Annual Cost									
25,000	\$ 4,761,894	\$ 282,859	\$ 282,859	\$ 282,859	\$	\$ 282,859	\$ 282,859		\$ 282,859
50,000	\$ 7,482,977	\$ 444,493	\$ 444,493		\$	\$ 444,493		•••	\$ 444,493
30,000	γ // 102/37/	ψ 111,133	Ç 111,133	7 111,133	Υ	Ÿ 111,133	7 111,133		7 111,133
	NPV								
MBR Treatment Capital Cost									
25,000	\$2,384,097	\$ 2,384,097	\$ 2,384,097	\$ 2,384,097	\$ 2,384,097				
50,000	\$3,735,086	\$ 3,735,086	\$ 3,735,086	\$ 3,735,086	\$ 3,735,086				
100,000	\$5,721,834	\$ 5,721,834	\$ 5,721,834	\$ 5,721,834	\$ 5,721,834				
335,000	\$12,778,762	\$ 12,778,762	\$12,778,762	\$ 12,778,762	\$ 12,778,762				
SBR Treatment Capital Cost									
25,000	\$3,576,146	\$ 3,576,146	\$ 3,576,146	\$ 3,576,146	\$ 3,576,146				
50,000	\$6,357,593	\$ 6,357,593	\$ 6,357,593		\$ 6,357,593				
100,000	\$9,536,390	\$ 9,536,390	\$ 9,536,390		\$ 9,536,390				
335,000	\$12,778,762	\$ 12,778,762	\$12,778,762		\$ 12,778,762				
Package Plant Treatment Capital C	Cost								
25,000	\$2,384,097	\$ 2,384,097	\$ 2,384,097	\$ 2,384,097	\$ 2,384,097				
50,000	\$3,735,086	\$ 3,735,086	\$ 3,735,086		\$ 3,735,086				
,	,				, ,				

	NPV					NPV Analysis Page 2 of 2
Site 16, 19, and 29 Disposal Capital	Cost					
25,000	\$221,250	\$ 221,250	\$ 221,250	\$ 221,250	\$ 221,250	
50,000	\$354,000	\$ 354,000	\$ 354,000	354,000	\$ 354,000	
100,000	\$531,000	\$ 531,000	\$ 531,000	\$ 531,000	\$ 531,000	
335,000	\$1,185,900	\$ 1,185,900	\$ 1,185,900	\$ 1,185,900	\$ 1,185,900	
Site 10 Disposal Capital Cost						
25,000	\$621,250	\$ 621,250	\$ 621,250	\$ 621,250	\$ 621,250	
50,000	\$754,000	\$ 754,000	\$ 754,000	\$ 754,000	\$ 754,000	
	NPV					
Downtown Conveyance Capital Co	st (39E)					
25,000	\$2,364,661	2364661	\$ 2,364,661	\$ 2,364,661	\$ 2,364,661	
50,000	\$2,401,536	2401536	\$ 2,401,536	\$ 2,401,536	\$ 2,401,536	
100,000	\$2,445,786	2445786	\$ 2,445,786	\$ 2,445,786	\$ 2,445,786	
335,000	\$3,038,795	3038795	\$ 3,038,795	\$ 3,038,795	\$ 3,038,795	
Downtown Conveyance Capital Co						
25,000	\$2,132,201		\$ 2,132,201	\$ 2,132,201	\$ 2,132,201	
50,000	\$2,169,076		\$ 2,169,076	\$ 2,169,076	\$ 2,169,076	
100,000	\$2,213,326		\$ 2,213,326	\$ 2,213,326	\$ 2,213,326	
335,000	\$2,748,220	2748220	\$ 2,748,220	\$ 2,748,220	\$ 2,748,220	
Out of Town Conveyance Capital C						
25,000	\$2,973,777		\$ 2,973,777	\$ 2,973,777	\$ 2,973,777	
50,000	\$3,010,652		\$ 3,010,652	3,010,652	\$ 3,010,652	
100,000	\$3,054,902		\$ 3,054,902	3,054,902	\$ 3,054,902	
335,000	\$3,800,190	3800190	\$ 3,800,190	\$ 3,800,190	\$ 3,800,190	
Hideaway Village Conveyance Cap						
25,000	\$1,209,913		\$ 1,209,913	1,209,913	\$ 1,209,913	
50,000	\$1,246,788	1246788	\$ 1,246,788	\$ 1,246,788	\$ 1,246,788	

