6 Framework

6.1 Introduction

Following the Mashpee Sewer Commission meeting held on January 17, 2013, the framework of the Recommended Plan development began to take form based on the findings of the three options run through the MEP model and summarized in Chapter 4 of this report.

The Project team worked through a worksheet prepared by the Sewer Commission to consider which items/plan components should be carried forward; and based on that list, Options 1A, 1B, and 1C were examined to see how these components could be integrated into those nitrogen management options. Major components were identified so that a cost evaluation of various alternatives could be compared as part of the Recommended Plan Report.

Based on the various components to be considered, each was grouped into one of the following three categories (each as defined below):

- Source Removal
- Direct Environmental Mitigation
- Land Management Strategies

Source Removal is the removal of nitrogen (or some portion of it) before it reaches the local groundwater and can be further divided into the following subcategories:

- Wastewater Management
- Stormwater Management
- Fertilizer Management

Each of these allows the Towns within the planning area to mitigate nitrogen before it enters the groundwater and eventually reaches the ponds and estuary systems.

Direct Environmental Mitigation is generally defined in this report as the removal of nitrogen (or some portion of it) at or in close proximity to the area of impact. This can be further divided into the following subcategories:

- Dredging/Inlet Widening
- Shellfish Aquaculture
- Permeable Reactive Barriers
- Enhanced Natural Systems

Land Management Strategies are generally defined in this report as the growth and development management strategies to reduce the potential of the Project Planning Area reaching a build-out condition which increases the cost and difficulty of achieving TMDL compliance.

Much of the discussion as part of this project to date has focused on the Source Removal approach, and recently there has been a greater push for the Direct Environmental Mitigation to be used in one of two ways—reduce or eliminate the need for Source Removal in certain areas, or be implemented prior to

Source Removal—to either allow longer phasing of any Source Removal strategy or ultimately the reduction of the need for full-scale traditional wastewater management.

As was clearly shown in all eight previous scenarios, a massive amount of Source Removal is required to achieve the TMDLs under the build-out condition if Direct Environmental Mitigation is not considered or feasible.

6.2 Source Removal

During the Sewer Commissions recent monthly working session, several approaches were identified:

- Potential Cluster Systems at the following locations:
  - Santuit Pond Area
  - Pirates Cove
  - Monomoscoy / Seconsett / Popponesset Island
  - Other Areas
- Use of Existing WWTPs (in the planning area)
  - Use of all, but ownership, upgrade, and expansion will be site-dependent and discussed later in the cost section
- Potential New WWTPs
  - Transfer Station and High School
  - Possibly at Keeter Property, Old Highwood Well
  - Unlikely at Rock Landing or Back Road Sites
- Eco-Toilets
  - Mashpee needs to establish what its plan will be to address these, may follow Falmouth's lead
- MMR
  - Unknown at this time whether the site will be available for any use. Ideal for regional facility, especially if expanded recharge is allowable at the existing sand infiltration beds
- Stormwater
  - BMP's need to be implemented on a case-by-case basis, with nutrient removal capabilities considered in most sensitive watersheds.

6.3 Direct Environmental Mitigation

- Dredging/Inlet Opening
  - No clear areas identified in either MEP reports for dredging or widening to significantly improve water quality. For Popponesset Bay the MEP report stated "it is unlikely that dredging will improve water quality with the three main subembayments", however the report stated that the main channel should continue to be dredged to avoid further degradation of estuaries health. Same as for removal of "muck" removal from the bottom any of the Town's estuaries (outside of regular maintenance for navigation).
- Shellfish Aquaculture
  - Oysters—Mashpee River, Popponesset Bay
  - Quahogs—Jehu, Hamblin, Great River, Little River, Ockway Bay, and Popponesset Bay

- PRBs
  - Pirates Cove
  - No other definitive areas identified at this time
- Enhanced Natural Systems
  - Abandoned Cranberry Bog naturalization/conversion
    - Discussion on bogs south of Santuit Pond and those east of the Quashnet River.
    - Potential conversion of shallow ponds/water hazards to deeper ponds for additional natural attenuation.

6.4 Land Management Strategies

- Growth Neutral/Flow Neutral
  - Town will need to develop a policy that meets the criteria of the State SRF program to make themselves eligible for zero-percent SRF loans
- Purchase of Open Space/Build-out Development Properties
  - Town will need to identify which properties could be purchased to reduce build-out potential, therefore reducing potential future flow, and reducing the projected nitrogen loading to the embayments.
- Potential Well and/or Treatment and Disposal Sites
  - Town can work towards securing additional public drinking water supply well locations and potential treated water recharge sites to foster flexibility in addressing their wastewater needs and protecting their drinking water supplies.
- Seasonal and year-round property phasing impacts
  - Phasing and implementation can target year-round developments or apply near-term solutions to areas that are more seasonal in nature to achieve a quicker rate of result while minimizing infrastructure investment in the near-term.

6.5 Recommended Plan Components

6.5.1 General

As developed as part of the initial scenarios/options, the following sections identify those decisions/recommendations made to date as they relate to Source Removal, Direct Environmental Mitigation, and Land Management Strategies.

6.5.2 Source Removal

The following sites and technologies were selected for further consideration for wastewater treatment and removal. This section will also briefly touch on stormwater removal technologies identified previously in this report.

6.5.2.1 Sites

As identified in Chapter 2, the following new treatment and recharge sites were identified and should be carried forward.

6.5.2.1.1 Potential Treatment Sites

1. Site 2—Ashumet Road
2. Site 4—Transfer Station
3. Site 6—Keeter Property
4. Back Road Sites

Site 2—although being kept as a viable location—will likely be combined with a wastewater treatment and recharge facility at Site 4. Similarly, the Back Road Site may be considered as a cluster facility, but if combined would likely be served from a new WWTF facility potentially located at the High School.

6.5.2.1.2 Recharge Sites

1. New Seabury/Site 7
2. Back Road Sites
3. Site 4—Transfer Station
4. Site 6—Keeter Property
5. Willowbend Golf Course

Rock Landing was removed from further consideration for several reasons:

- Difficulty and cost associated with the relocation of the existing wells.
- The site is a very high-quality drinking water supply site that supplies nearly 50-percent of the Town's water supply.
- Recharge from the location (if wells were relocated and site was used for treated water recharge) would still end up back in several of the Towns' sensitive embayments and not directly out to Nantucket Sound (for example Site 7).

6.5.2.1.3 Potential Cluster System Sites

In addition, the following potential cluster developments were identified by the Sewer Commission as shown on Figure 6-1:

- Briarwood/Otis Trailer Village
- Holland Mill Estates & South Cape Resorts
- Pickerel Cove
- Pirates Cove
- Popponesset Island
- Santuit Pond
- Monomoscoy Island
- Seconsett Island

- The Seabrooks
- Tri-Town Circle

Within these development areas the Sewer Commission identified possible vacant properties, private association lands, and Town landings as a first look at any potential space for locating a cluster system. Each of these developments was then examined to see where they were relative to Zone II's, flood zones, natural habitats, and Areas of Critical Environmental Concern (ACEC). Figures 6-2 through 6-10 show these features in relation to these developments. Cluster development potential was screened based on proximity to these areas. Based on the summary shown in Table 6-1, the following areas will be carried forward in the Recommended Plan development for further evaluation:

- Briarwood/Otis Trailer Village
- Pickerel Cove
- Pirates Cove
- Tri-Town Circle
- Santuit Pond

Areas within identified natural habitats will need to be addressed on a site-by-site basis. Mitigation and land swap will be considered if these areas remain as part of any Recommended Plan. These efforts will need to be coordinated with Natural Heritage and Endangered Species Program (NHESP) and will likely require additional study that is currently beyond the scope of this project.

Table 6-1 Potential Cluster System Site Review

Cluster Sites	In Zone II	In 100 Year Flood	In V Zone	In 500 Year Flood	In Natural Habitat
Briarwood/Otis Trailer Village					Yes
Holland Mill Estates & South Cape Resorts	Yes			Yes - Part	Yes
Pickerel Cove					Yes - Part
Pirates Cove		Yes	Yes	Yes	
Popponesset Island		Yes			
Santuit Pond	Yes - Part				Yes
Monomoscoy Island		Yes		Yes	
Seconsett Island		Yes		Yes	
The Seabrooks	Yes - Part	Yes	Yes	Yes	Yes - Part
Tri-Town Circle	Yes				

Developments within a Zone II or 100-year flood zone were screened from consideration based on the additional costs, siting limitations, and restrictive regulations regarding the location of treatment and

recharge facilities within these areas. The proximity of Pirates Cove to potentially available adjacent areas and the Willowbend Golf Course were taken into consideration in keeping this a viable option for a cluster system.

6.5.2.1.4 Existing WWTF Sites (in the Planning Area)

The Recommended Plan evaluations will consider the use of all existing facilities. However the ownership, upgrade, and expansion issues associated with each specific facility will be site-dependent and will need to be taken into consideration as part of the Recommended Plan regarding their integration into that plan.

Upgrade and expansion of the following facilities/locations is to be considered in the Recommended Plan:

- New Seabury
- Willowbend
- Mashpee High School
- Mashpee Commons

Upgrade and expansion may include physical plant improvements, upgrades to systems handling the currently permitted design flows, upgrades required to handle additional wastewater flows, or complete replacement of the existing facility with a new facility (due to age of system, year of implementation, level of treatment).

6.5.2.1.5 Massachusetts Military Reservation Site

The potential use of the MMR site will remain in consideration as part of the Recommended Plan; however, because a local or regional plan has yet to be developed or agreed upon with the MMR, the details of its use may need to be addressed as part of the adaptive management approach the Town takes into consideration with its neighbors Falmouth and Sandwich. The Towns' Board of Selectmen have written a letter stating the Town's interest in the use of facilities at this site dated March 27, 2013. A copy of the letter is included in Appendix I.

6.5.2.2 Wastewater Treatment Technologies to be Considered

Wastewater treatment facilities with performance to reach 6 to 10 mg/L total nitrogen being carried forward include:

- Activated Sludge/Extended Aeration
- Sequencing Batch Reactor
- Membrane Biological Reactor

The use of each of these technologies with denitrification filters to achieve levels less than 3 mg/L will be considered for those facilities that would recharge within one of the watersheds (Popponesset or Waquoit Bay); however, since this can be added to the end of the treatment process, these types of advanced treatment facilities may be phased in over time. There are several different types, and they will be specific based on the treatment system that precedes them and client preference regarding operations. These can include traditional upflow and downflow filters in addition to Nitrex™ or other media-based systems.

Use of RBCs will only be considered as they currently exist within the Town at existing wastewater treatment facilities. Any facility that has to achieve 3 mg/L in the future will be based on one of the three previously identified technologies (AS/EA, SBR, MBR) due to the difficulty of RBC systems to consistently achieve full nitrification of their effluent.

UV disinfection will be the only disinfection technology considered as stated in Chapter 2 and the Technology Screening Report.

