Characteristics of the Stow Road Property

I. Background

The 2012 report *Feasibility Study & Conceptual Plans* Goldsmith prepared by Prest & Ringwall, Inc. (GPR) focused upon the feasibility of building affordable housing and a community center on the Stow Road property. Although the feasibility of a public safety facility was not considered, much of the information obtained could apply to any development. This document is an attempt to summarize what we currently know about the Stow Road property.

II. Nitrogen Loading

According to the GPR report, nitrogen loading is a limiting constraint of the Stow Road property. Title V State Environmental Code 310 CMR 15.000, states that the site should receive less than 440 gallons per day (GPD) of design flow. GPR calculates this limit as 6,459 GPD for the Stow Road property.

GPR envisioned two wells, each with a capacity of 3,225 GPD[1]. There are two protection zones, Zone I and Zone II. The Zone-I Protective Well Radius associated with each well is 176.28 ft. In addition, the radius of the Interim Wellhead Protection Area (IWPA) associated with each well is 471.67 ft.

A. Zone I:

For pumping rates less than 100,000 GPD, the Zone I Radius is given by the formula,

$$\text{Zone I Radius (ft)} = 150 \log\left[\text{Pumping Rate (GPD)}\right] - 350 .$$

The land within Zone I is subject to the following conditions and requirements.

1. *Water supplier must own or control (via a conservation restriction) all land in Zone I. Only water supply activities may take place within the zone.*
2. *Zone-I regions are priority areas for hazardous waste inspections and enforcement, together with waste site remediation.*
3. *No sewer lines may be located in Zone I except to eliminate a source of pollution.*

Figure 1 below plots the Zone I radius of an individual well against the water production of the well.

On the plot, several flow rates and radii of interest are shown. These are:

1. A well whose Zone I radius, 140 ft., fits entirely within the property we own. Although the flow per well, 1,848 GPD, is significantly less than the wells of the GPR design, the need to enact a conservation restriction with the owners of several adjacent properties is eliminated.
2. The GPR design.
3. A design that incorporates a waste-treatment plant. It is assumed that the waste – treatment plant removes 50% of the nitrogen in the effluents, so that the allowable design flow is doubled. This increases the Zone I radius of each well to 219 ft. The incursion into adjacent properties is increased substantially.

[1] An interesting provision of the existing regulations is that if multiple wells are used to provide water, the Zone I radii that apply are that of each well. The several wells need only be spaced more than 25 ft. apart

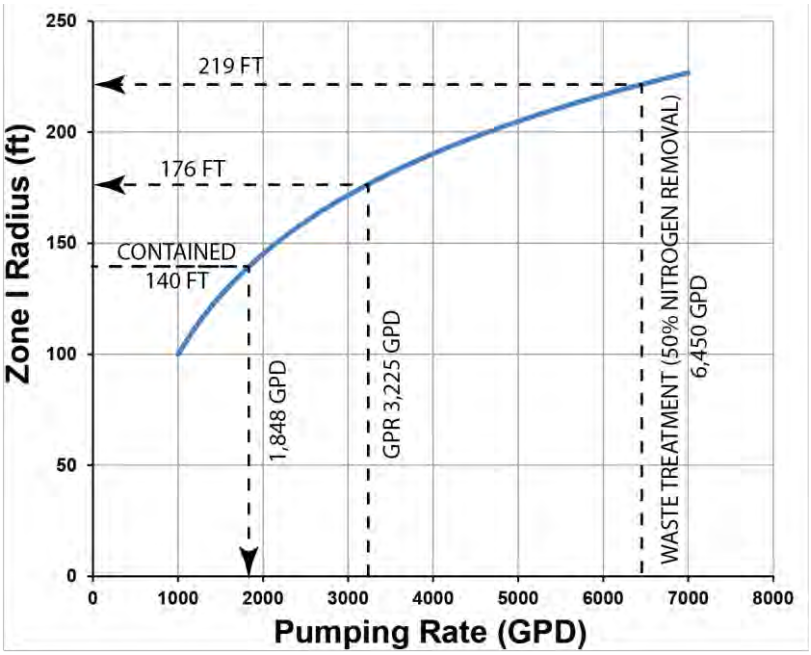

Figure 1. Zone I radius as a function of pumping rate.

