

Draft Guidance for Groundwater Discharge

Wastewater treatment facilities typically treat effluent to a nitrate-nitrogen concentration of 5 to 10 milligrams per liter (mg/L) and pump the effluent to a site where it is discharged to groundwater. Wastewater treatment facilities that treat and discharge to groundwater more than 10,000 gallons per day (gpd) require a Groundwater Discharge Permit (GWDP) from MassDEP. Obtaining a GWDP requires a detailed site evaluation for effluent disposal.

Siting groundwater discharge has been an integral part of wastewater planning on Cape Cod, and elsewhere, for decades. Given the sensitive natural resources of the region, the increased nitrogen load to Cape Cod watersheds associated with population growth since the 1960s, and the limited undeveloped developable property remaining in the region, the Commission and others have sought to identify sites that balance the need to cost-effectively treat and dispose of wastewater while remaining protective of the environment.

As towns refine conceptual plans and develop and implement adaptive management plans pursuant to the Section 208 Cape Cod Area-Wide Water Quality Management Plan, traditional collection, treatment and discharge of treated wastewater effluent is likely to be part of many nitrogen-management solutions. This document aims to provide guidance to towns in identifying wastewater effluent discharge sites by summarizing regional efforts in identifying potential discharge sites and outlining the factors that must be considered in a site-specific selection process.

Region Wide Groundwater Discharge Analysis

A region wide groundwater discharge analysis was undertaken by Cape Cod Commission staff to evaluate and apply criteria for the purpose of siting effluent disposal sites Cape-wide. The analysis screened parcels ten acres or larger, of which there are 2,289 on Cape Cod (see Figure 1). The analysis then applied a number of exclusion areas, listed below.

