Review of Septic Systems Regulatory Requirements for The Town of Sherborn

Final Report and Summary of Recommendations

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Submitted to:

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1. OVERVIEW

Lombardo Associates, Inc. (LAI) was retained by Citizens for a Better Sherborn to review the Town of Sherborn (TOS) Regulations of the Board of Health (BOH), as they apply to septic system and small wastewater treatment facilities. The purpose of this review is to identify areas where the Sherborn regulatory requirements differ from Title V and, where TOS regulations are more stringent, to render a professional opinion concerning the appropriations of TOS BOH regulations that are more stringent than Title V.

1.1. Town of Sherborn Regulations Vs. Title V Regulations

The major differences between the TOS and Title V regulations are as follows:

1. Title V requires a minimum 4-foot separation from high groundwater level, increasing to 5 foot if the percolation rate is less than 2 mpi. TOS regulations require a minimum 5-foot separation, increasing to 6-foot if located in an area where periodic flooding can occur.

2. TOS regulations require a 6-foot layer of naturally occurring pervious material if impervious soils, ledge or other confining layer is present below the disposal area. Title V has no such provision.

3. Naturally occurring pervious material is defined as having a percolation rate of less than 20 mpi in the TOS regulations. Title V allows soils up to 60 mpi.

4. Title V gives a loading rate credit for utilizing pressure distribution. TOS regulations require both gravity and pressure distribution system to use the gravity distribution loading rates from Title V.

5. TOS regulations do not allow construction in fill where separation to groundwater is less than 5 feet. Mounding to meet the groundwater separation requirement is not permitted. Title V allows mounded systems constructed to comply with the separation to groundwater requirement, provided that 4 feet of naturally occurring pervious material remains.

6. TOS regulations require 4" of aggregate above the distribution piping in the trenches. Above this, 2" of peastone is required. Title V does not require aggregate above the crown of the distribution pipe and allows for geotextile to substitute for the 2" layer of peastone required on top of the aggregate. Therefore, trenches designed under TOS regulations are 6" deeper than equivalent Title V trenches.

7. For a trench system with reserve area designated between the trenches, Title V allows two deep hole tests and one percolation test. TOS regulations require a minimum of 3 deep hole tests and two percolation tests. Both TOS and Title V require that the highest value for percolation testing and groundwater table be used. Both have provisions for requiring additional testing if deemed necessary.

8. TOS regulations require that all systems be sized as if garbage grinders are installed. Title V requires 50% increase in size for systems with garbage grinders, however it is not required for systems without.

9. TOS regulations differ from Title V with respect to the following disposal area setback distances:

    - Water Supply Well = 125' – 175' (Title V = 100')
    - Open Surface Drain = 125' (Title V = 10')
    - Watercourse, not a public water supply = 125 (Title V = 50')
    - Property Line = 20' (Title V = 10')

10. TOS only allows percolation testing from November 1st – April 29th. Title V allows percolation testing year-round, provided that testing is not conducted in frozen soils.

11. Small Wastewater Treatment Facilities (SWWTF) have similar requirements to Groundwater Discharge permits. Title V generally applies to flows up to 10,000 gpd and MADEP Groundwater Discharge requirements apply to flows in excess of 10,000 gpd. It is unclear from the regulations received by LAI what is defined as a system "other than a single family residence" and what is defined as a SWWTF.

Of the differences listed above, the following two have been identified as primary issues of focus and will be analyzed in detail in the subsequent sections of this report:

1. Vertical separation distances from groundwater, bedrock or other impervious materials.

2. Definition of impervious material, >20 mpi with TOS and >60 mpi with Title V.

1.2. Wastewater Treatment in a Soil Adsorption System

The unsaturated zone of a soil adsorption system is defined as the area between the bottom of the drainfield and the seasonal high groundwater elevation or other impermeable material. This zone is made up of what is commonly referred to in regulatory terms as "naturally occurring pervious material". Treatment occurs in this zone via the following mechanisms (Siegrist, 2006):

- Biodegradation via biofilms and organic matter
- Physical filtration / adsorption
- Biological oxidation through the biofilm that forms on the surface of the soils
- Biological denitrification, within the biofilm

The following factors affect treatment within a soil adsorption system:

- Permeability of soils (typically measured by percolation tests)
- Depth of unsaturated zone
- Effluent quality

- Application rate
- Dosing frequency and distribution method (pressure vs. gravity)
- Physical / chemical properties of soil

The design long term application rate (LTAR) is the hydraulic application rate for septic tank effluent that is expected once the drainfield biomat has matured. This is the design loading rate used to determine the area requirement of the dispersal area. The LTAR, in both Title V and TOS regulations, is determined based on the classification of the soil and the percolation rate. Effluent quality is factored in only where garbage grinders are applied, with TOS requiring that all dispersal areas be designed to accept septic tank effluent from houses equipped with garbage grinders.