Odor Control and sludge management systems/technologies will be considered on a site-by-site and process-by-process consideration as part of the Recommended Plan development and will be evaluated in the next report phase.

Collection systems (vacuum, gravity, STEP, STEG, and low pressure sewers) all remain in consideration and should be evaluated at the time of design when site conditions, survey, and utility constraints and design requirements are known. At this time the Town does not have any formal sewer guidelines or regulations that may dictate the components of the system and therefore impact the cost of installation.

6.5.2.3 Treated Water Recharge Technologies

As stated previously, use of open sand beds, traditional subsurface leaching facilities, and drip irrigation are being carried forward as treated water recharge technologies. Spray irrigation is limited by its use, its infrastructure requirements, and the DEP regulations that regulate it and its effluent quality. In addition, there are also time of year use restrictions and other considerations when dealing with spray irrigation that have screened it from consideration.

6.5.2.4 Eco-Toilets

Mashpee will need to establish how Eco-Toilets may be used as part of the Recommended Plan. The Town of Falmouth is actively leading this work in demonstration projects, and the Town of Mashpee currently has regulations allowing the use of certain types of Eco-Toilets; but a robust plan of how these can be used as part of achieving TMDL compliance must be established and will likely be part of the adaptive management approach of the Recommended Plan.

6.5.2.5 Stormwater

Best Management Practices (BMP's) need to be implemented on a case-by-case basis, with nutrient removal capabilities considered in most sensitive watersheds. The Town should continue the implementation of these features and focus on the use of the following technologies within the more sensitive watersheds:

- Dry extended detention basins
- Wet retention ponds
- Infiltration basins
- Stormwater wetlands
- Submerged gravel wetlands
- Bioretention (rain gardens)
- Water quality swales

- Infiltration trenches

6.5.3 Direct Environmental Mitigation

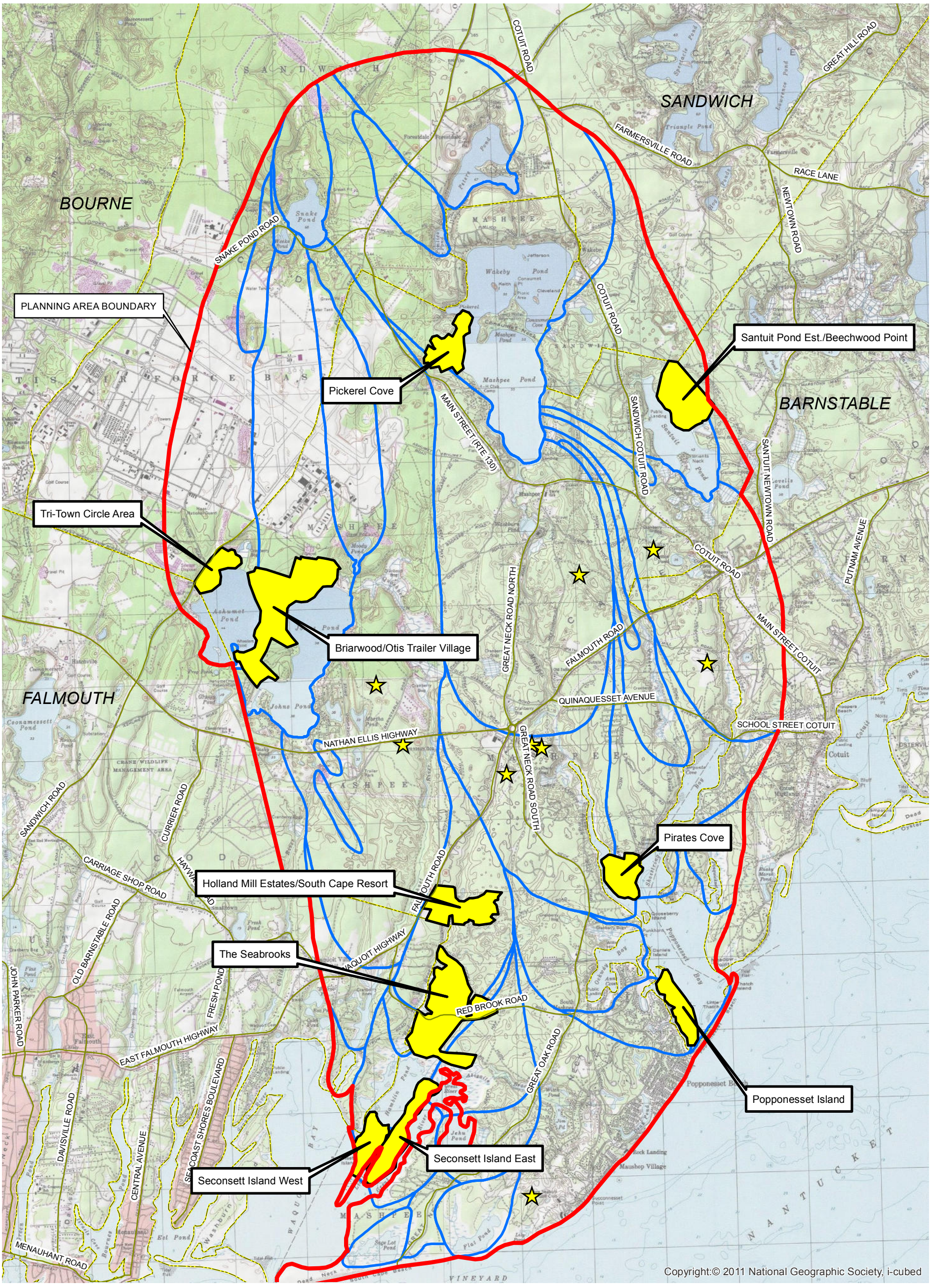
As discussed previously in this chapter, these measures will be considered as features of any Recommended Plan. Their implementation will depend on several factors, which will be a function of existing pilot projects, new pilot/demonstration projects, and adaptive management strategies developed with the Recommended Plan. These will include at a minimum:

- Dredging/Inlet Opening
- Shellfish Aquaculture
- PRBs
- Enhanced Natural Systems (wetlands/old cranberry bog restoration)

6.5.4 Land Management Strategies

In addition to the traditional Source Removal and Direct Environmental Mitigation measures, the Town/District should consider how to include other nitrogen mitigation measures through the following approaches identified previously:

- Growth Neutral/Flow Neutral
- Purchase of Open Space/Build-out Development Properties
- Potential Well and/or Treatment and Disposal Sites
- Seasonal and year-round property phasing impacts



Legend

Planning Area Boundary ☆ Existing Private WWTP Potential Cluster System

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Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

CLUSTER SYSTEM LOCATIONS

Job Number	86-12001
Revision	A
Date	08 Aug 2013

Figure 6-1

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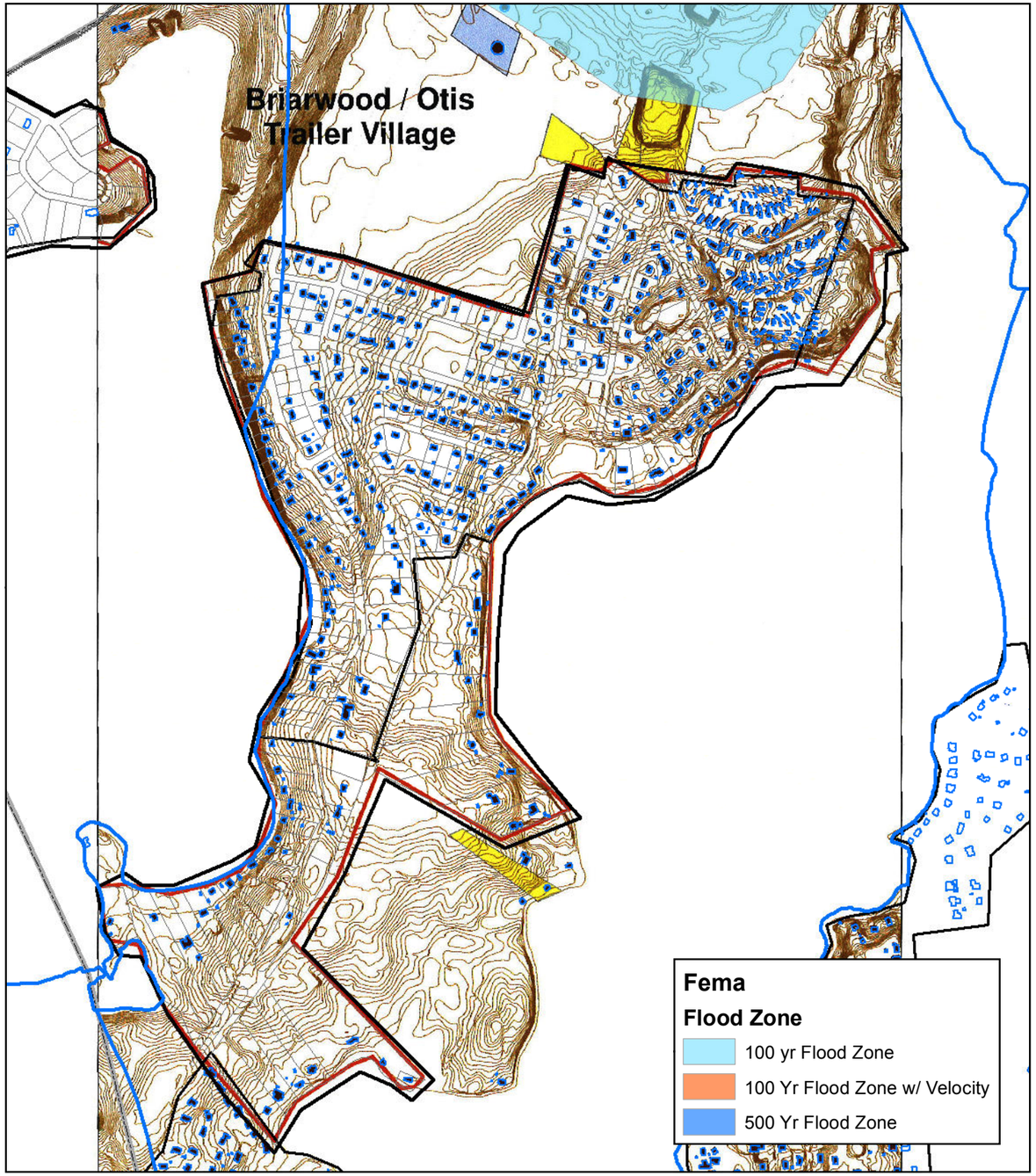