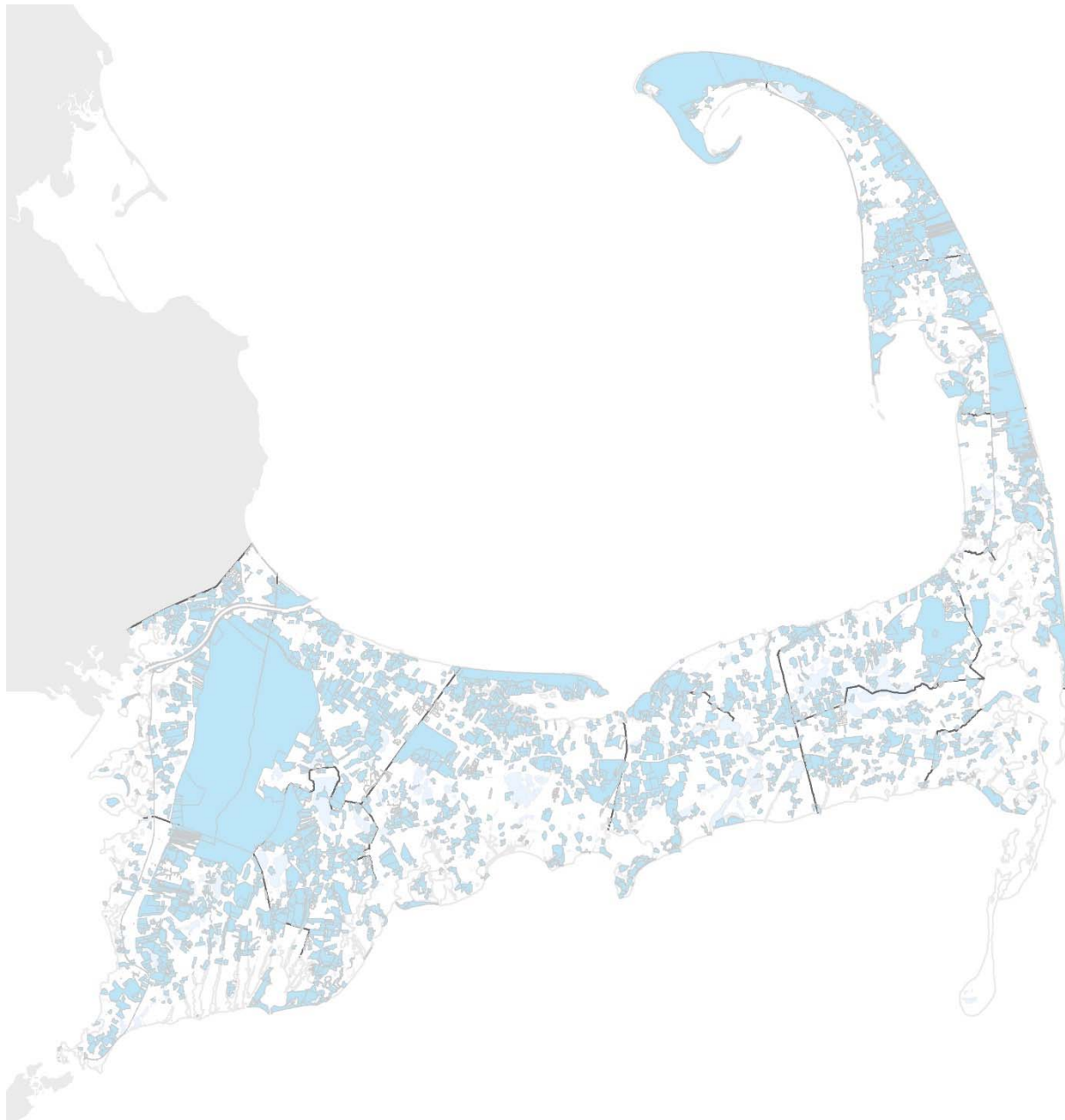


FIGURE 1: THERE ARE A TOTAL OF 2,289 PARCELS THAT ARE 10 ACRES OR LARGER CAPE-WIDE.

Exclusion Areas:

- Flood Plain V Zones (FEMA) - Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves
- Sensitive Habitat
 - Wetlands, plus 100 ft buffer
 - Water bodies, plus 100 ft buffer
- Residential Development, plus 100 ft buffer
- Zones of Contribution (USGS) - Area of an aquifer through which groundwater flows to a water supply well from the area contributing recharge
- Zone II to Public Water Supply (MassDEP) - Area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at approved yield, with no recharge from precipitation)
- Watersheds with a TMDL for Nitrogen or a Massachusetts Estuaries Project (MEP) Technical Report

The greatest land use constraint identified is proximity to residential development, followed by exclusions related to wetland buffers and watersheds with a nitrogen TMDL or nitrogen reduction needs identified in MEP technical reports. Zone IIs also account for a number of excluded parcels. Thirty-six percent of the ten acre parcels are within a Zone II. Figure 2 shows the 10 acre parcels with no exclusions.

Summary of Available Parcels for Discharge

Of the 2,289 parcels on Cape Cod that are 10 or more acres, 39 parcels have no constraints related to the exclusion areas described above. These 39 parcels total 738 acres, averaging 19 acres per parcel. Twenty-seven of the 39 parcels are located in direct discharge areas, ideal locations for discharge that drain directly to open coastal water.

