



## APC & Nemasket Watershed Management and Climate Action Plan

### Existing Conditions and Anticipated Climate Change Impacts Overview

# LAND DEVELOPMENT

## CURRENT CONDITIONS IN WATERSHED

### APC Watershed Overview

The Assawompset Ponds Complex watershed is dominantly rural in character with extensive areas of medium and low density residential development, forests, wetlands, and agricultural areas. The watershed includes several areas of protected open space including the Assawompset Pond Complex and Betty's Neck Wildlife Conservation Easements, the Black Brook Wildlife Management Area, and the Freetown-Fall River State Forest.

Levels of development vary across the ponds. Quittacas Pond's shores are completely protected and Pocksha and Assawompset Ponds' shores are largely protected, mainly for water supply protection. Long Pond on the other hand is not protected and is heavily developed<sup>1</sup>. Dense residential development along Long Pond is an issue, particularly because new property owners are not following responsible practices and are installing pavement and artificial turf and using fertilizers directly adjacent to the pond, which is a threat to water quality. Private septic systems have also been identified as a source of nutrient contamination in Long Pond. Variances are often granted to homeowners, allowing these types of development closer to the water's edge.<sup>2</sup>

Threats to water quality and wildlife in the Ponds include nutrients and pesticides from shoreline development, road drainage from Routes 18 and 105, fallout from SEMASS incinerator, sand and gravel processing on Assawompset Neck (groundwater quality), and recreational watercraft use on Long Pond<sup>1</sup>.

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<sup>1</sup> Mass Audubon IBA profile for the Assawompset Ponds Complex

<sup>2</sup> APC Steering committee conversations

## Lakeville<sup>3</sup>

Lakeville is located in the northeast portion of the watershed, and borders large portions of each of the ponds in the Assawompset Ponds Complex, as well as the western bank of the Upper Nemasket River. It is the most developed of the four towns directly bordering the ponds, at 19% of land developed. Between 1970 and 2000, Lakeville's population increased by 124%, compared to Plymouth County's 90%, the Southeast Regional Planning and Economic Development District's regional community average of 25%, and the state's 12%. Land development accompanied this population growth, and over 400 acres were developed between 1999 and 2005. The rate of development has since slowed, and from 2012 to 2017, 90 acres of land were developed, a rate of 2.5 acres per square mile. An influx of new residents unaccustomed to relatively rural life, associated with the construction of the Lakeville T-Station, have brought concerns of improper well and septic maintenance impacting water quality.

Lakeville boasts abundant environmental resources, including the Assawompset Ponds, woodlands, farms, fields and cranberry bogs, which provide important services like flood control and drinking water protection. Only 15% of land in Lakeville was permanently protected, as of 2017, leaving many of these natural areas vulnerable to development. Conversion of natural areas to impervious area increases stormwater volumes. Stormwater flooding impacts communities in the watershed, cutting off access to major thoroughfares, and damaging shorefront property and septic systems, threatening water quality. Undersized culverts throughout town often contribute to localized flooding and are at threat of failure. Areas along the Nemasket River were particularly impacted by the floods of 2010. Many shorefront communities have limited access by narrow, privately owned dirt roads that routinely flood during storms and cut-off resident access. Power outages are frequent throughout town, resulting from tree fall on above ground power lines, and responses from utility providers have been variable. Snow removal and storage has become increasingly difficult as winter storms have become more intense, due to lack of appropriate places to store snow without road salts potentially contaminating water resources.

### **Lakeville Land Use/Land Cover<sup>4</sup>**

Residential uses occupy 39% of Lakeville's land area, institutional uses (including some categories of public open space) occupy 35%, vacant land 11%, open space and recreational uses 6%, industrial 2%, and agriculture 2%.

Much of the land that appears to be available for future development is in the Res/Ag, Res/OS, Non-Productive Ag, and Open Space and Recreation land use categories. In combination these categories occupy approximately 27% of the total land area in Lakeville.

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<sup>3</sup> Sources: Lakeville MVP Plan and Losing Ground 2020 data

<sup>4</sup> Sources: Lakeville comprehensive plan and review of parcel maps

The watershed area is zoned largely for residential (single family, with accessory dwelling permitted) use, with some areas zoned for business and industrial use. There is a small portion of the watershed covered by the Mixed Use Development and Smart Growth Overlay Districts in the northeast portion of the town.

**Lakeville population projection:**  
 2010 Census: 10,602, 2040 projection: 12,175

### Middleborough<sup>5</sup>

Middleborough encompasses the northeast portion of the watershed, and contains the lower Nemasket River as well as the eastern banks of Assawompset, Pocksha, and Great Quittacas

Ponds. It is the largest town in the watershed, and the second largest in the state, at over 70 square miles. A historically agricultural community, Middleborough is characterized by a low density development pattern, but agriculture has become less popular and development rates increased in recent years. Though less developed than Lakeville and Freetown, with 16% of the town’s area developed, Middleborough had the highest rate of development, 6.8 acres per square mile, of the four towns in watershed, from 2012 to 2017. These development patterns are threatening the town’s rural landscape and valued open spaces. Population growth is also contributing to a growing income gap, and lack of affordable housing for low-income and elderly residents.