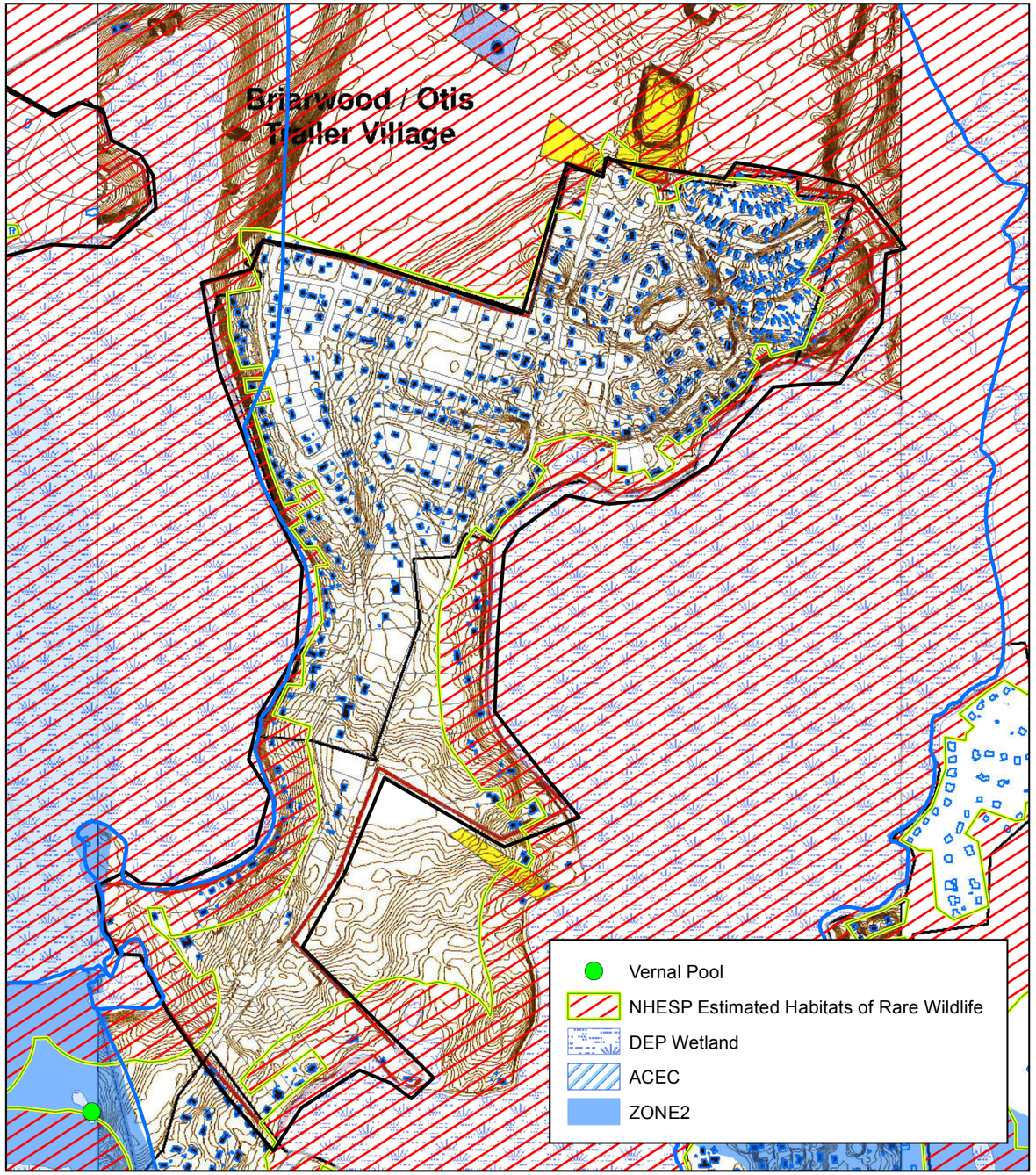

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Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Job Number 86-12001
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Briarwood

Figure 6-2

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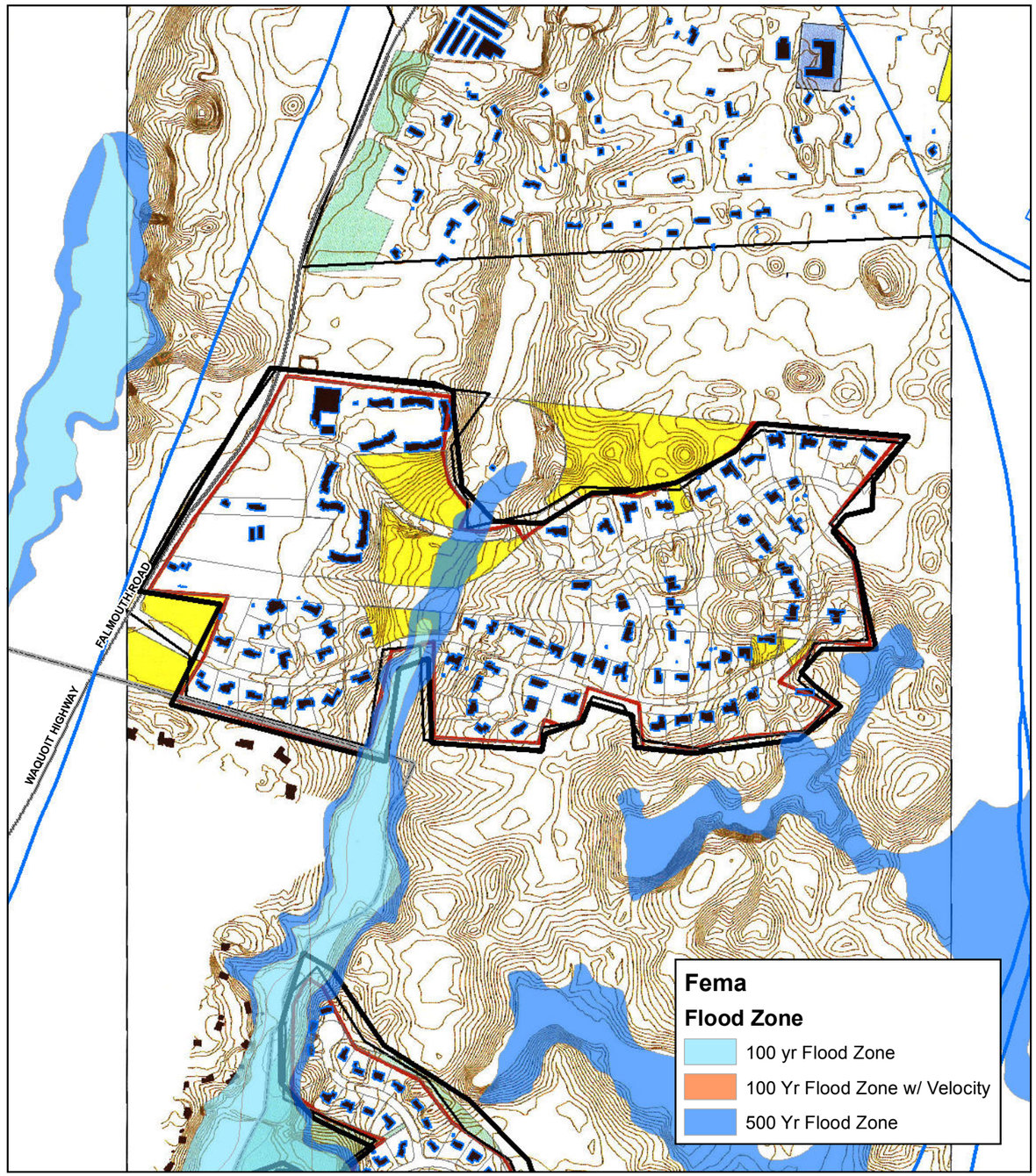

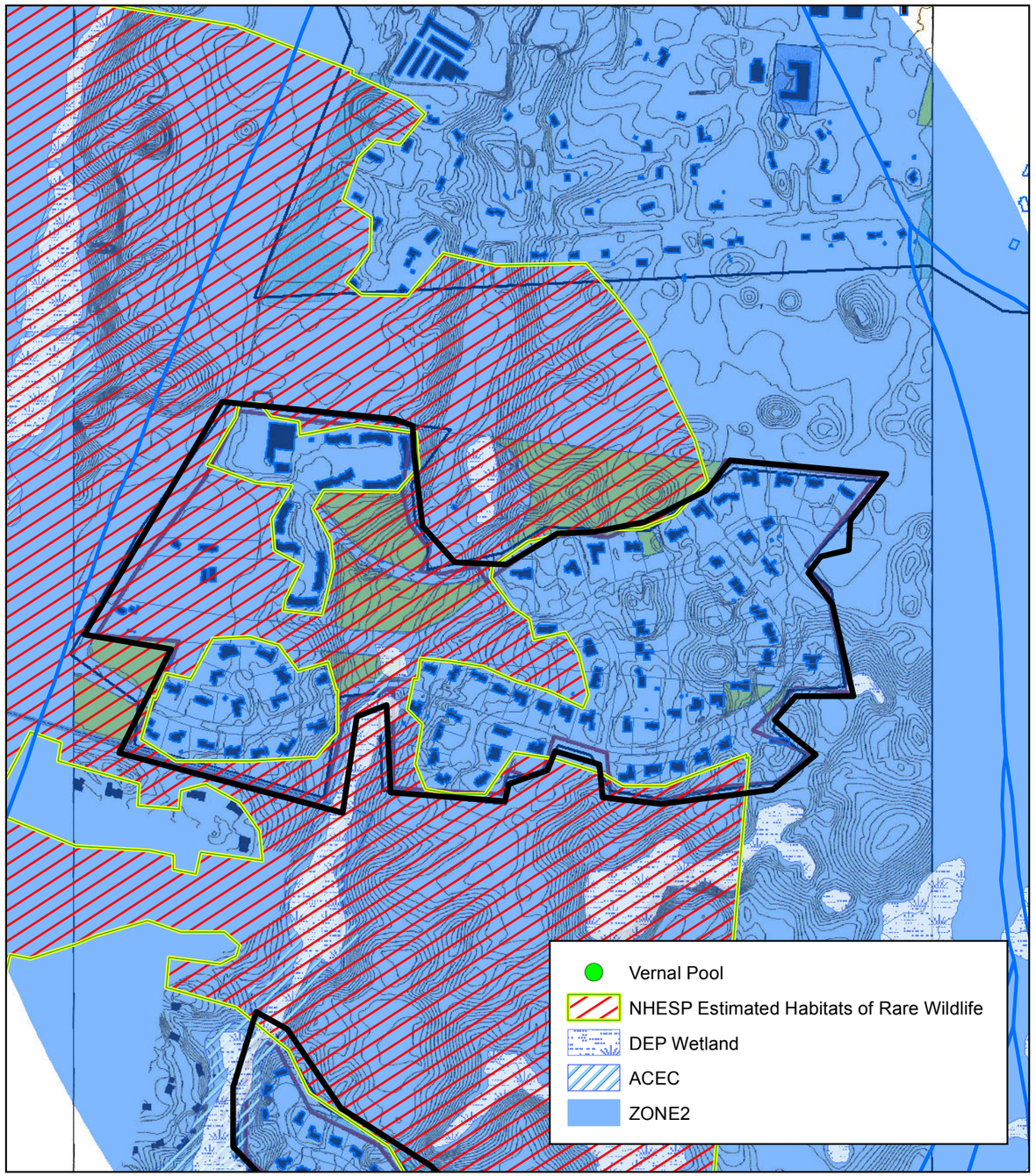

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Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Watershed Nitrogen Management Plan