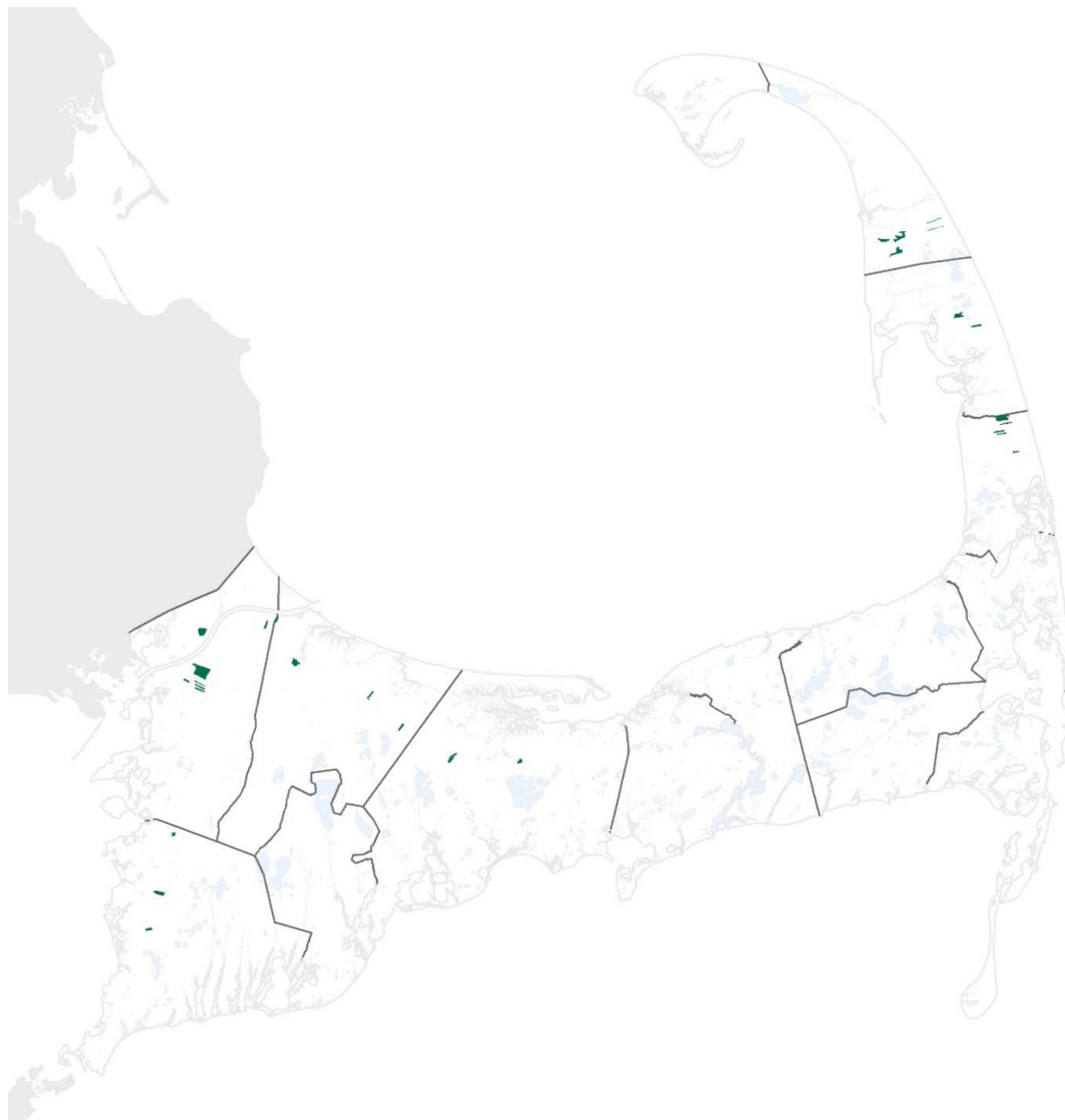


FIGURE 2: THERE ARE A TOTAL OF 39 PARCELS THAT ARE 10 ACRES OR LARGER AND HAVE NO CONSTRAINTS FOR GROUNDWATER DISCHARGE CAPE-WIDE.

In a less conservative approach, an analysis was completed that began by considering the 2,289 ten acre parcels and removed only the areas associated with the exclusion areas, preserving the remaining part of the parcel. This analysis resulted in 744 parcels, totaling 64,000 acres, with an average size of 82 acres per parcel (Figure 3). Of the 744 parcels, 383 are located in direct discharge areas.



FIGURE 3: THERE ARE A TOTAL OF 744 PARCELS THAT ARE 10 ACRES OR LARGER AND HAVE AT LEAST SOME PORTION OF THE PARCEL AVAILABLE FOR GROUNDWATER DISCHARGE.

The region wide groundwater discharge analysis results in a subset of potential parcels that are likely constrained to certain areas such as Joint Base Cape Cod, the Cape Cod National Seashore and other protected areas and areas outside of watersheds with a nitrogen TMDL or MEP technical report. The number of parcels is likely to decrease as more information becomes available about watersheds believed to be nitrogen sensitive, but that do not yet have a TMDL or MEP technical report.