Permeable soils make for excellent groundwater recharge capability in Middleborough, but also make ground water supplies more vulnerable to pollution. The town has established wellhead protection zones to preserve drinking water supplies; however, these areas are outdated and in need of review to ensure adequate protection under future climate scenarios. Current

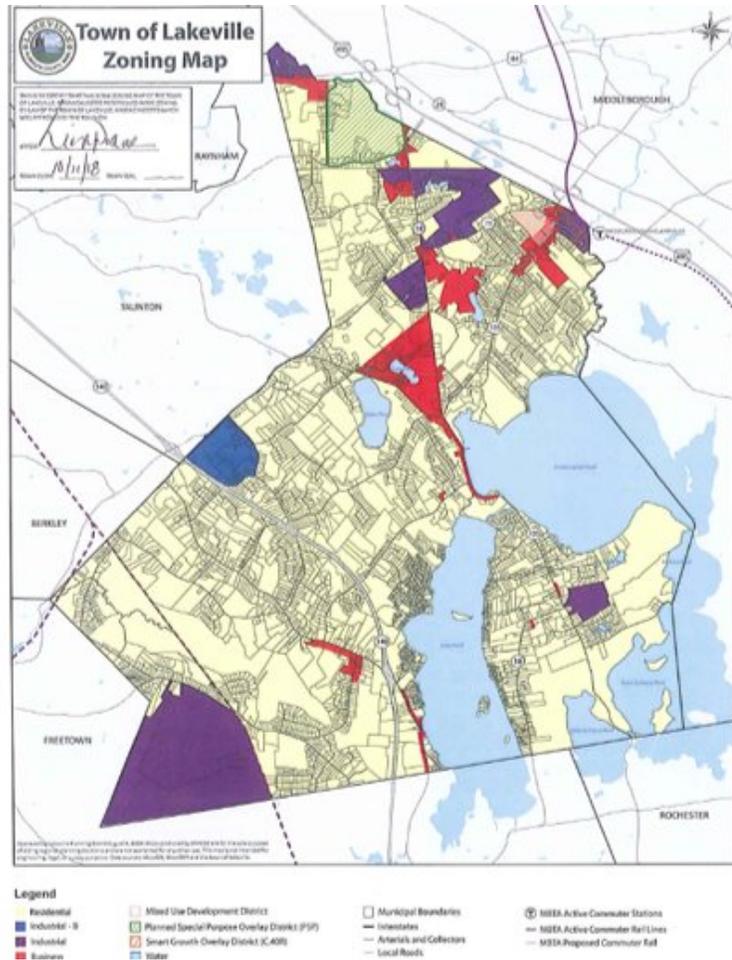


Figure 1 Lakeville zoning map

<sup>5</sup> Sources: Middleborough MVP Plan and Losing Ground 2020 data

development regulations are also not adequately protecting important resource areas like wetlands and their buffers.

### Middleborough Land Use/Land Cover

The area of the watershed within Middleborough is largely zoned residence rural (single family only, accessory apartments by special permit). There are also general use (multi family by special permit and mixed business – residential use), residence A, residence B (no obvious differences between the 3 residential uses, except open space residential preservation development allowed by special permit in RR and RA, but not at all in RB), and business uses clustered around Middleborough Center and along 495 and the rail line. Water resource protection overlay districts lie in several areas within the watershed as well.

(Information from Open Space Plan, note that this information dates from 1998 and will need to be updated with new analysis)

### Residential

Potential subdividable land: 14,182 acres, 7,466 new units

Existing subdivided lots: 911

Potential new dwelling units: 8,377

### General Use District

Potential subdividable land: 1,788 acres

1,076 single family units or 2,116 multi-family units

**Middleborough population projections** (Donahue Institute)  
2010 Census: 23,116, 2040 projection: 34,964

The I-495 corridor through Middleborough appears to have significant buildable land that is currently undeveloped (fig. 3).

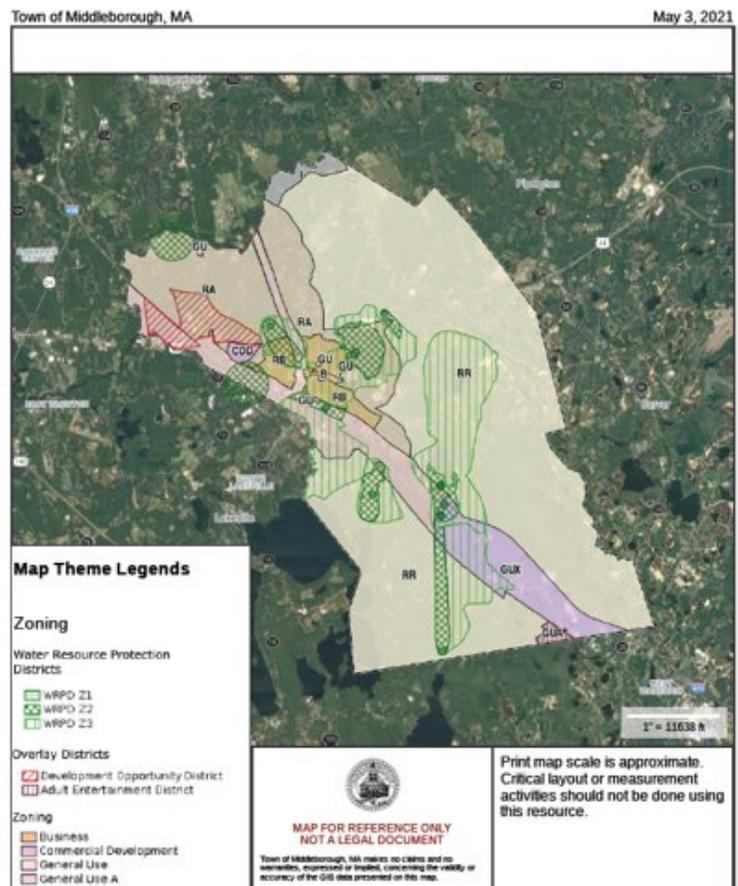
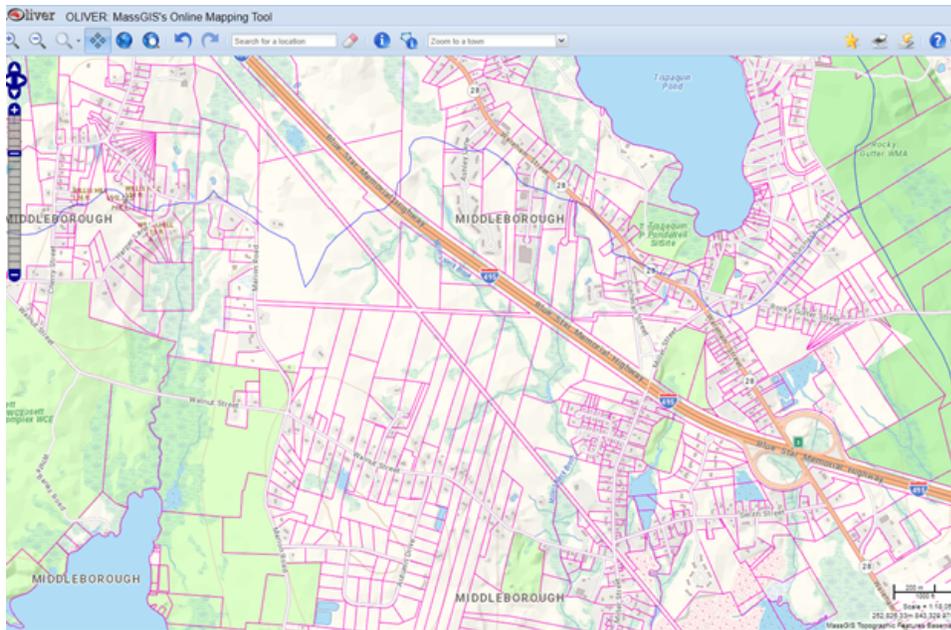