Appendix J: All Treatment and Disposal Options

Treatment Technology	25,00	0 GPD	50,000 GPD	100,000 GPD	335,000 GPD	Cost	Comments	
Package Plant	10, 16,	21,	10, 16, 21,	NA	NA	\$	Medium footprint	
	39E		39E				Odor issues if not operated	
							properly	
							FOG¹ control/ pretreatment	
							required	
							Cannot handle septage	
MBR	10, 16,	21,	10, 16, 21,	10, 16, 21,	10, 16, 21,	\$\$\$	30-40% greater capital costs	
	39E ²		39E ²	39E ²	39E ²		Twice the O&M ³ costs	
							Reliable	
							No odor issues	
							Small footprint	
							Can handle septage	
CDD	10.16	24	10 16 21	10 16 21	10 16 21	* * *	Can upgrade	
SBR	10, 16,	21,	10, 16, 21,	10, 16, 21,	10, 16, 21	\$\$	Handling septage can be difficult	
D1 101	39E ²	10	39E ²	39E ²	16.00.10		Larger footprint	
Disposal Sites	10, 16,	19,	10, 16, 19,	16, 19, 29	16, 29 + 19			
	29		29					
Alternative Options	T							
Send flow to MMA ⁴ for		Inteasik	ole. MIMA is coi	nstrained on ex	disting capacity	and are	a to expand.	
treatment and disposal								
Send flow to Wareham for	or				_		plant. However, Wareham is considering	
treatment and disposal			•				date Bourne flows.	
Send flow to MMR ⁵ for				•			about 160,000 GPD. If MMR were to take	
treatment and/or disposa				_	-		Mashpee, Falmouth, and Bourne. Could	
		•	•		• •	•	stewater could be piped across the Cape Cod	
		Canal. (Cost to install a	pipe under the	e Cape Cod Can			
NA = Not applicable					³ = O&M – operations and maintenance ⁴ = MMA – Massachusetts Maritime Academy			
¹ = FOG – fats, oils, grease ² = Downtown plant location of	annot tal	ko sontas					s Maritime Academy s Military Reservation	
- Downtown plant location c	ailliot tal	re sehrag	;c.		- INIINIW - INIASS	acriusetts	o ivilitary neservation	

Appendix K: Financing Options Presentation

The following is a copy of the handout given out by Robert J. Ciolek of the Clean Water Protection Planning Group in in July 20th, 2011 presentation to the Bourne Wastewater Advisory Committee.

COMMUNITY FUNDING FOR WASTEWATER CAPITAL PROGRAMS

July 20th, 2011

Presentation to the Town of Bourne Wastewater Advisory Committee

Robert J. Ciolek, Consultant, Clean Water Protection Planning Group Cape Cod Wastewater Funding Facts

Wastewater Funding Reality - Cape Cod

Presuming Cape Cod communities execute their present Comprehensive Wastewater Management Plans (CWMP), the total capital cost of building planned wastewater systems will range from \$3.2 billion to \$5.8 billion.

There are 215,000 people living on Cape Cod. On a *per person* basis, each person would be responsible for between \$14,884 to \$26,977 in capital costs.

There are 174,000 properties on Cape Cod. On a *per property* basis, each property owner would be responsible for between \$18,391 to \$33,333 in capital costs.

- · Amounts do not include annual operating expenses, ranging from \$40 to \$68 million per year
- · If half of Cape properties become system customers, double per capita and per property estimates
- Several communities have not developed reliable cost estimates
- · Does not take into consideration impact from CLF litigation
- · Does not take into cost consideration any possible increase in wastewater standards
- · Inflation not included

Benefits of Wastewater Capital Program

Benefits of Wastewater Capital Program on Cape Cod

The policy decision involving who should pay and by what funding option or options should be firmly based on an understanding of the tangible and intangible benefits of the program.