B. Zone II and Interim Wellhead Protection Area (IWPA):

The Zone II protection area protects the primary recharge area around a public water supply. It is determined by hydro-geologic modeling and is approved by DEP's drinking water program. In cases where such modeling has not been performed and there is no approved Zone II protection area, the IWPA is used for the area. For pumping rates less than 100,000 GPD, the IWPA Radius is given by the formula,

$$\text{IWPA Radius (ft.)} = 32\left[\text{Pumping Rate (Gal/min)}\right] + 400 = \frac{\text{Pumping Rate (GPD)}}{45} + 400$$

A sample of the restrictions that apply to Zone II and the IWPA are given below.

1. *No new landfills may be sited within Zone IIs and IWPAs, and existing landfills in these areas were required to close as of 1995.*
2. *No sludge landfills and no application of Type II or sludge is allowed within Zone IIs.*
3. *Zone IIs are sensitive areas requiring special conditions for setbacks, loadings, and design, under the Title 5 requirements for septic systems.*
4. *Zones IIs are priority areas for hazardous waste inspections and enforcement, and waste site remediation.*
5. *Hazardous waste tanks in Zone II must have secondary containment.*
6. *All new sewer lines in Zone IIs must be designed and constructed for maximum water tightness.*
7. *New sanitary wastewater treatment facilities that discharge to the groundwater cannot be sited in Zone IIs unless it is not feasible to site them elsewhere.*

8. *Use of specified pesticides is restricted in Zone IIs and IWPAs (333 CMR 12.00). Waivers from federal SDWA testing requirements for pesticides and volatile organic chemicals (VOCs) are linked to source protection as well as to existing source water quality and presence of high-risk land uses.*
9. *Wetland monitoring requirements for water supply withdrawals protect wetlands within the recharge area from desiccation or lowering of groundwater.*

These restrictions appear to be much less severe than those of Zone I.

III. Water Requirements

The design-flow limitation can be mapped into residential site-development constraints using Table I below. Presumably, similar constraints exist for public buildings.

TABLE I
DESIGN FLOW RULES

Type of Structure	Design Flow Criteria
Affordable Housing	110 GPD per bedroom
Senior Housing	150 GPD per unit (max two-bedroom units)
Town Hall Annex	75 GPD per 1,000 ft^2
Town Meeting Space	3 GPD per Seat
Community Center	6 GPD per Seat
Senior Center	6 GPD per Seat

A. GPR Concept C

GPR's Concept C is close to the design-flow limit and is shown in Fig. 2 below.