Figure 2 Middleborough zoning map



**Figure 3** MassGIS parcel map for Middleborough 495 corridor

## Freetown<sup>6</sup>

Freetown is a town of 8,870 residents in southeastern Bristol County. The south and eastern portions of Freetown are in the APC watershed. The town has little in the way of public water and sewer availability. This dependence on private well and septic systems has fostered a large lot, single family home dominated landscape.

The need for improved management of Long Pond/Assawompset Pond Complex for flood control and water quality was one of the recurring themes in the MVP process.

The Heaven Heights and Hemlock Point neighborhoods, in eastern Freetown and the APC Watershed, were identified as vulnerable areas. Heaven Heights is flagged in both the infrastructure and environmental risk matrices due to problems with septic systems. Hemlock Point is included in the infrastructure risk matrix as being vulnerable due to flooding issues that impair the road network.

### **Freetown population projection**

2010 Census: 8,870, 2040 projection: 9,313<sup>7</sup>

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<sup>6</sup> Source: Freetown MVP Plan

<sup>7</sup> Donahue Institute projection

## Freetown land use/land cover

Freetown has significant unbuilt land area in the southwest quadrant of the ACP watershed. Much of this unbuilt area may be constrained by wetlands (fig. 4)

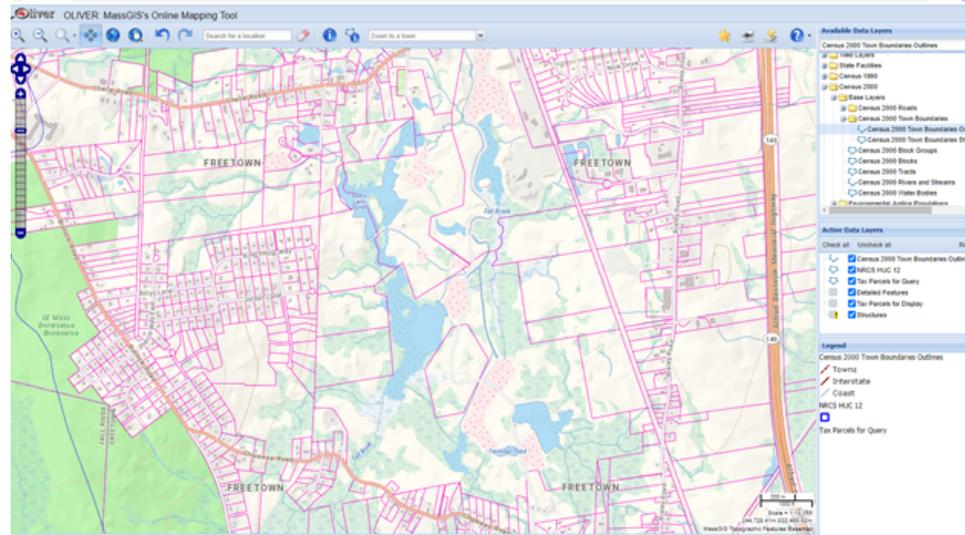


Figure 4 Mass GIS parcel map for western Freetown

The portion of the watershed that lies in Freetown is largely zoned for residential (single family or duplex, and multi-family by special permit) and general (mixed use residential/business) uses within watershed. There are some areas zoned as open space (only uses permitted are agriculture; religious, educational, or municipal use by town; cemeteries; and recreational facilities) industrial, and a concentrated area of business, village business, and village residential uses in the East Freetown downtown area.