Key question: What are the benefits of the wastewater capital program?

- Protection of the Cape's clean drinking water resources
- · Protection of public health and sanitation
- · Permits responsible growth and targeted economic development
- Renewal and protection of saltwater and freshwater resources
- Achieves compliance with federal and state laws and regulations
- Recognizes that civilized communities do not foul their own nest

If the description of benefits is accurate and generally accepted, two follow-on questions should then be asked and answered:

Who benefits from the wastewater capital program? Who should pay for the wastewater capital program?

Community Wastewater Funding Choices

Funding Options for Cape Cod Towns

There are two broad categories of expenses for community wastewater projects: operating expenses for annual operations and maintenance and capital expenses associated with constructing the wastewater system. Some funding options are available for one or the other type of expense; a couple are available for both types of expenses.

There are four basic funding choices for Cape Cod towns:

- Funding from existing Town funding sources for capital and/or operating expenses
- · Funding from betterment assessments for capital expenses
- Funding from a Proposition 2½ override or debt exclusion vote for capital expenses
- · Funding from a system of rates and charges for operating and/or capital expenses

There may be some funding support from existing, though *very* limited, federal or state grants for capital expenses. A combination of two or more of the funding options will inevitably be utilized by each town in various permutations and amounts.

Much of the system will be financed by low-interest loans from the Commonwealth or through Town-issued general obligation bonds, with the principal and interest (debt service) repaid by one or more of the four funding alternatives.

Use of Existing Town Revenue

All or most debt service costs paid by property tax within Proposition 2½ levy limits. A Town may continue to pass through some capital and likely all operating costs to customer base through rates and charges or other funding methodology.

Advantages:

- · No immediate financial impact on Town property owners
- · Spreads cost over a wider base than other funding choices
- Towns will maintain control over scope, pace and cost of project
- · Town government will remain directly accountable for program
- · No legislation needed

- · Most Towns are at Proposition 2½ levy limit
- Major reductions in important Town-funded services will be required
- · Available, non-tax revenues are minimal compared to total cost of program
- · Town's bonding capacity would be severely stretched and bond rating may decline
- · Tax-exempt entities would realize program benefits but do not pay real estate taxes
- · Solely using Town funds would make regionalizing services more difficult
- · Would create significant pressure to limit scope of wastewater capital program

Betterment Assessments

Towns have the statutory authority to levy involuntarily betterment assessments in order to defray the capital cost of installing sewer infrastructure improvements.

Advantages:

- Town may lien property and may place charges on tax bills, thus reasonably insuring it will be paid by property owners
- · Appearance of fairness as assessment is for the receipt of a property benefit
- Relatively low interest rate 2% over underlying debt interest rate

- Narrowest base of funding for wastewater capital program
- Mismatch between benefits of program and those obligated to pay betterments as many beneficiaries will pay nothing
- Sewer betterment assessments bear little relationship to cost of wastewater program – betterments only based on cost of neighborhood sewering projects
- Not tax deductible
- Property owners must pay betterment principal and interest in just twenty years
- If EDU formula used, sewer betterments on Cape Cod could unintentionally become confiscatory

Proposition 2½ Override or Debt Exclusion

Substantial debt service costs paid by property tax *after* successful override campaign(s). Town may continue to pass through some capital and operating costs to customers by system of rates and charges or other funding methodology.

Advantages:

- Minimal impact on existing Town services
- · Town will continue to control scope, pace and cost of project
- · Spreads cost of program over wider base than other funding options
- · Tax deductible for those who itemize
- · Town government will remain directly accountable for program
- Creation of "Municipal Stabilization Fund" provides for control over expenditures
- · No legislation needed

- · Override will require capital-related override ballot campaign
- · Significant real estate tax impact for town property owners
- · Could create conflict between those connected to sewers and those not connected
- Solely using locally generated funds would make regionalizing services more difficult
- Tax-exempt entities would realize program benefits but do not pay real estate taxes

System-wide User Fees, Rates and Charges

Funding could occur by imposing a system of user fees, rates and charges, to be managed by each Town, which could pay for some or all capital costs plus all operating expenses, paid by the users of the service.