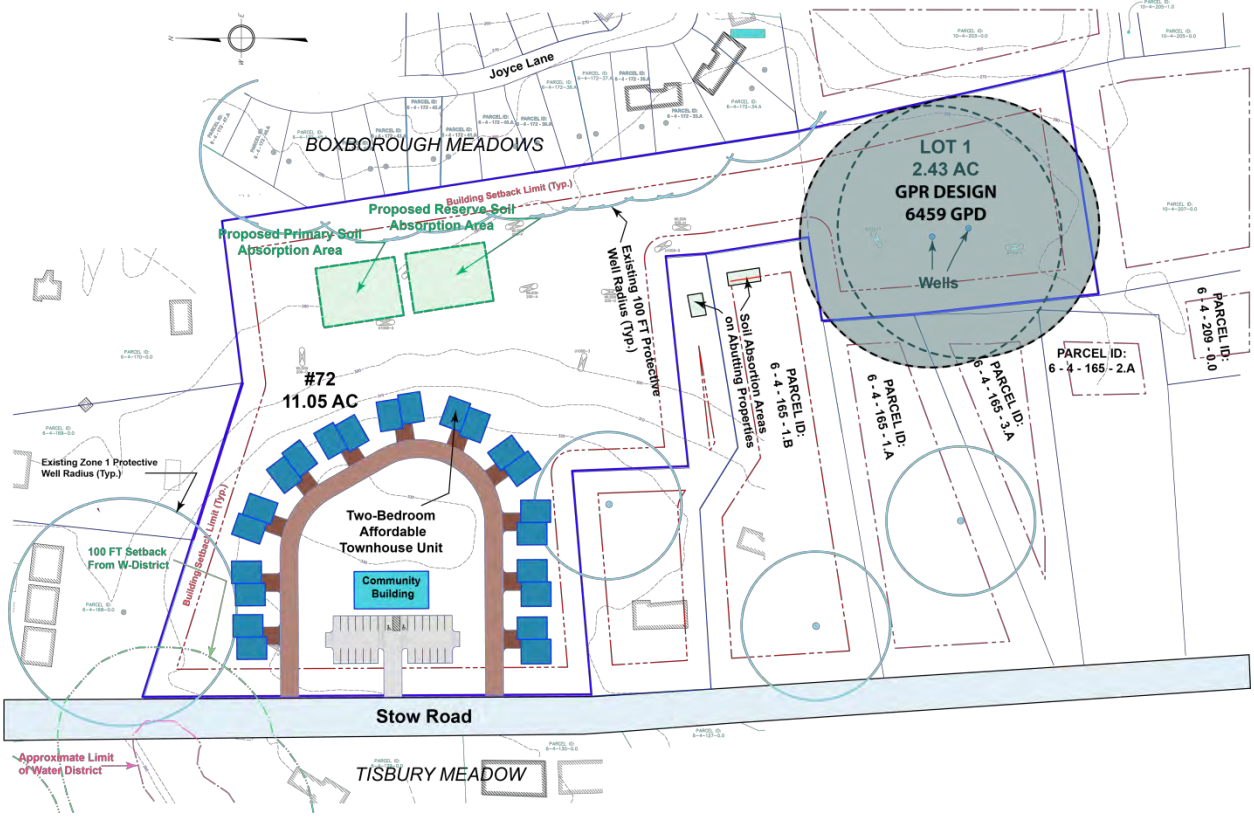

Figure 2. Affordable Housing and Community Center, near the design-flow limit.

We would have to negotiate Conservation-Restriction Agreements with five owners of adjacent properties under this design.

B. Self-Contained Zone I Radii

In this case, the total water production of the two wells is reduced to 3,696 GPD. This is depicted in Fig. 3.