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Holland Mills

Figure 6-3

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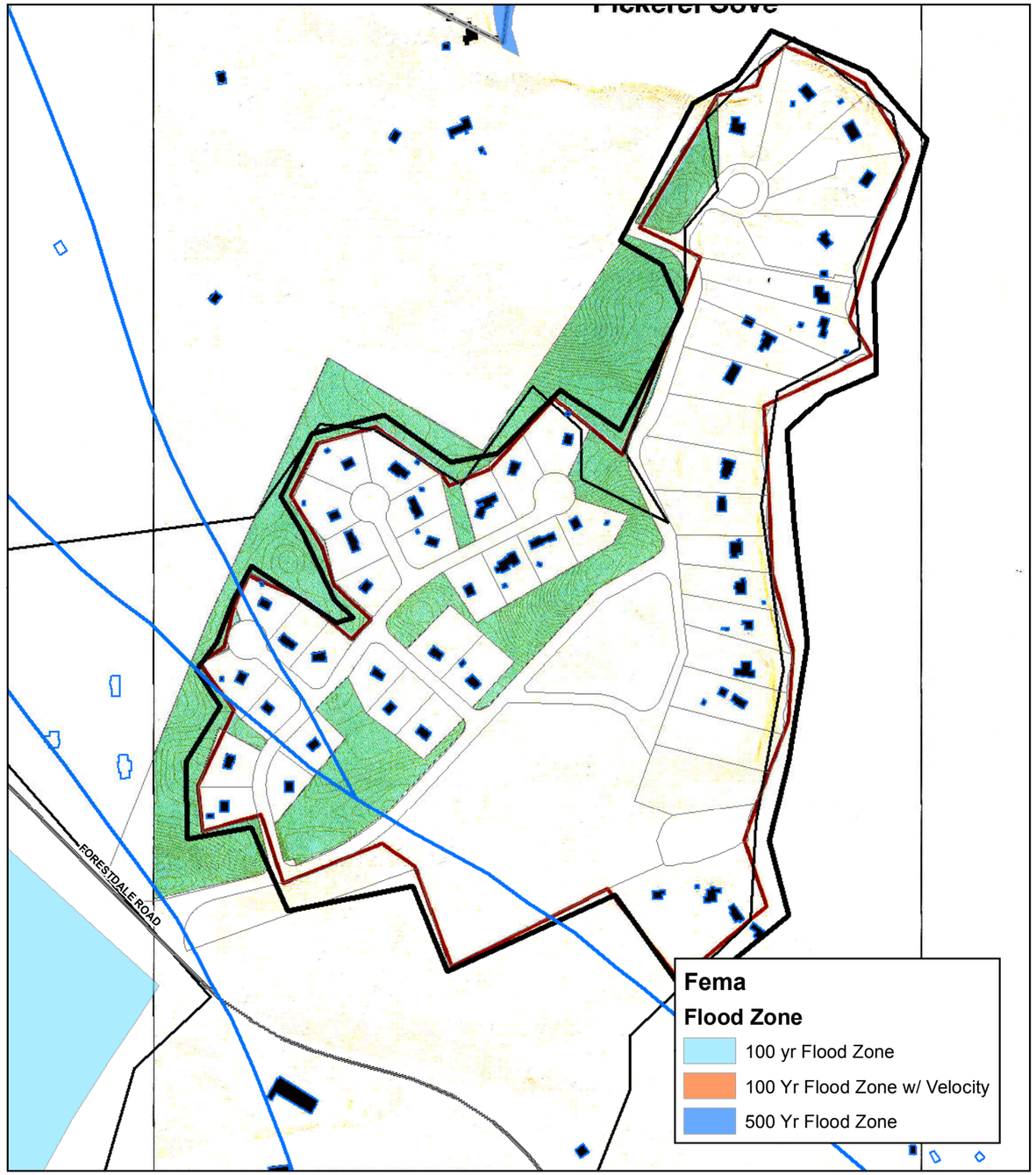

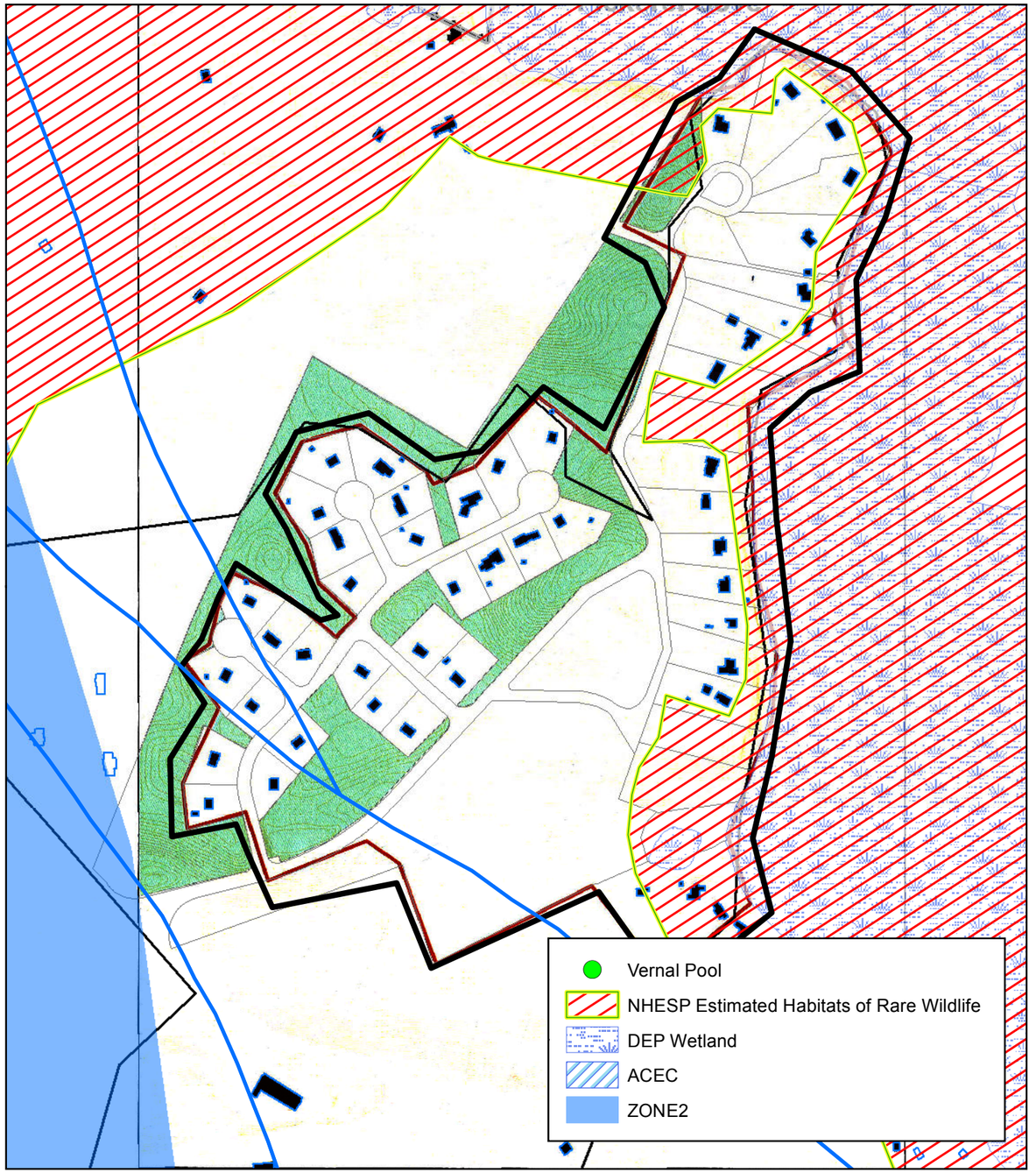

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Watershed Nitrogen Management Plan

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Pickerel Cove

Figure 6-4

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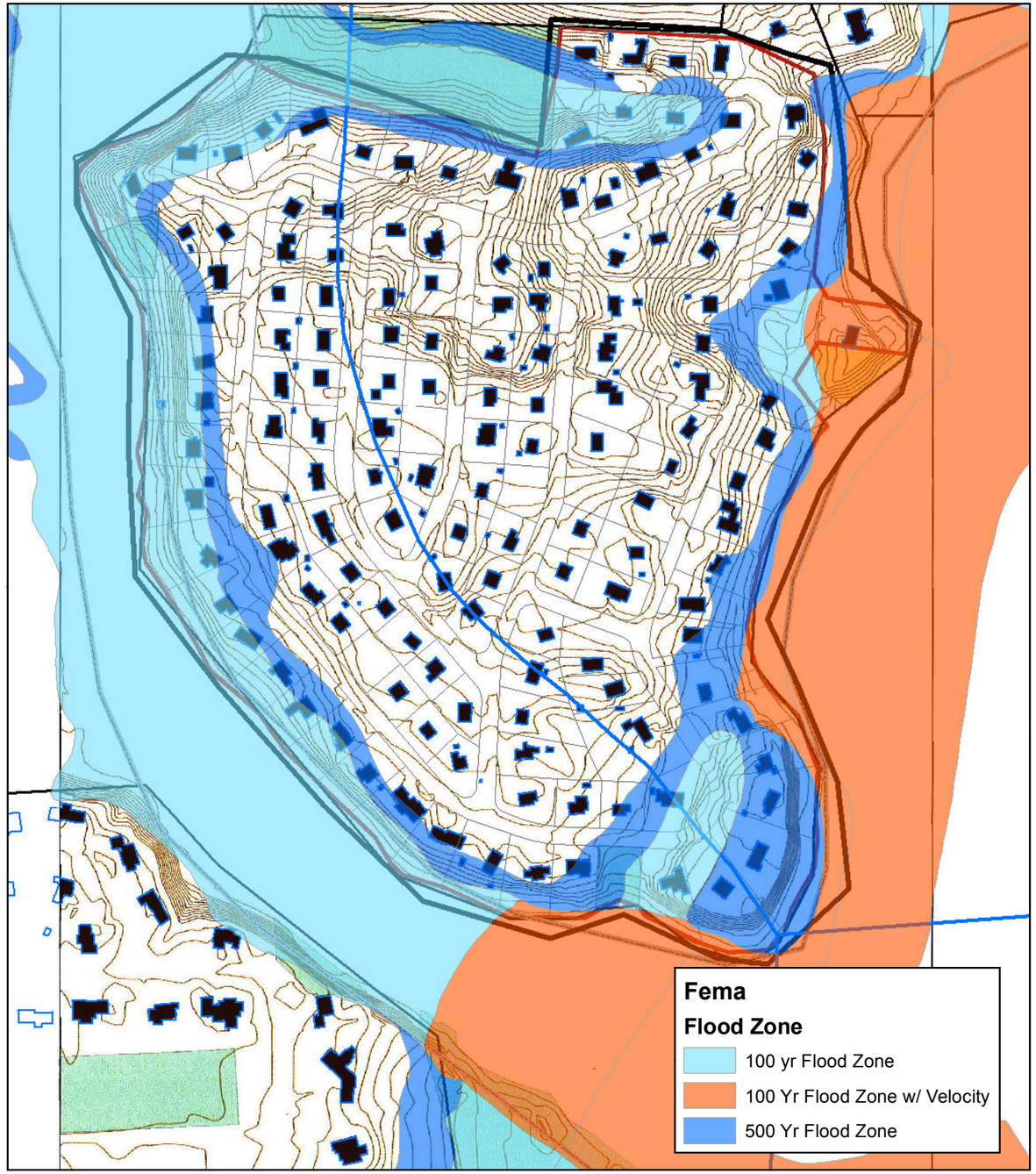