Site-Specific Considerations for Groundwater Discharge Site Selection

Beyond the regional analysis, further screening will be necessary to include site specific constraints and opportunities. This is best done at the local level and a number of towns have already conducted this type of analysis. Factors to consider include, but are not limited to, the following:

- Ownership
 - Private
 - Municipal
 - Open Space
- Hydrogeology - Permeability
 - Depth to Groundwater – Mounding and Breakout Assessment
 - Groundwater Flow – Downgradient Receptors Assessment
- Concurrent Uses – For example, parcels where discharge could occur along with an existing golf course or gravel pit

In 2016, AECOM provided the Commission with a list of general considerations for groundwater discharge site selection. AECOM divided the considerations into three general categories: those that make an area least favorable for discharge, those that make an area less favorable for discharge, and those that make an area more favorable for discharge. The following summarizes considerations included in each category.

Areas Least Favorable for Groundwater Discharges:

- Areas within the Zone II of public water supply wells. Zone IIs are defined as that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at approved yield, with no recharge from precipitation). DEP Groundwater Discharge Permit regulations have specific requirements for siting discharges in a Zone II relative to the treatment of Total Organic Carbon (TOC). The requirements are most stringent for potential discharges within a 2-year time of travel. These stringent thresholds for TOC removal result in the need for substantially more advanced and expensive treatment. Areas susceptible to coastal and stormwater flooding, e.g. FEMA V and A Zones.

- Areas of Critical Environmental Concern (ACECs). ACECs are defined as areas that receive special recognition by the Commonwealth of Massachusetts because of the quality, uniqueness, and significance of the area's natural and cultural resources. Designation of these areas creates a framework for local and regional stewardship of critical resources and ecosystems.
- Areas containing habitat for rare and endangered species, federal and state parks and other sensitive receptors such as wetlands. Groundwater disposal on these lands may have a negative effect on these resource areas, and the permitting effort would be much higher, adding to the cost and time of the project.
- Areas within or upgradient of clusters of residences or businesses that rely on on-site water wells and are not served by public water.

Areas Less Favorable for Groundwater Discharges:

- Watersheds with estuaries with a high nitrogen Total Maximum Daily Load (TMDL) requiring a high level of nitrate removal
- Areas with shallow depth to groundwater
- Areas with fine soils such as silts and clays
- Areas with a history of failed septic systems due to poor soils, high groundwater, etc.
- Areas where a groundwater discharge could impact an existing plume of groundwater contamination

Areas More Favorable for Groundwater Discharges:

- Watersheds where groundwater discharges directly to the ocean rather than to embayments. These watersheds drain to large water bodies that have no TMDL, so the nutrients have little or no adverse impacts.
- Areas with greater depth to groundwater; generally more than 20 feet to the water table under high water table conditions
- Watersheds where the groundwater discharges to a water body that has an assimilative capacity for additional nitrogen load.

Additional Resources

In 2006, Stearns and Wheeler, on behalf of Barnstable County and the Town of Barnstable, completed “Effluent Disposal and Reuse Planning: Guidance Document and Case Study Report” which discusses considerations similar to those identified by AECOM and applies criteria in a site screening analysis for the Town of Barnstable.

In 2012, the Cape Cod Commission completed “Wastewater Management Planning for Bourne’s Downtown,” a similar effort to apply considerations and criteria in a site specific way to identify potential discharge locations. This analysis was part of a Regional Economic Strategy Executive Team (RESET) technical assistance project. Potential discharge sites were identified, one of which has undergone detailed assessment by the Town of Bourne.

References

Bourne Wastewater Advisory Committee. 2012. Wastewater Management Planning for Bourne’s Downtown. With Assistance from the Cape Cod Commission and CH2MHill.

Stearns and Wheeler. 2006. Effluent Disposal and Reuse Planning: Guidance Document and Case Study Report. Prepared for Barnstable County and the Town of Barnstable.