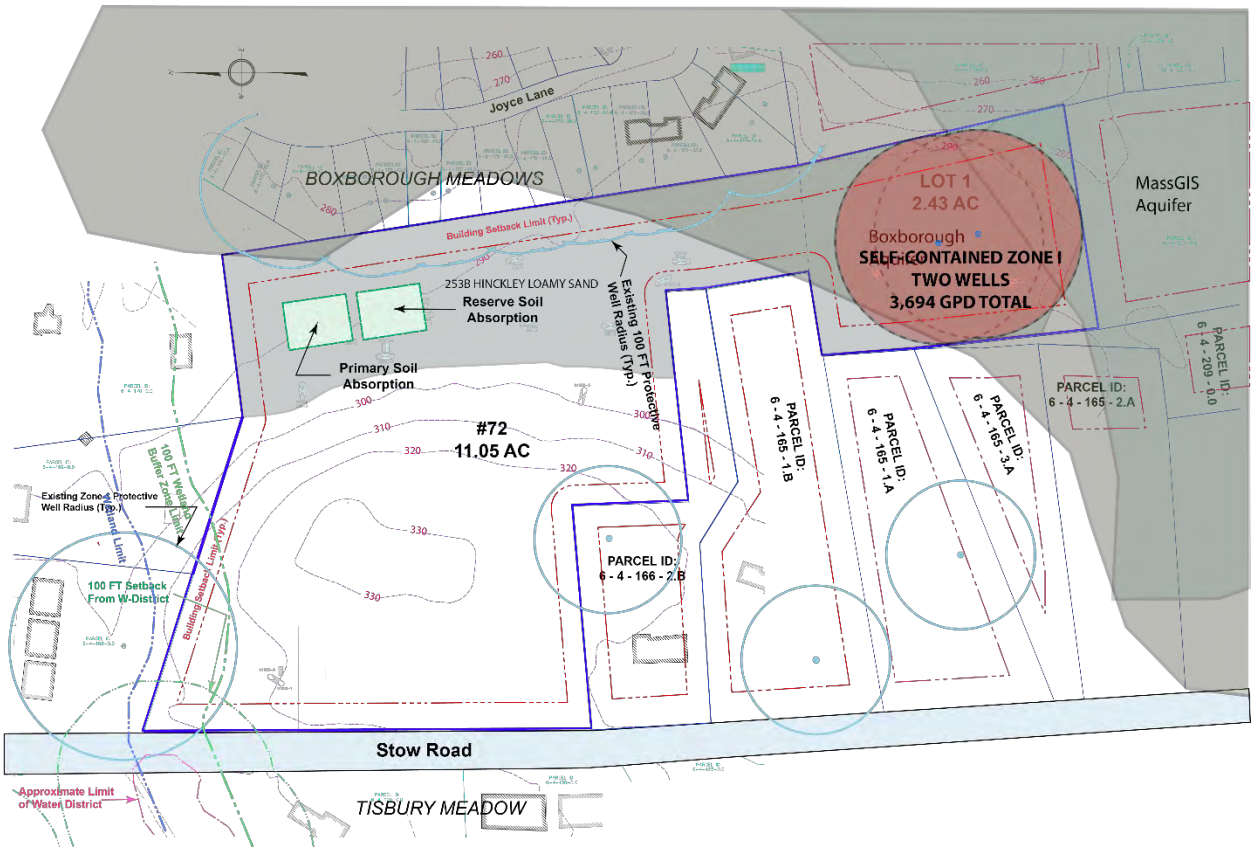

Figure 3. Design with self- contained Zone I

C. Advanced Waste Treatment

In principle, advanced waste-treatment methods could be used to ease the nitrogen-loading constraint. Typically, such treatment systems can remove 50% or more of the nitrogen in the effluents. They also cost about three times as much as a conventional system.

If 50% of the nitrogen were removed, the permissible well output would presumably be doubled, which increases the Zone I Protective Radius. Figure 4 below depicts the protective radii for this assumption. In addition, the area required for the treatment plant has been increased by about 50% (a guess) in this figure.