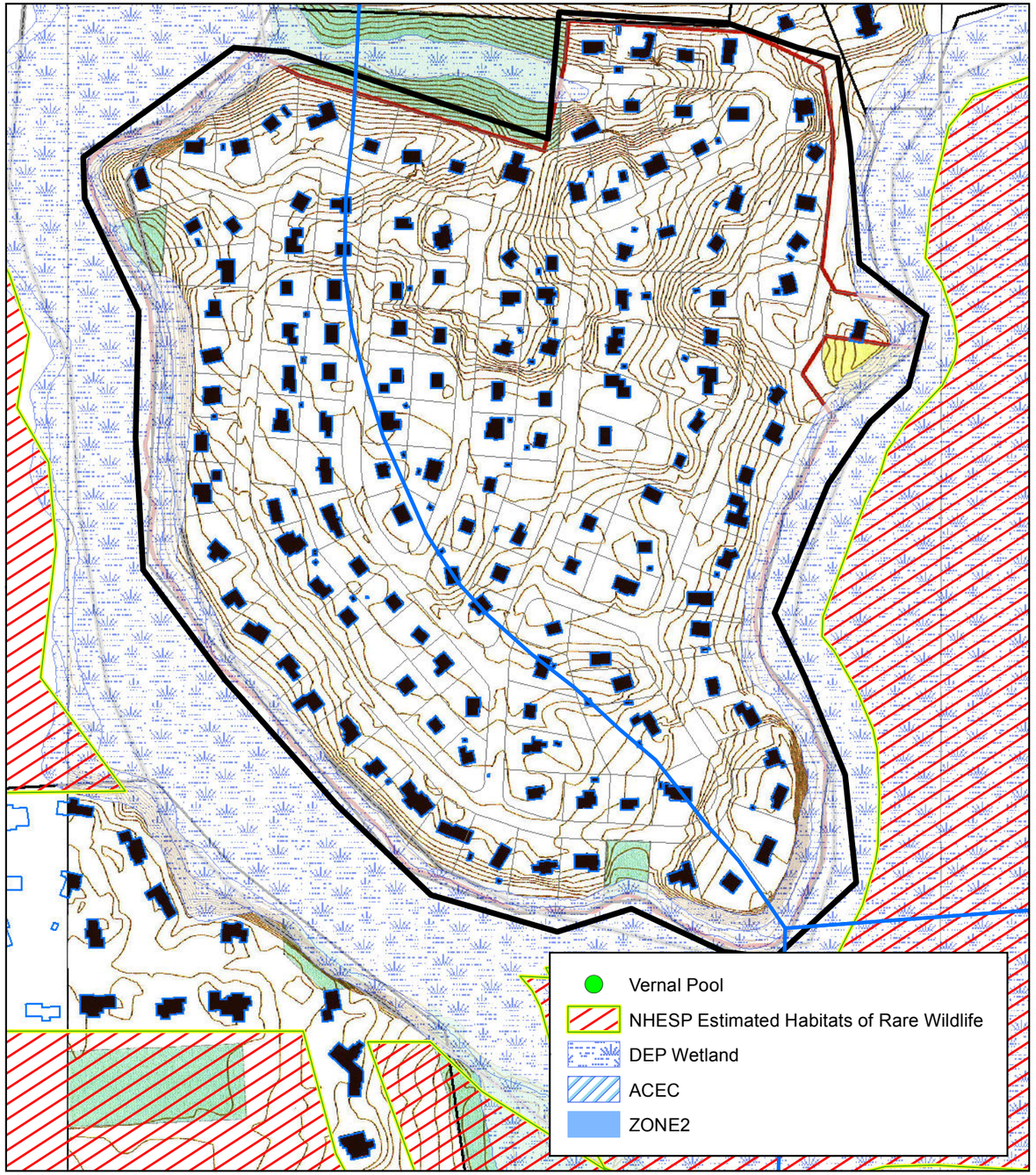

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Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

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Pirates Cove

Figure 6-5

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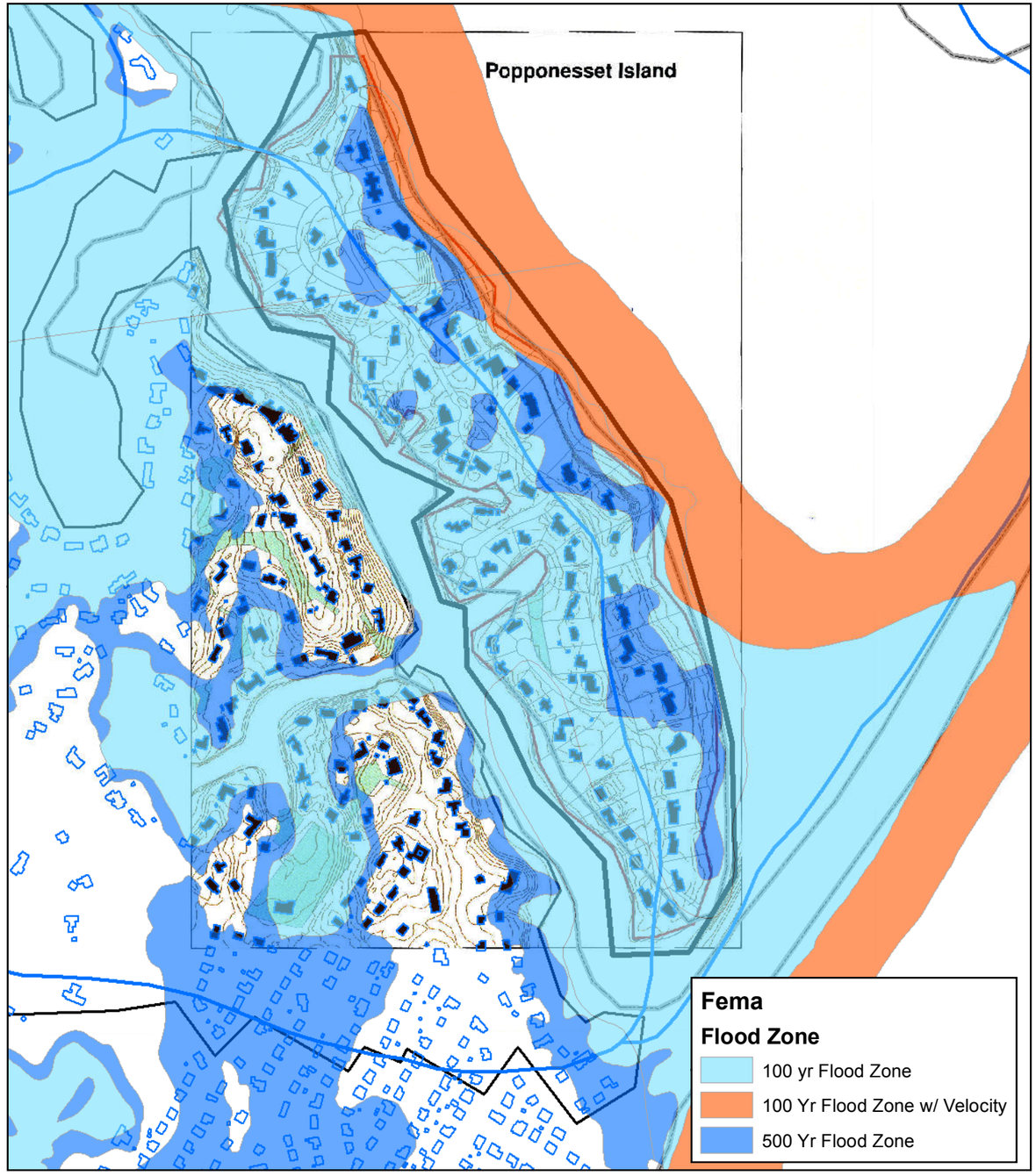

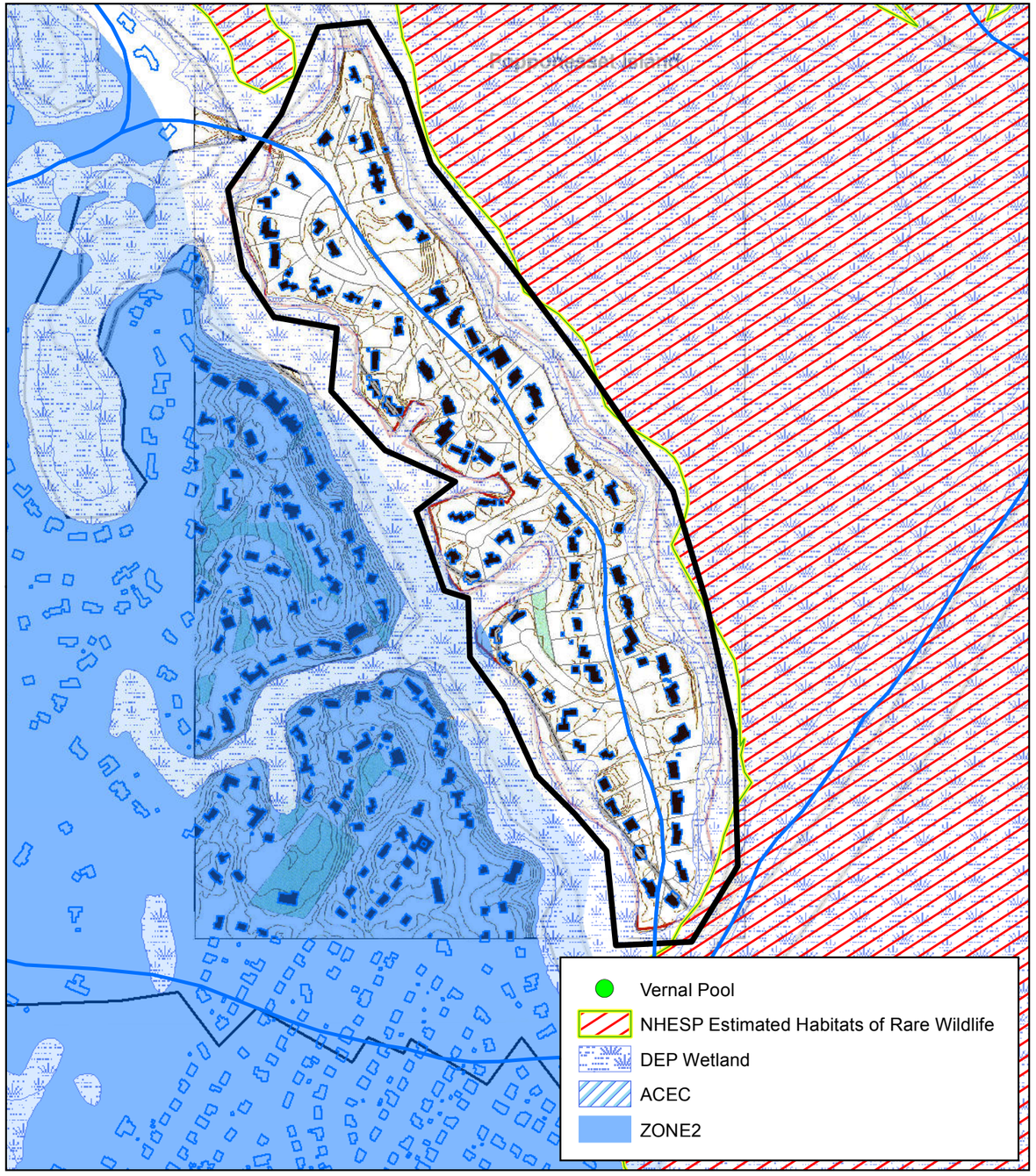

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Watershed Nitrogen Management Plan