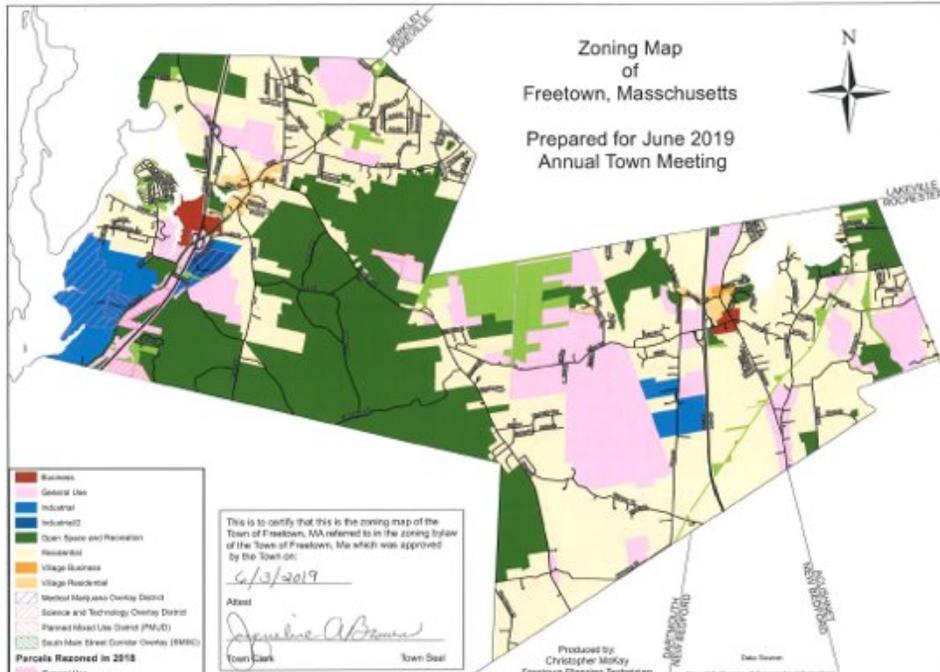


Figure 5 Freetown zoning map

## Rochester<sup>8</sup>

Rochester's landscape is dominated by forests and waterways, with many surrounding towns benefitting from Rochester's abundant water resources. In fact, Rochester's aquifers provide drinking water for its own residents, as well as residents in neighboring towns, including Marion, Mattapoisett, and Fairhaven, totaling over 25,000 people served. In addition, the Assawompset Pond Complex, which acts as the primary source of drinking water for the City of New Bedford and a secondary source for the City of Taunton, is located partially within Rochester's borders. Rochester's two largest rivers, the Mattapoisett and the Sippican, both eventually empty into Buzzards Bay. Rochester's high water table, dependence on private wells and septic systems, and role as a local hub for drinking water supply, make water resources protection a central issue in town.

Participants discussed past impacts from natural hazards they have experienced, and came to consensus on the top four concerns to their community, which were identified as:

- Flood/Drought Cycle
- Pests (vectors, invasive species)
- Storms/High Winds
- Forestry Health

### **Water Supply and Management**

Because the majority of town residents get their water from individual wells, but municipal wells owned by the Town of Marion receive their water from Rochester, and the Assawompset Pond Complex serves the community of New Bedford, Rochester residents face a unique situation wherein local water resources are not primarily locally-controlled. This means that when drought hits, the local water table may be drawn down to supply other communities, leaving Rochester residents without sufficient supply. Similarly, when flooding occurs, many residents experience flooding in their basements, an all-too-common problem that the Fire Department is called in to address. Water quantity and availability were also concerns for the purposes of fire suppression, especially at the Old Colony Vocational High School, which does not currently have its own sprinkler system or independent water source.

### **Solar Development Pressure**

Workshop participants expressed extreme concern about the increase in solar development they are seeing in Rochester. While appreciating the need for clean energy, participants lamented the clearcutting of forest for solar development that has been on the rise in town,

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<sup>8</sup> Rochester MVP Plan

and were concerned that the town's many cranberry bogs will be the next targets for solar development, further straining Rochester's ability to retain its rural and agricultural character. A review of the town's solar bylaw to include responsible siting and sizing guidelines was a recurring action participants were eager to take.

Management recommendations include proactive forestry management:

- Develop a Forest Management Plan to address tree death from invasive species and resulting hazards; include utility resilience planning for private and public property.
- Couple Forest Management Plan with a utility infrastructure vulnerability study, prioritizing tree assessments along power corridors. Recommend power line undergrounding where feasible.

### Rochester population projection

2010 Census: 5,232, 2040  
projection: 6,404<sup>9</sup>

### Rochester land use/land cover

A relatively small portion of the watershed lies within the north west portion of the town of Rochester. This portion of the town is zoned for agricultural-residential use (allowing single family and agricultural uses, one multi-family dwelling up to 4 units per lot, and additional by special permit), a portion of which also lies within the Mattapoisett River Valley Watershed overlay district (uses not in zoning bylaw).

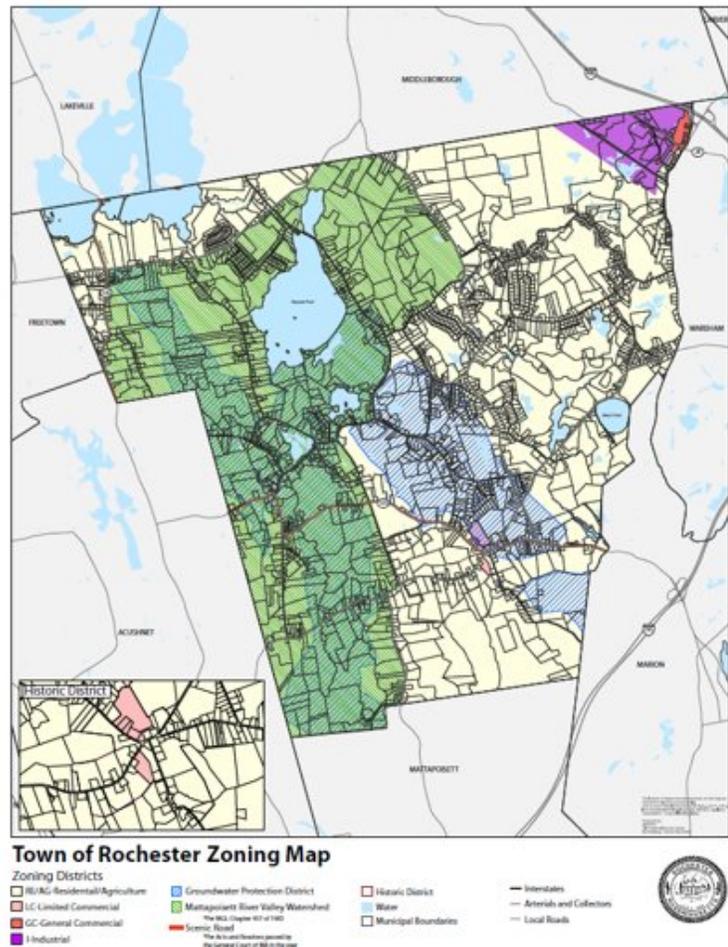
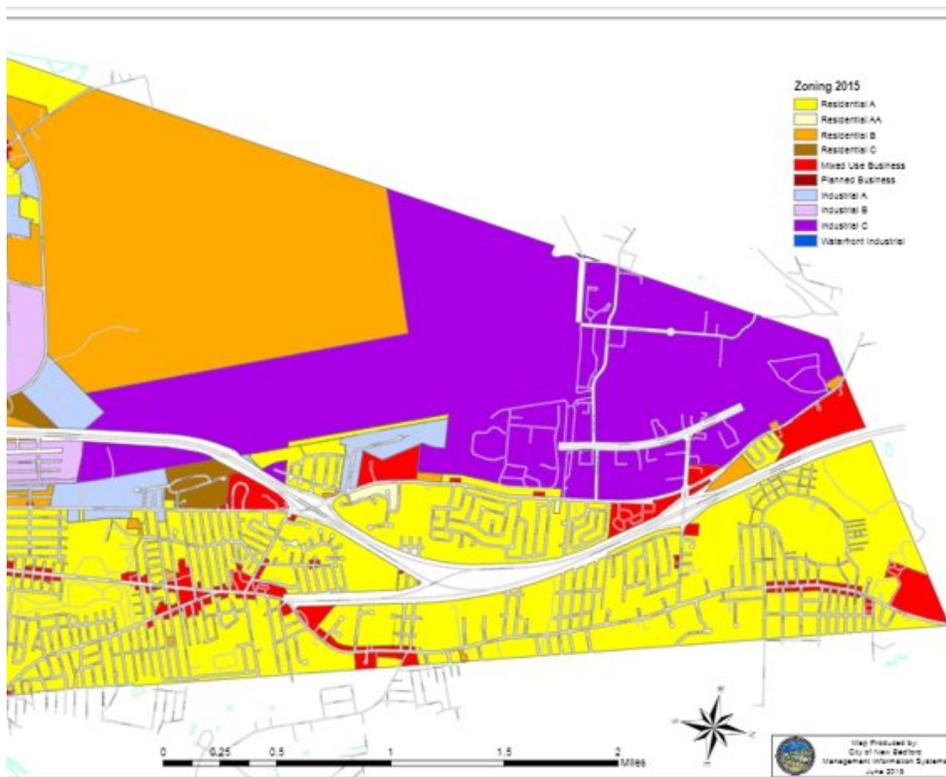