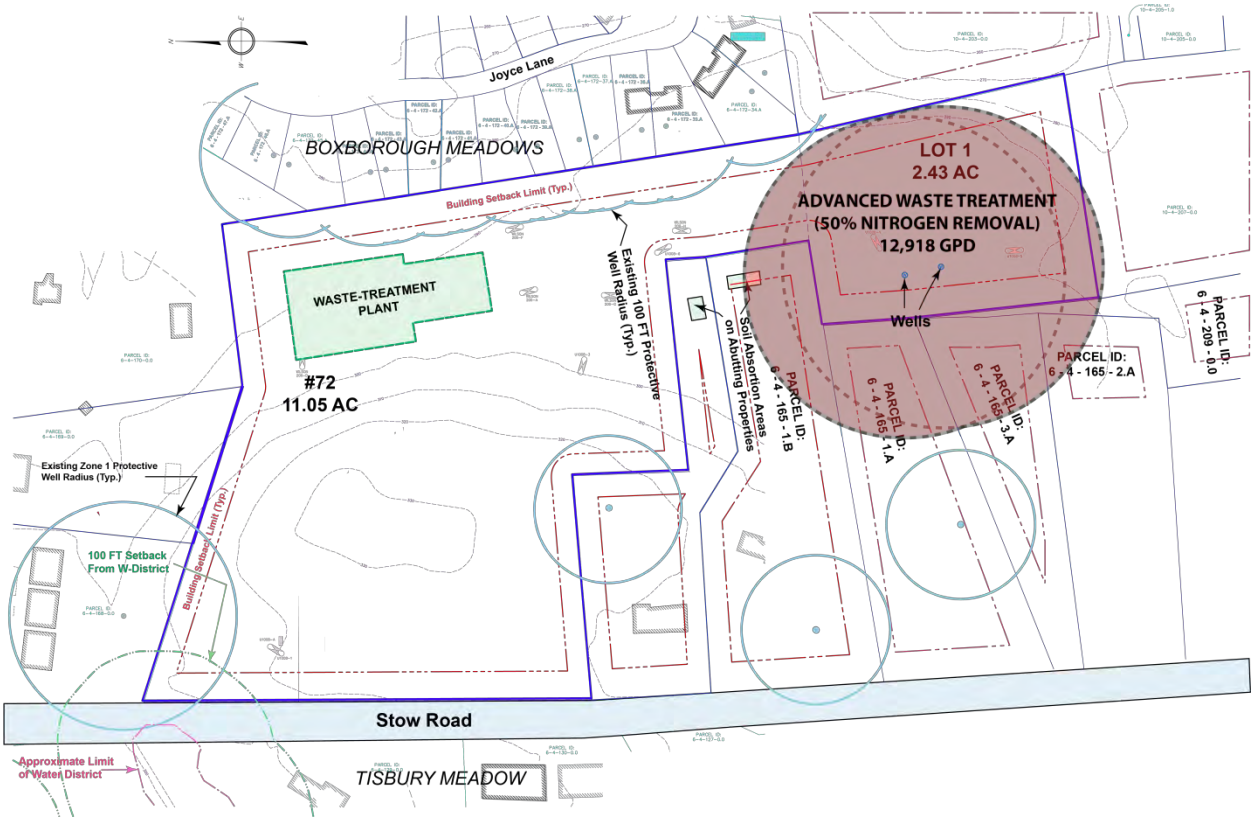

Figure 4. Design with waste-treatment plant.

The larger Zone I Radii cause a more significant intrusion into the neighboring properties.

IV. General Characteristics of the Stow Road Property

A. GPS Coordinates

The GPS coordinates of the corners of the property are shown in Fig. 5 below.