Job Number	86-12001
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Popponesset Island

Figure 6-6

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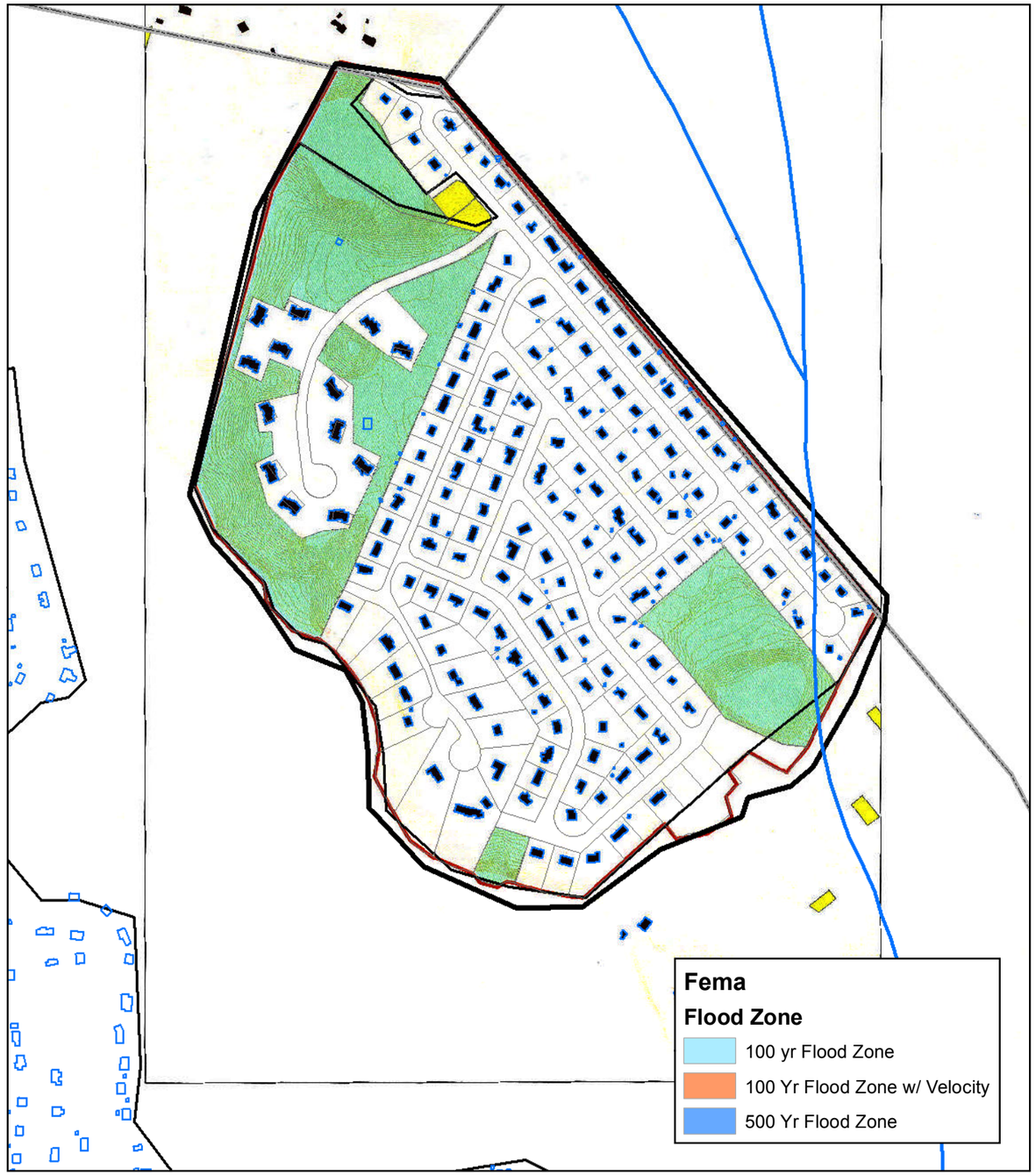