Figure 6 Rochester zoning map

<sup>9</sup> Donahue Institute

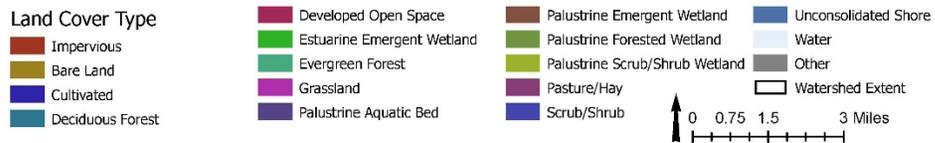
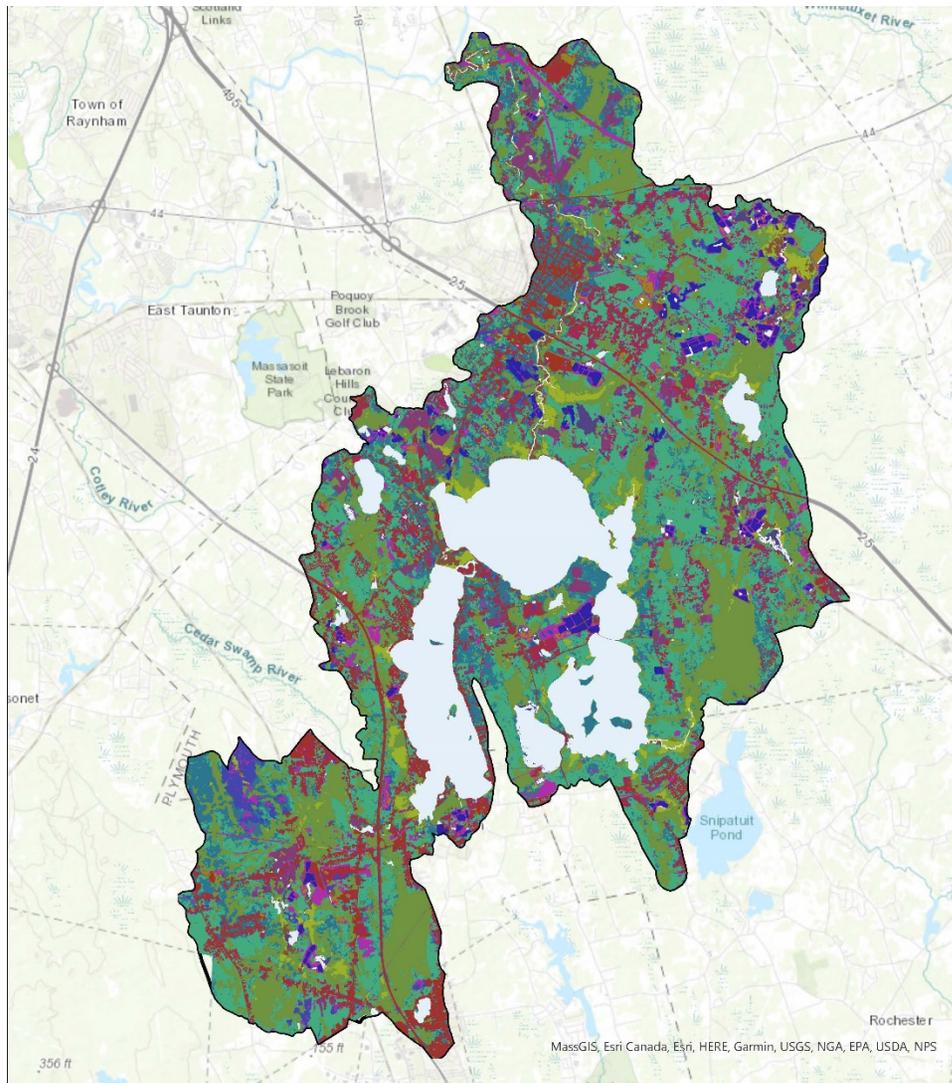
## New Bedford<sup>10</sup>

A relatively small portion of the southern extent of the watershed lies in New Bedford, a coastal city and the most densely populated community in the watershed. New Bedford is also the most developed community in the watershed, with 59% of land area developed and 33% natural. The portion of the town that lies within the watershed is zoned for residential (single family, and two-family in Residential B zone only) or mixed business uses (single or multi family, agriculture, business). A 34-acre warm water kettle pond, Sassaquin Pond, lies within the watershed in New Bedford. Sassaquin Pond is heavily utilized for recreation fishing. Dense residential development, including cottages built on its shores, have impaired water quality in the Pond, and swimming is not allowed due to bacterial contamination. (As of the 2014 Open Space Plan) The City proposed a watershed overlay district restricting development in the area surrounding Sassaquin Pond with an increased minimum lot size and encouraging other best management practices to reduce stormwater pollution, including education and outreach in the surrounding neighborhoods.