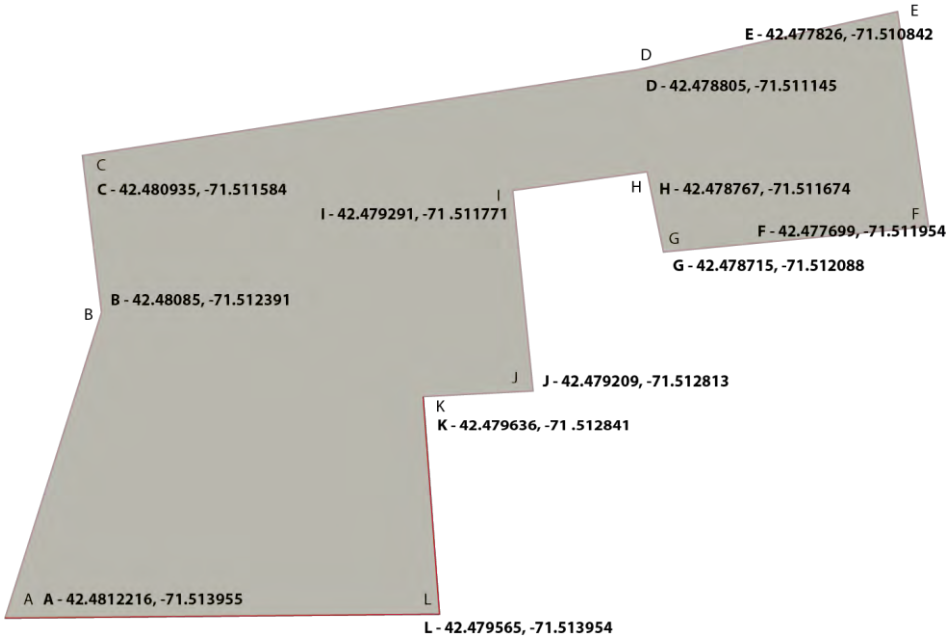

Figure 5. GPS coordinates of Stow Road property.

B. Topography

A qualitative representation of the topography of the Stow Road property is shown in Fig. 5 below. In this image, the vertical rises are amplified by a factor of four.

Figure 6 Stow Road topography

The elevation contours, as depicted in the GPR report, are shown in Fig. 7 below.

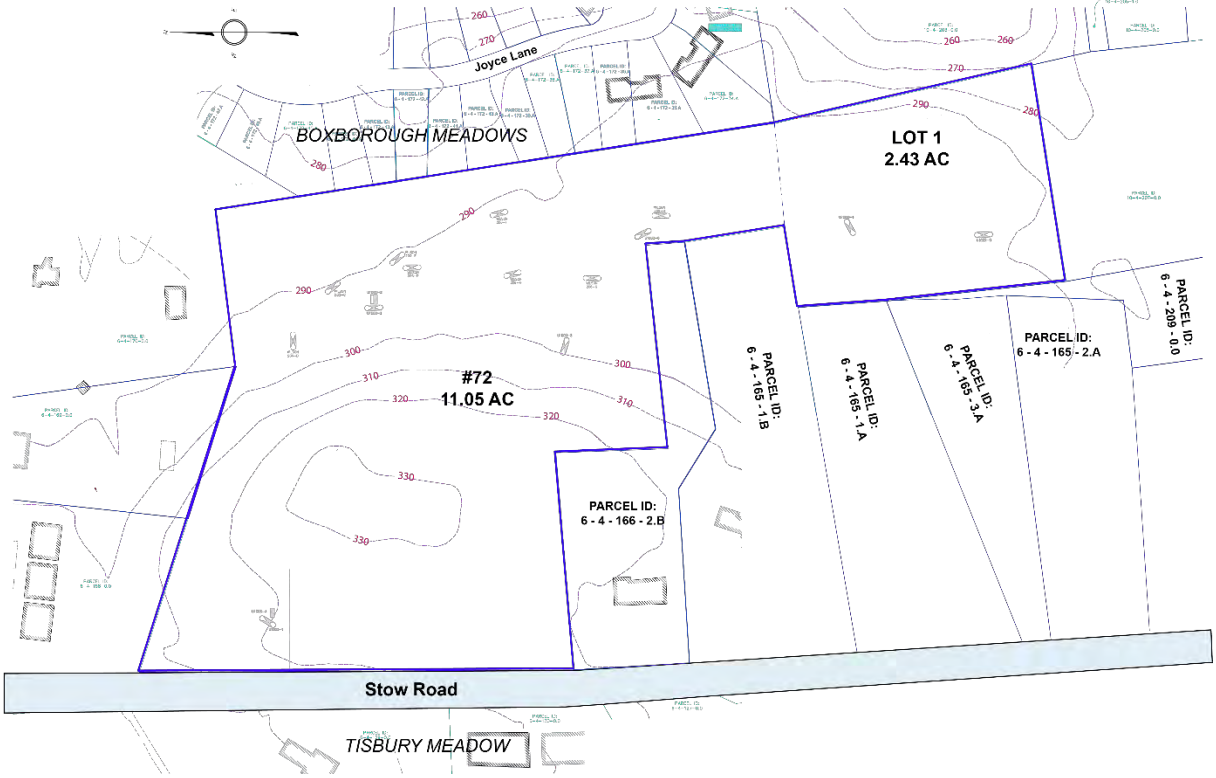

Figure 7. Elevations of Stow Road Property

The MAPGIS illustrations on the Boxborough website also show the elevations.