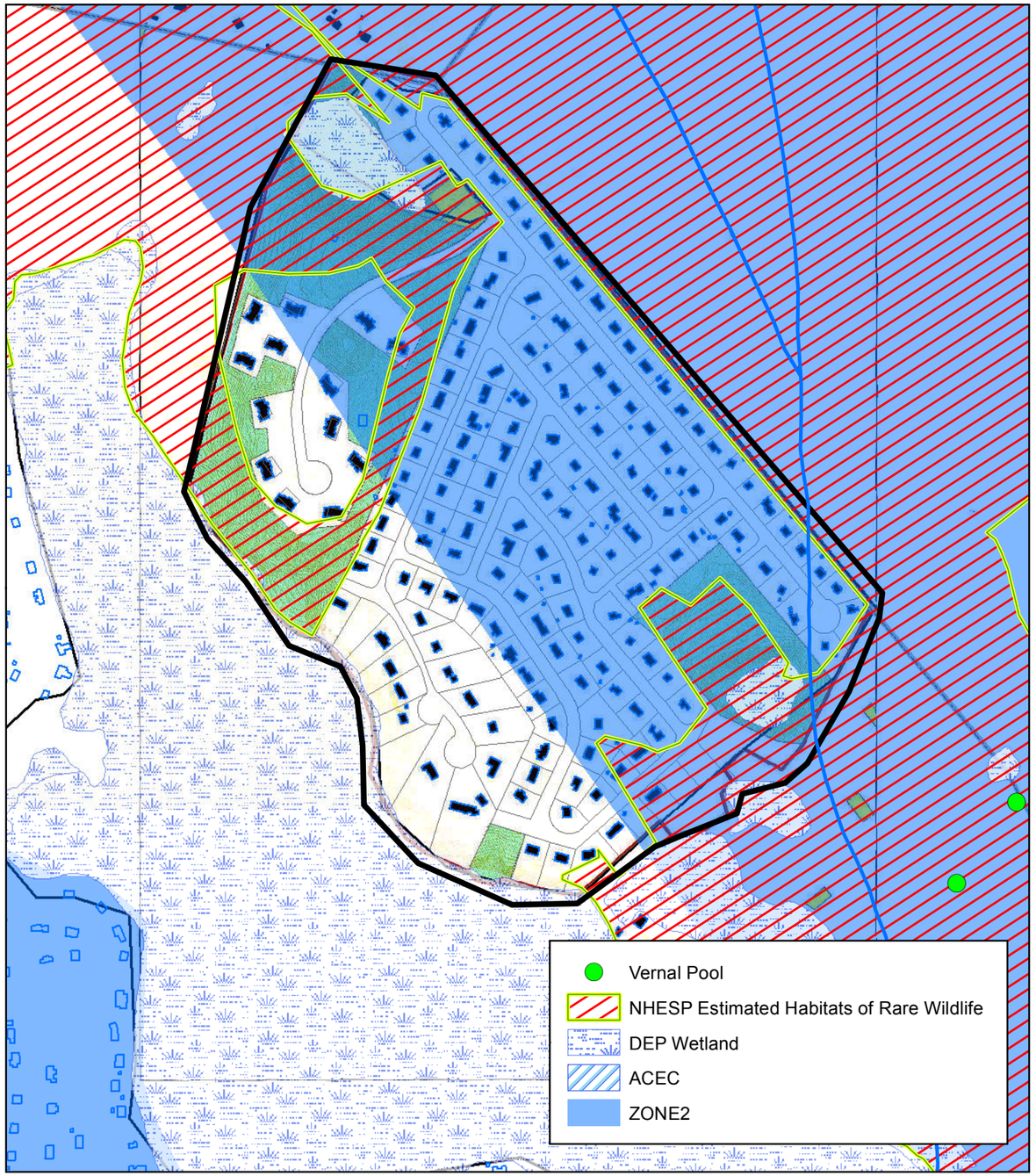

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

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Revision A
Date 08 Aug 2013

Santuit Pond

Figure 6-7

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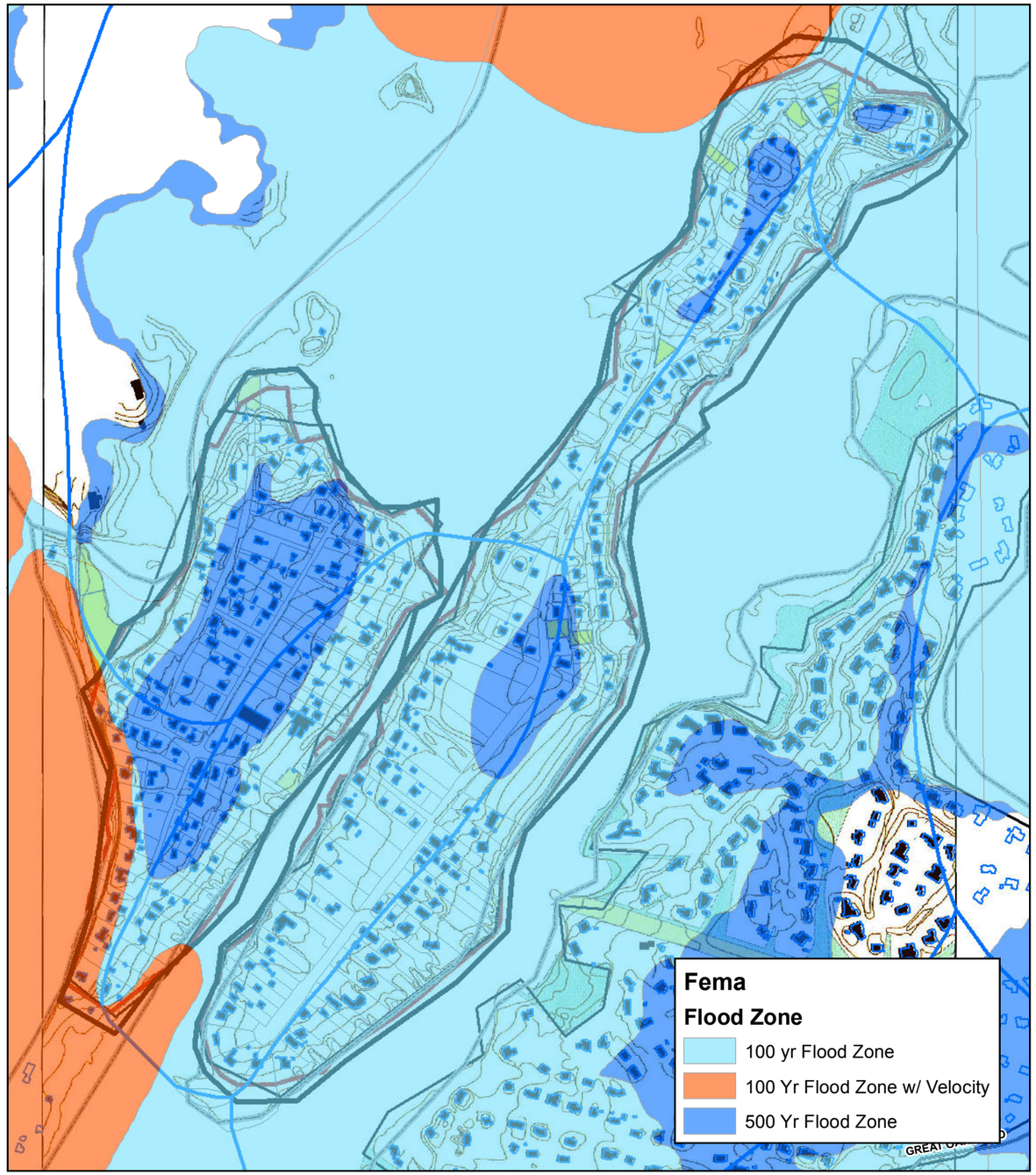

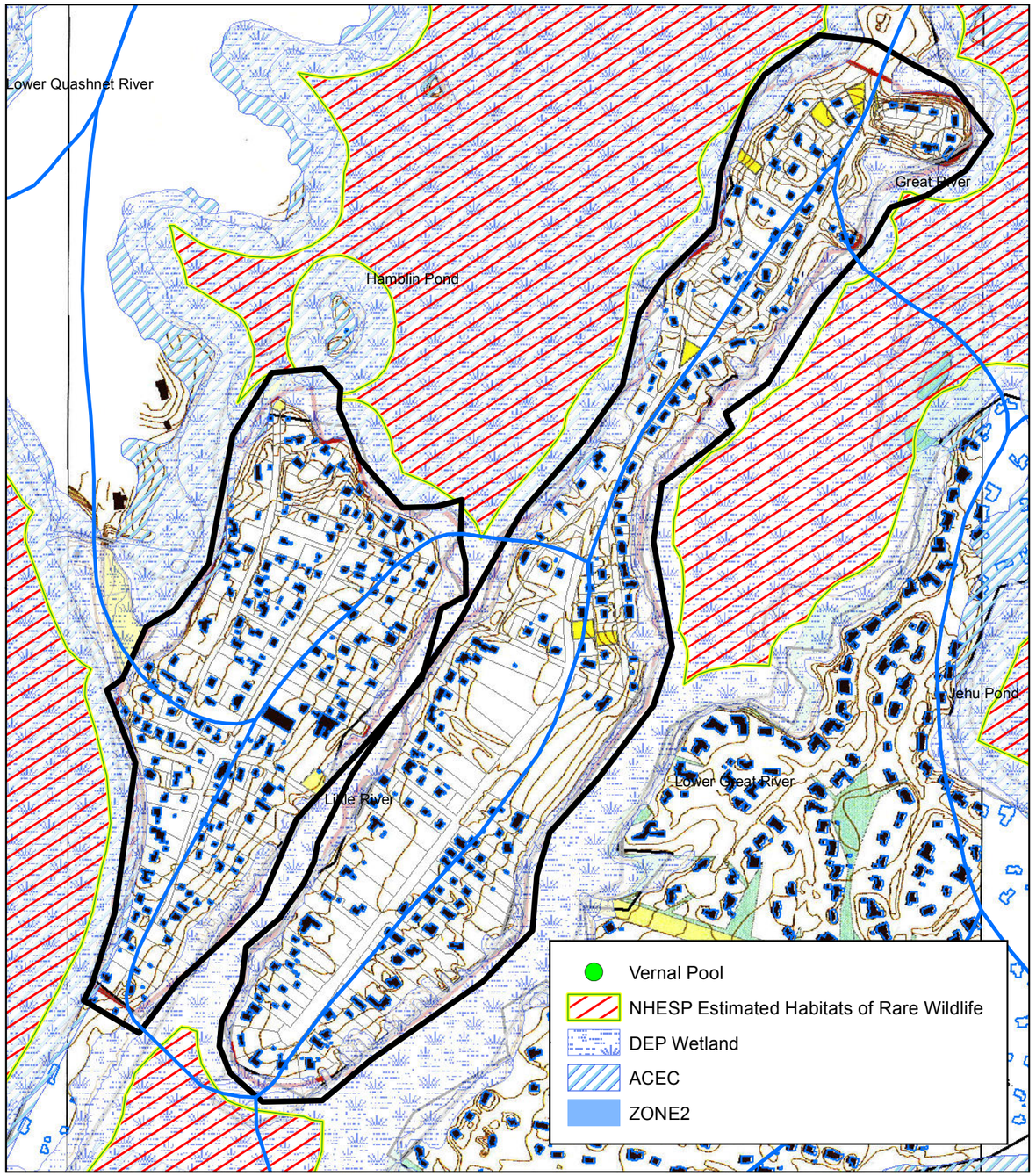

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Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

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Monomoscoy Island

Figure 6-8

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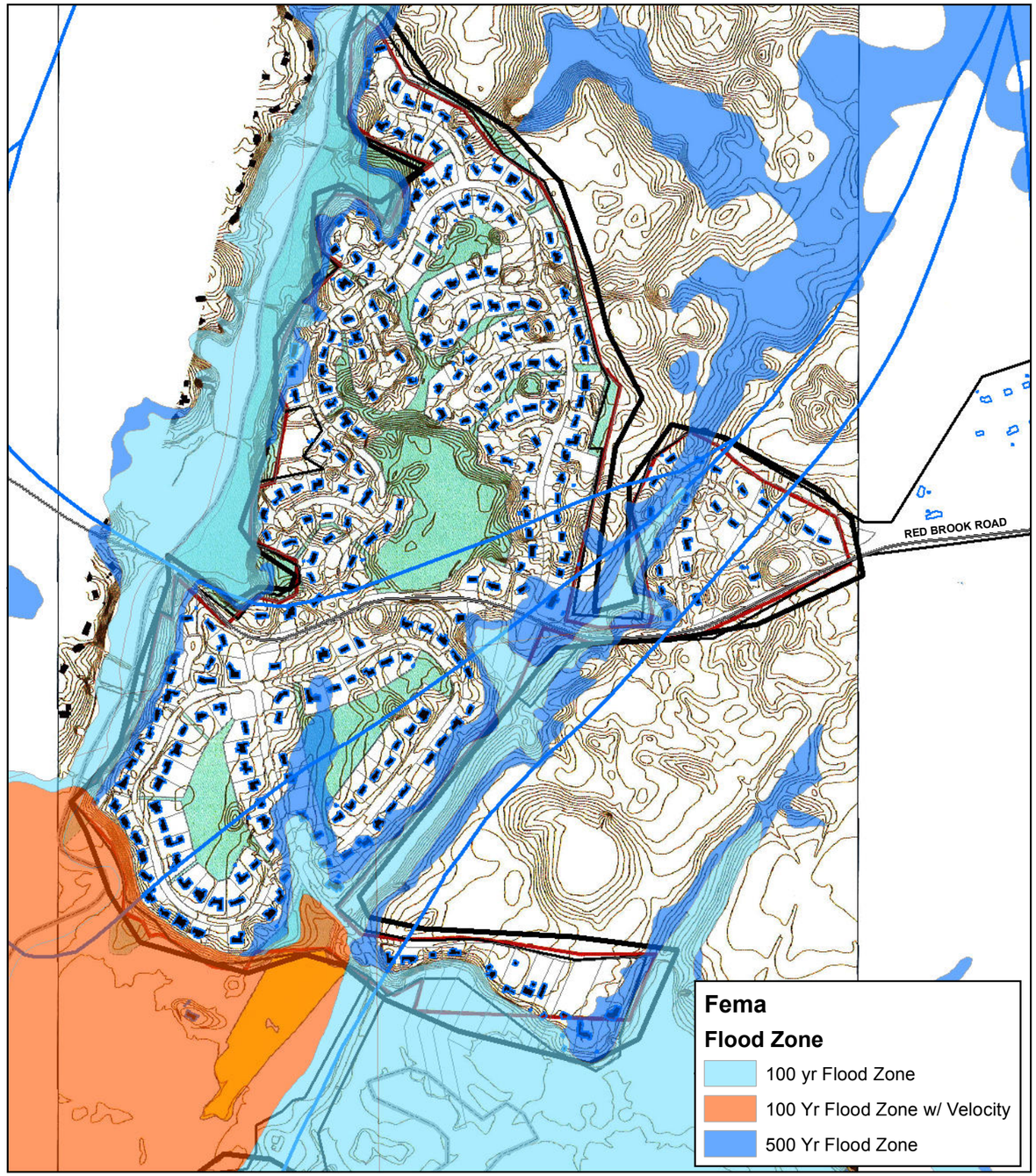