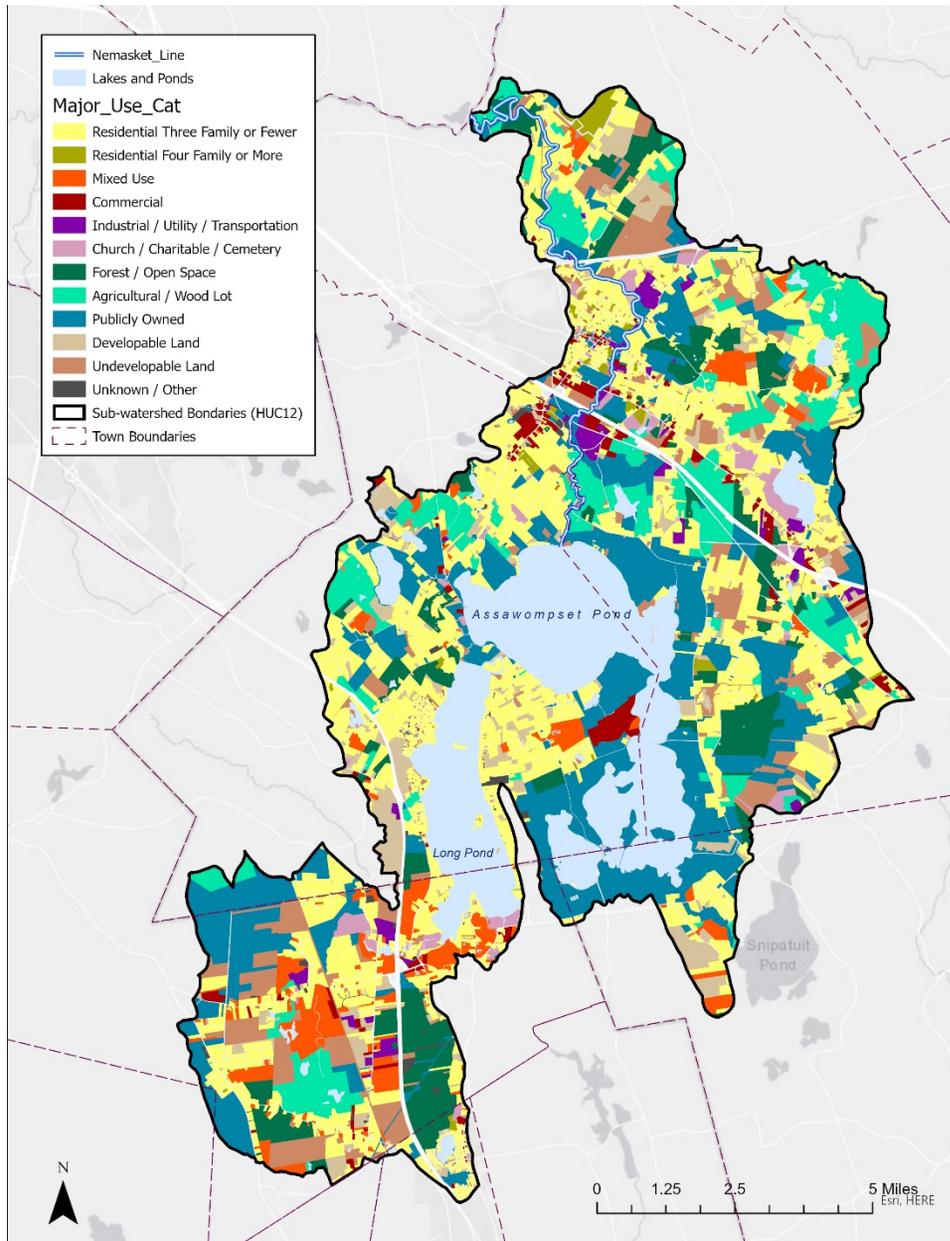
**Figure 7** New Bedford zoning map, cropped to watershed area in northern extent of the city

<sup>10</sup> Sources: New Bedford Master Plan, Open Space Plan and Losing Ground 2020 data



Land Cover Type	Sum of Acres
Bare Land	458
Cultivated	951
Deciduous Forest	8,047
Developed Open Space	3,268
Evergreen Forest	10,771
Grassland	1,059
Impervious	2,555
Palustrine Aquatic Bed	282
Palustrine Emergent Wetland	563
Palustrine Forested Wetland	8,373
Palustrine Scrub/ Shrub Wetland	769
Pasture/ Hay	792
Scrub/ Shrub	419
Water	6,560

Figure 8 Watershed land cover map and table



Assessed Land Use Type	Sum of Acres
Residential 3 Units or Fewer	22,649
Residential 4 Units or More	322
Mixed Use	3,250
Commercial	757
Industrial / Utility / Transportation	605
Church / Charitable / Cemetery	697
Forest / Open Space	3,205
Agricultural / Woodlot	4,399
Publicly Owned	8,672
Developable Land	2,195
Undevelopable Land	1,849
Unknown / Other	161