Advantages:

- · Flexible and efficient funding system
- Wide base for spreading costs (would include tax-exempt and government users)
- Can more easily create a funding system which best matches relationship of treatment costs with contributions of effluent requiring treatment
- System can be designed to permit some subsidy for low-income households and would enable the issuance of monthly billing making household budgeting easier
- · Enhances impact of adopting special debt exclusion
- Could encourage regional approach to problem solving

- · Over time, will grow to become a significant utility bill
- Not tax-deductible
- Zero-sum funding mechanism; absent some new revenue source, reductions for some ratepayers means increases in charges to other ratepayers

Other Financial Options

Limited and usually targeted funding is available from other sources or financing methodologies. Such funding will be constrained in amount or by statutory requirements.

USDA Rural Development Loan and/or Grant

Statutorily limited by population size of community/district and amounts available; community income test

District Improvement Financing/Tax Increment Financing

Typically for commercial development purposes; likely requires interim financing and a financial backstop; complex approval process; geographically limited

· Community Development Block Grant/Community Development Action Grant

Limited funds available and must meet strict grant requirements

DIF Efforts in Massachusetts

Very few communities have moved forward with DIF financings, pursuant to MGL Ch.40Q, though examples exist and should be studied:

Worcester
 Carver
 Gardner
 Quincy
 Somerville/MBTA
 Completed
 In Process
 In Process

Town of Carver DIF effort was directed at creating a water district to enhance planned commercial development:

- ✓ Town put together planning and financial advisory team
- ✓ Town created DIF which was approved by Town Meeting and subsequently by the Commonwealth

Possible Funding Mitigation Options

Legislative Approval of New Revenue Source

Paying for the cost of the capital program can be achieved in part by obtaining direct financial support through the imposition of a new tax, a new fee or reestablishing federal or state grant funding.

Advantages:

- · A new tax or array of taxes could pay for part of capital costs
- Depending upon the type of tax, cost of the program might be spread over a larger population base than by either betterments or real estate tax
- Tax revenue or new grant funding might be made available to all Cape Cod communities for similar capital programs
- · Could possibly encourage regional approach to problem solving

- Would require a major campaign effort and approval by the Legislature and Governor
- Negative financial impact on whomever is obligated to pay any new tax
- Some payers of the tax may not be responsible for or benefit from the Cape's wastewater capital program
- Could result in unforeseen new Town obligations or restrictions imposed by State
- Role of Towns in managing wastewater program may be circumscribed

Use of MGL C59, Section 21(n)

Towns may replace wastewater rate revenue with property tax revenue with only a vote of town Boards of Selectmen or Town Council. Special debt service exclusion and *not* a new funding source, but a legislative grant of authority permitting a shifting of costs from wastewater ratepayers to Town taxpayers.

Advantages:

- · Dollar for dollar replacement
- · Broadens financial base
- Avoids Proposition 2½ override requirements
- Decreases rate revenue which is paid by system users with property taxes which are paid by both system users and non-users
- Special debt service exclusion will lower rate revenue requirements but cannot be used to reduce betterment assessments

- Funding method may pit property owners against wastewater system customer base
- · While statutorily permissible, would be controversial as it is non-instinctual
- Avoids Proposition 2½ override requirements

Regionalizing Wastewater System

Could result in a reduction of capital and operating costs, primarily through the development of fewer though somewhat larger wastewater treatment facilities.

Advantages:

- · Smaller number of wastewater treatment facilities needed
- · Greater flexibility in finding discharge sites outside nitrogen sensitive areas
- · Some savings in overhead and operating expenses
- · Improved planning coordination of capital program
- · Could better integrate alternative and innovative technology solutions
- · Improved planning for watershed protection, particularly for shared watersheds
- · Could more efficiently and effectively address Cape-wide Title V issues

- Would require complex and likely controversial legislation
- · Communities would no longer directly control wastewater systems
- Need to insure public accountability