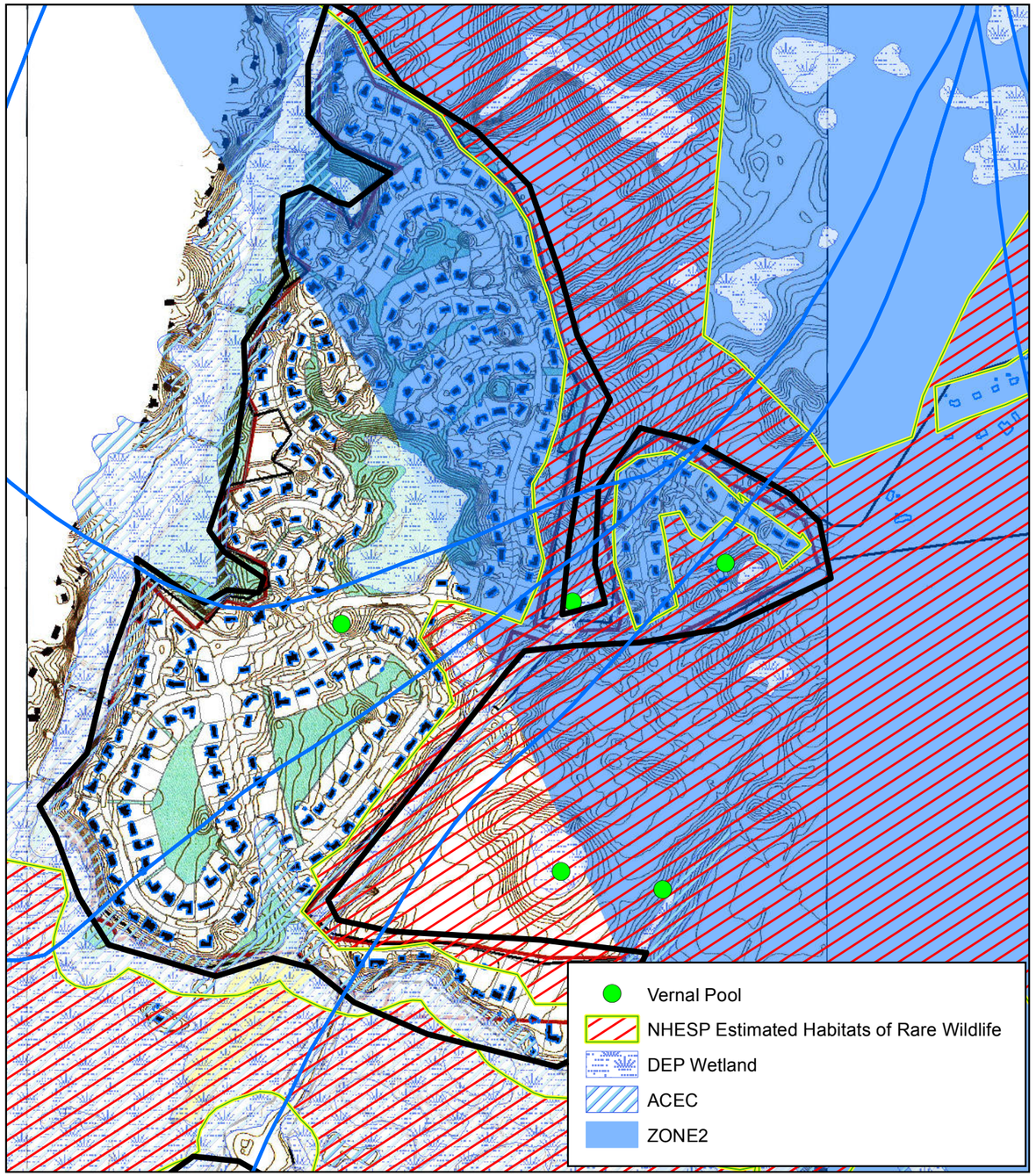

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Job Number 86-12001
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Date 08 Aug 2013

The Seabrooks

Figure 6-9

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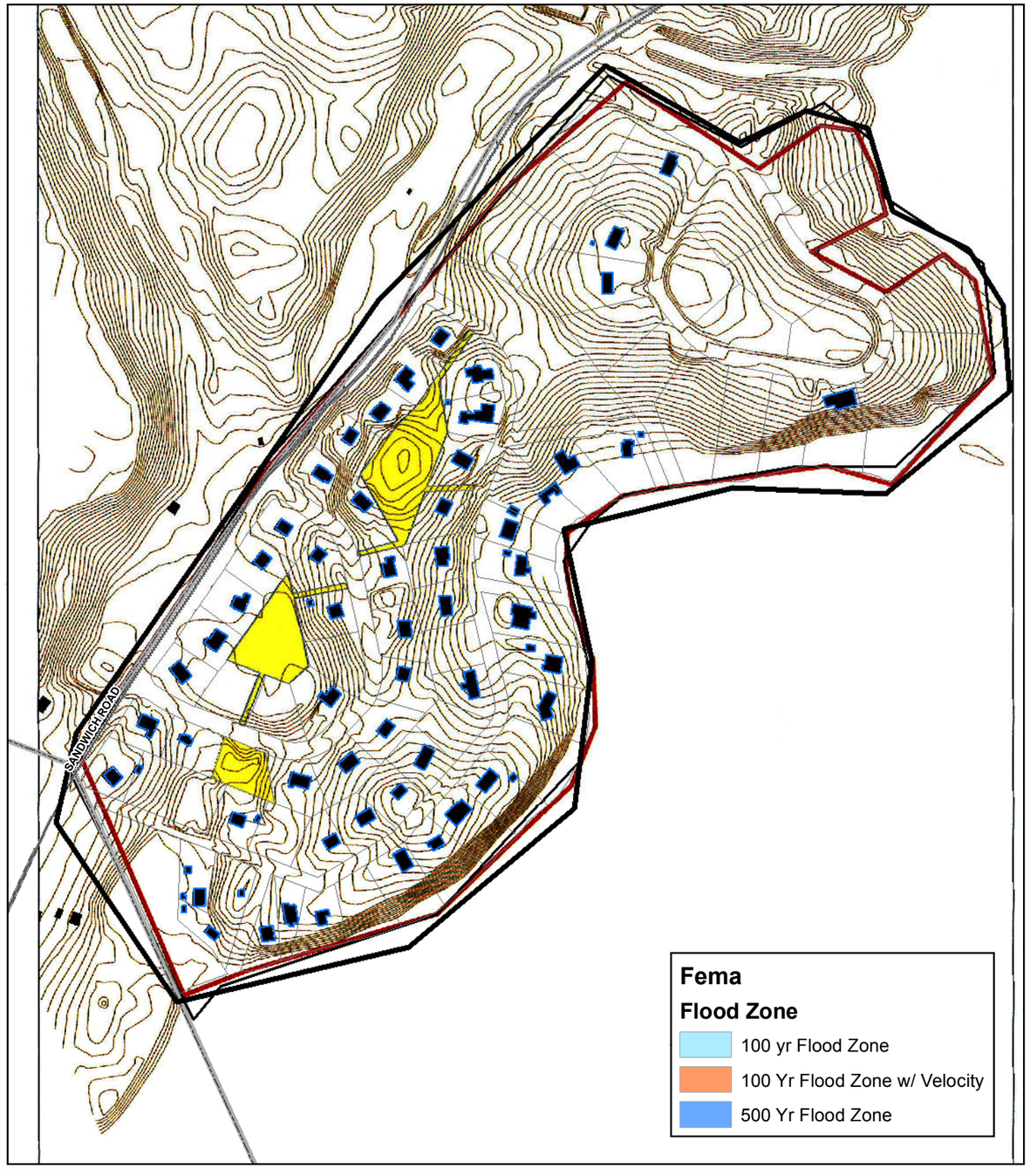

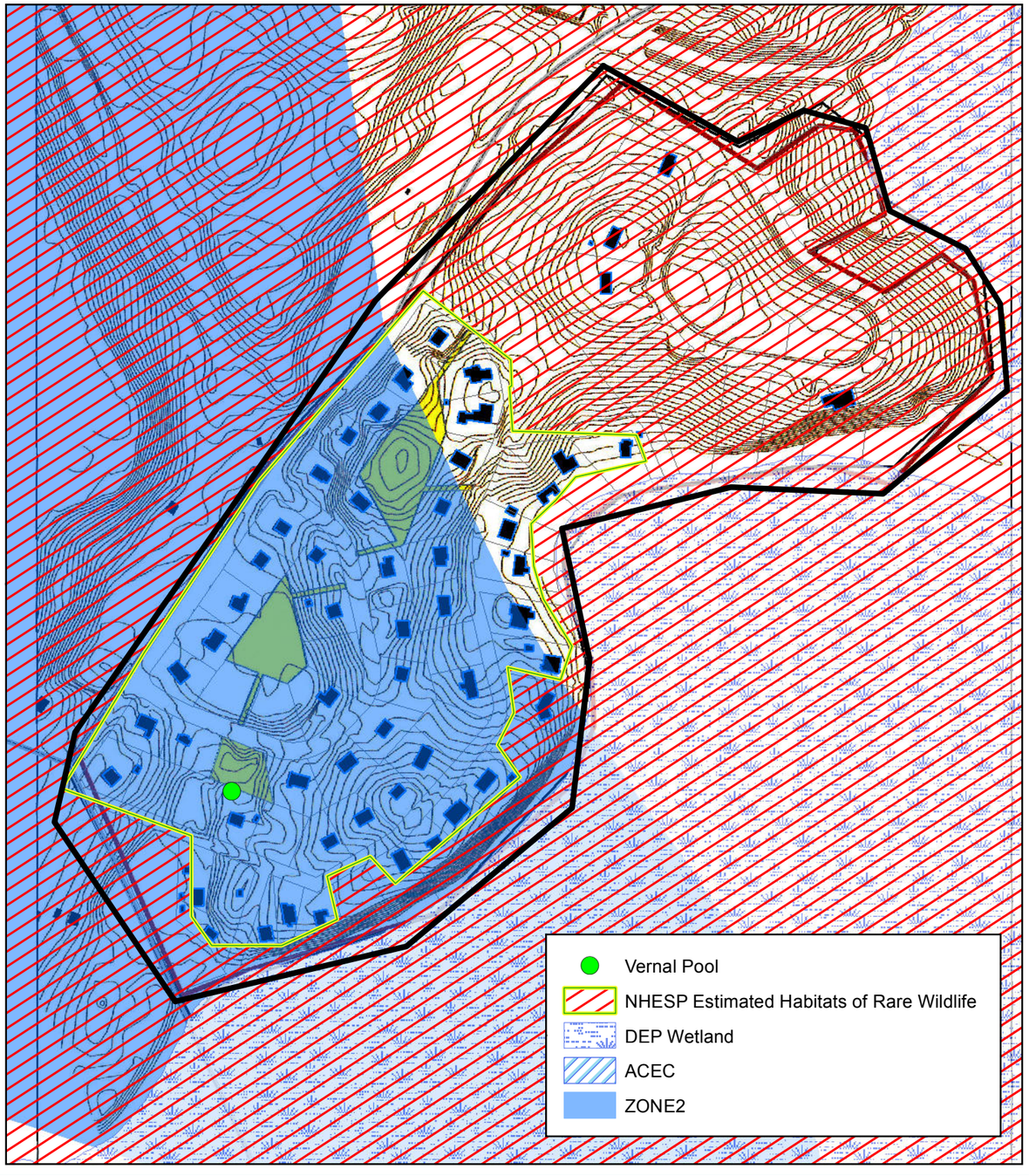

Paper Size ANSI B

1 inch = 300 feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001 Feet

N

Town of Mashpee Sewer Commission
Watershed Nitrogen Management Plan

Job Number 86-12001
Revision A
Date 08 Aug 2013

Tri-Town Circle Area

Figure 6-10

G:\86\12001\GIS\00074 Mashpee\2013\Cluster System MXD\Systems Duplicate\Tri Towns Cluster System.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:jjobrien

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