Figure 9 Watershed land use map and table

## Watershed zoning summary<sup>11</sup>

Use	Lakeville	Middleborough	Freetown	Rochester	New Bedford
Residential – single family	yes	yes	yes	yes	yes
Residential – two family	Not addressed	Special permit, only w/in General Use	yes	yes	yes
Residential – three or more family	Not addressed	Special permit only, up to 3 units	Special permit	Yes (up to 4; SP for more)	Yes, in MUB only
Agriculture	Yes	Yes	yes	yes	yes
Mixed Use	Special permit for residential uses in business district	Yes – general use district	Yes – general use, village-residential/business districts	no	Yes – Mixed Use Business district
Business / Commercial	Yes	yes	yes	no	yes
Industrial	Yes	No, but some uses allowed in general use district	yes	no	No
Open Space	No designated use	No designated use	yes	No designated use	No designated use

## Recent development Trends<sup>12</sup>

Both watersheds are mostly situated in Plymouth County, the 7th most developed county in the state at 26% developed, and the southeast portion of the Assawompset Watershed lies within Bristol County, the 6th most developed county at 29%. Plymouth County was the most rapidly developing county between 2012-2017 at a rate of 6.1ac per square mile, and Bristol

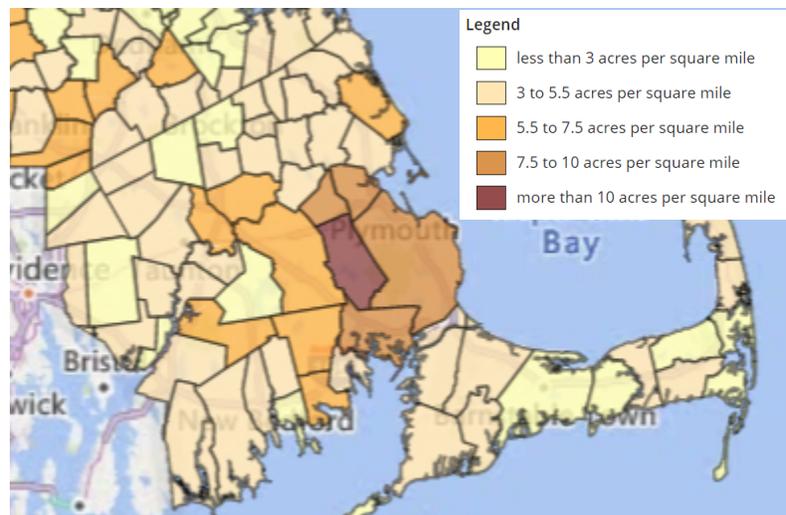


Figure 10 development rates by town in southeastern Massachusetts

<sup>11</sup> Summary of uses allowed in each town, within the watershed boundary only

<sup>12</sup> Losing Ground 2020 data

the 5th most at 3.9 ac per square mi.

	Lakeville	Middleborough	Freetown	Rochester	New Bedford
Town area	23,117 ac	46,198 ac	22,652 ac	23,057 ac	12,906 ac
% developed	19%	16%	17%	12%	59%
% natural land	73%	71%	75%	72%	33%
% open land	8%	12%	7%	16%	6%
New development 2012-2017	90 ac 2.5 ac / sq mi	490 ac 6.8 ac / sq mi	222 ac 6.3 ac / sq mi	245 ac 6.8 ac / sq mi	76 ac 3.8 ac / sq mi
Rank in state (ac developed per sq mi)	196	16	24	17	114
Development 2005-13	117 ac 3.2 ac / sq mi	373 ac 5.2 ac / sq mi	167 ac 4.7 ac / sq mi	122 ac 3.4 ac / sq mi	103 ac 5.1 ac / sq mi
Permanently conserved land (in 2019)	3,475 ac	8,211 ac	6,003 ac	5,005 ac	2,220 ac
% permanently conserved	15%	18%	27%	22%	17%
Rank in state (%)	247	224	137	178	230

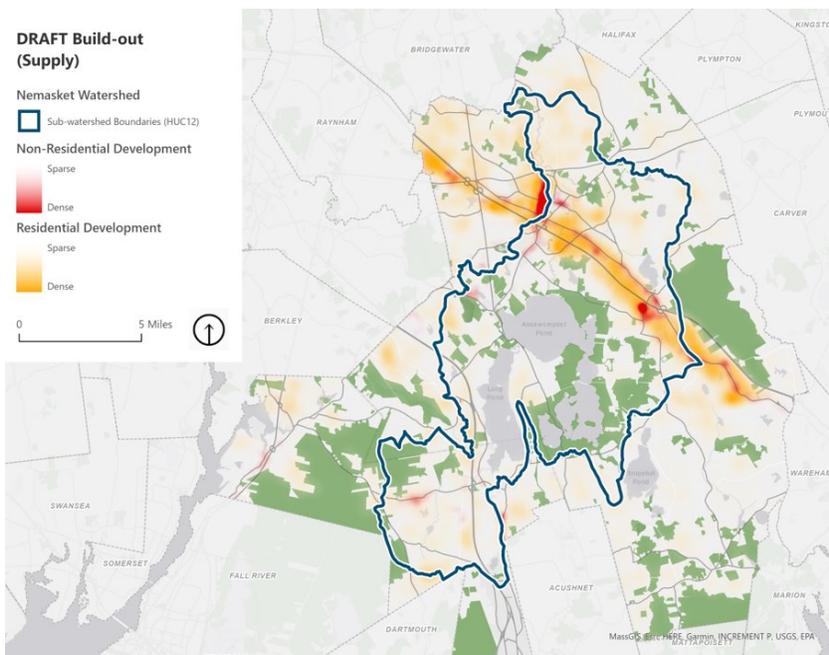
## Land Use Regulations

	Lakeville	Middleborough	Freetown	Rochester	New Bedford
Wetland bylaw?	No	Yes - 25ft vegetated buffer	Yes (2008 Rules & Regs) - 100ft wetland buffer; 200ft river/stream/lakebuffer	Yes (bylaw, year?) - 100ft buffer	Yes – 100ft buffer of any “bank”, lake, river, stream, pond (not wetlands?) or upon any land subject to flooding by surface/groundwater; 25 ft setback from all resources areas preferred but not required
Stormwater bylaw?	No	Yes	No	No?	Yes
Soil/ Earth Removal bylaw?	Yes	Yes	Yes	Yes	No?
Conservation Subdivision / OSRD?	No	Yes – special permit in residential and general use districts	No (but Planned Mixed Use Development overlay district requires open space protection)	No?	35% green space required all residential lots; 20% industrial
Cluster development allowed?	Density bonuses in business/ industrial districts; mixed use and smart growth overlay districts	No?	No	Special Residential Development (SP)	Mixed Use Business, Planned Business districts, “KHTOD”?
Bylaws reviewed?	? Zoning bylaw review advisory committee	No?	2020 by MAS	No?	No?
43D?	yes	Yes	Yes?	No	Yes
Master Plan?	2020	2002	No	No	2010 - 2020