C. Land and Aquifers

Figure 8 below shows information about the soil, aquifers, and wetland buffer.

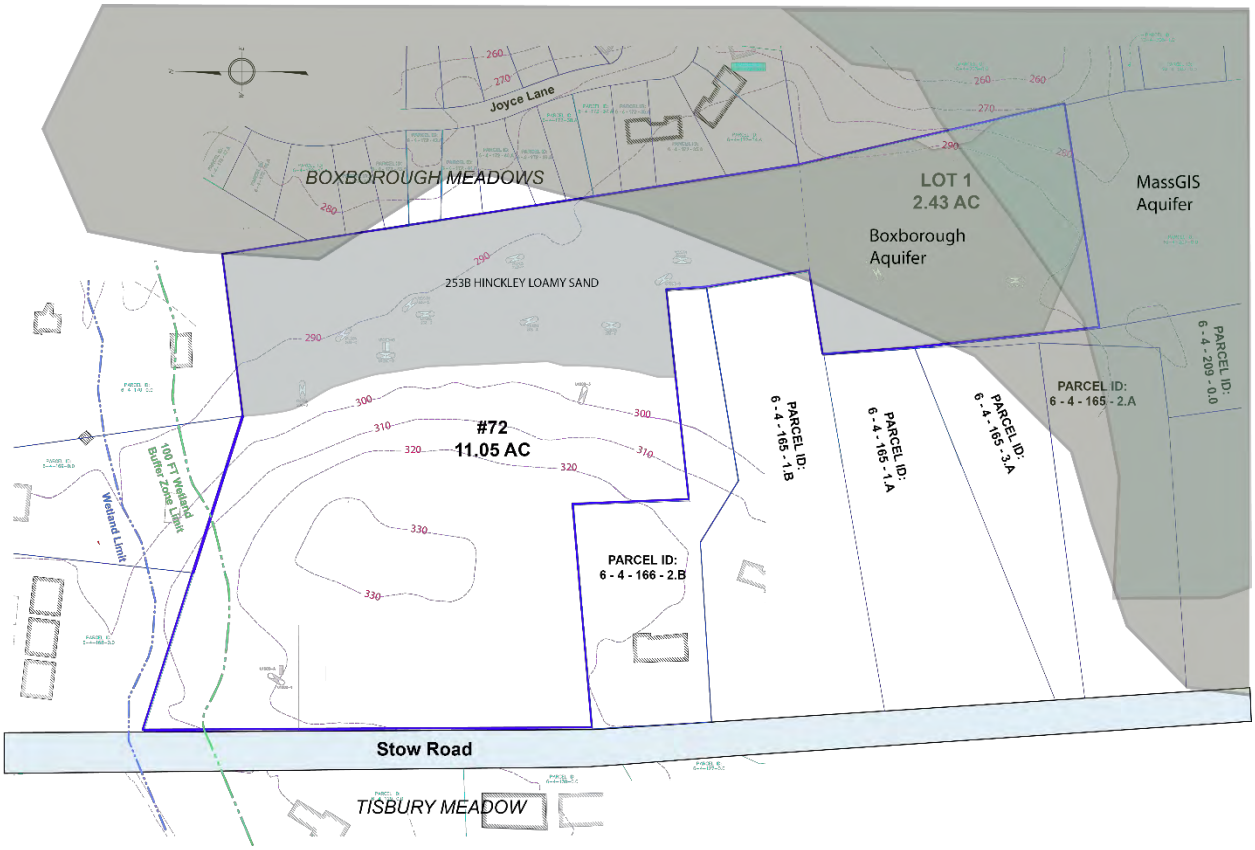

Figure 8. Stow Road: Land, aquifers, and buffers.