Open Space Plan?	2012	2008	In process?	2008; 7 Year Action Plan 2010	2014 - 2021
MVP certified?	Yes - 2019	Yes - 2020	Yes - 2019	Yes - 2019	Yes - 2018
CPA?	No (failed vote 2006)	Yes (adopted 2010) - 1% surcharge	No (failed vote 2012)	No (failed vote 2006)	Yes (adopted 2014) - 1.5% surcharge

### Future Urbanization in the APC Watershed

In the second year of the project, an analytic tool named CommunityViz will be used to examine buildout under existing development controls and the impact of modifications to those controls. The following map is a preliminary look at development potential in the watershed under existing development controls. The placement and extent of new impervious surface, location and type of new septic systems, and alteration of existing natural areas will all influence water quality, flood hazard, and biodiversity in the watershed.



Identified Areas with Large Potential Supply of Available Developable Land

## SUMMARY OF THREATS / CHALLENGES TO A HEALTHY / FUNCTIONING SYSTEM

- Increasing impervious area with development exacerbates stormwater flooding issues and increasing temperature trends

- Imperviousness associated with development prevents infiltration of rainfall and decreases groundwater supplies
- Dense residential development along Long Pond in particular, and excessive pavement and fertilizer use adjacent to the pond, is negatively impacting water quality in the ponds

## IMPLICATIONS OF ANTICIPATED CLIMATE CHANGE IMPACTS

More frequent intense storm events:

- Growing floodplains and loss of land for development is stressing the growing demand for land and housing
- More frequent and more intense rainfall events will exacerbate stormwater flooding and associated damages to aging public infrastructure, including culverts, dams, bridges, rail infrastructure and dams, which are at threat of failure is overwhelmed by too much stormwater
- Repeated flood damages and losses on shorefront properties
- High winds will cause more frequent damages to property and tree falls
- Flooding and tree falls impact road access and threaten above ground power infrastructure
- Power outages and flooding impact private well pumps and sewer systems some residents (in Lakeville, Middleborough...) rely on for drinking water and waste management
- Flooding can compromise sewer and septic systems, resulting in pollutant discharges
- Improper stormwater management, and improperly managed retired cranberry bogs throughout the region, can support mosquito populations, impacting public health

More intense flood and drought cycles:

- More frequent droughts impact forest health, increasing likelihoods of tree fall and fire hazards, threatening public health and property
- Changing distributions and abundances of invasive species impact forest health, and vulnerability to tree fall and fires
- Fluctuating water levels in surface in groundwaters will impact environmental health and threaten drinking water supplies (private and public wells as well as supplies in the ponds), especially as population growth increases demand

Extreme temperatures:

- Impact public health and are a particular hazard for vulnerable residents and those living in highly developed areas
- Exacerbate forest fire hazards
- Warmer temperatures increase mosquito and tick populations, threatening public health

## DATA GAP DOCUMENTATION

Overall development trends for land within the watershed would be useful (Losing Ground statistics are by town only). CommunityViz analyses may be able to provide some of that data, as well as predict future projections for the watershed area.

# TRADE-OFFS AND CO-BENEFITS WITH OTHER INTERESTS

## Future Land Development and...

1. **Water Quality: Trade-Off.** Development of natural areas often results in water quality impairments due to losses of important buffer habitats to wetlands and streams. Larger stormwater volumes traveling over impervious surfaces carry pollutants from built areas. Loss of vegetated buffers often means this contaminated stormwater enters straight into waterways, resulting in pollution and erosion of stream banks.
2. **Drinking Water Supply Levels: Trade-Off.** Development increases pressure on drinking water supplies, while also impacting its supply. Built areas allow less groundwater infiltration to recharge wells, and water quality impairments can affect drinking water supply. Managing development in wellwater recharge areas and managing stormwater with low impact development practices can reduce these impacts.
3. **Floodwater Management: Trade-Off.** Impervious developed surfaces prevent infiltration of rainfall into the ground. Flooding over built areas has the potential to move and migrate pollutants and debris into the water system. Minimizing these floodwater extents will minimize this effect.
4. **Stormwater Management: Trade-Off to co-benefit.** Increased stormwater infiltration decreases runoff that carries pollutant loads into the water system. Low impact development practices can maximize stormwater management that has fewer environmental impacts and puts less stress on municipal systems and budgets.
5. **Ecology, Unique Habitats and Natural Resources: Trade-off.** Conversion of natural areas for development fragments wildlife habitat and impairs natural resources. Low impact development that adapts to the land and preserves natural resources can minimize these impacts.
6. **Increased Inter-Agency Cooperation: Neutral to Co-Benefit?** Cooperative planning, regulatory updates, and enforcement of land use regulations can help manage development and its negative impacts.
7. **Recreational Access: Trade-Off, traditionally.** Conversion of natural areas for development can impair passive recreation opportunities in nature. Traditional development has often prevented public access to waterfront areas and barring watersport recreation. Thoughtful development and redevelopment of abandoned waterfront industrial sites can enhance public recreation opportunities.
8. **Increased public stewardship: Potential Co-Benefit?** Low impact development that works with the land can result in nature and development co-existing, which, alongside public education and awareness, can enhance stewardship of local natural areas.