In this figure, the soil and buffer information has been obtained from the GPR report. The aquifer information is from MAPGIS. The difference between the "Boxborough Aquifer" and the "MassGIS Aquifer" needs to be explained.

D. Available Building Area

The various constraints that impact the amount of land that is available for development is shown in Fig.9. These constraints include the well and wellhead protection areas, the septic system, the building setback, and the wetland buffers. An area that is roughly the estimated area of the public safety facility is also shown. It is located at the highest and flattest portion of the property.

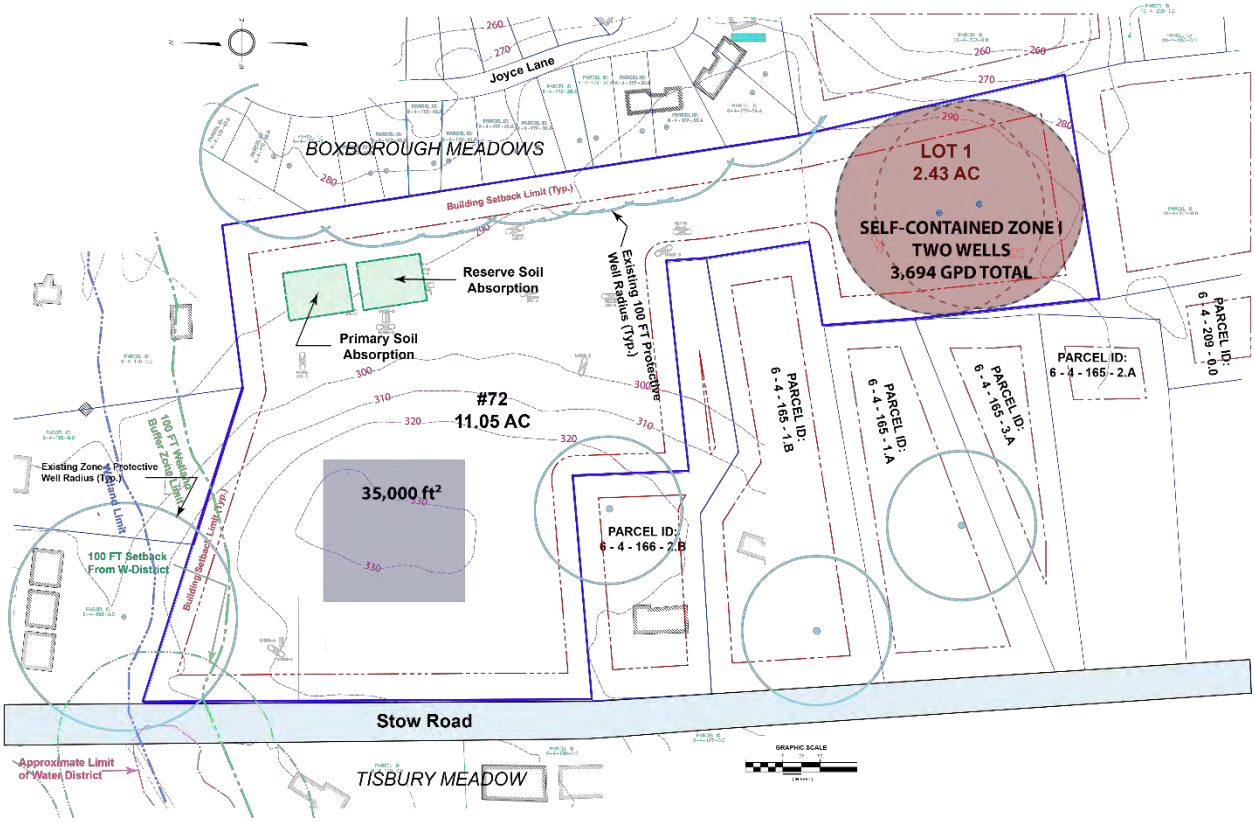

Figure 9. Available building area of Stow Road Property