When pre-treatment prior to a drainfield is used for septic system repairs, Title V allows a 50% drainfield sizing reduction or 2 foot reduction of the required depth to groundwater / bedrock. No such credit is provided in the TOS regulations.

1.3. Vertical Separation from Groundwater and Other Impervious Materials

The biomat forms at the interface of the aggregate and the naturally occurring pervious soils (defined as the drainfield bottom). The biomat thickness depends on effluent quality, as no appreciable biomat formation is expected with pre-treatment effluent (i.e. effluent with BOD < 20 mg/l). As the biomat thickness grows, it extends upwards into the aggregate, not typically down into the unsaturated zone. The unsaturated zone thickness is not expected to change over the lifetime of the system.

The mechanisms through which septic tank effluent is treated are exactly the same as an intermittent sand filter, which is essentially what a dispersal area is. Typical design criteria for an intermittent sand filter calls for an effective depth of the sand between 2-3 feet. Many states only require 2 feet of sand. The following are suggested depths to limiting layers (high groundwater or bedrock) for soil adsorption system (Siegrist, 2006):

- Type I to Type III effluents dispersed in Class I soil: **≥ 2 feet**
- Type I to Type III effluents dispersed in Class II and III soil: **≥ 3 feet**

Deeper unsaturated zones do not demonstrate additional levels of treatment. It is LAI's professional opinion that the 4-foot separation provided for in Title V provides a sufficient safety factor above the 2-3 feet recommended for treatment of septic tank effluent. In LAI's opinion, the additional one-foot of separation provided for in the TOS regulations does not produce any value with respect to public health and safety, and there is no technical basis for this requirement.

1.4. Percolation Rates

Percolation rates are a surrogate for measuring the hydraulic conductivity of soils. The slower the percolation rate, the more time the water spends in contact with the soil. Contact time is essential to treatment as adsorption, biological oxidation, virus inactivation and phosphorus removal all depend on contact between the grains of soil and the wastewater to be treated. Soils that have percolation rates of less than 2 minute

per inch (mpi) pass water so fast that the biomat may not form at the drainfield bottom interface, as described in Section 1.3. For this reason, Title V requires an additional foot of naturally occurring pervious soils between the drainfield bottom and any limiting layer. Alternately to the increase in depth to groundwater, adding a 6" – 12" layer of slower perc soils (i.e. Title V sand) below the drainfield piping could better achieve the desired treatment, rather than the additional depth to groundwater.

Additionally of concern are percolation rates that are too slow. Title V defines impervious material, or material in which a dispersal system is not permitted, as soils with a percolation rate greater than 60 mpi, even though many States allow septic system installations in soils with percolations rates of 60 – 120 minutes per inch.

As the percolation rate increases, it is necessary to reduce the design LTAR accordingly. These soils have smaller pore spaces and are more susceptible to clogging. The required dispersal system size increases as the percolation rate increases in both Title V and TOS regulations.

It is not uncommon in numerous States for percolation rates up to 120 mpi to be established as the highest allowable percolation rate. In areas where these types of soils are allowed, the corresponding design LTAR is appropriately lowered. The literature does not report these areas having increased failure rates for soil adsorption systems.

Prior to new regulations requiring appropriately sized, compartmentalized septic tanks and effluent filters, the effluent quality of the average septic tank was highly variable. As mentioned in Section 1.2, effluent quality directly affects the ability of a soil adsorption system to effectively treat wastewater. It was at that time that percolation rates were more commonly limited to ≤ 20 – 30 mpi. This is due to the increasing effect that high suspended solids concentrations have on soils with higher percolation rates. Recurring periods of septic tank effluent with unusually high TSS will shorten the lifetime of any soil adsorption system. This occurs more rapidly with soils that have higher percolation rates. Current regulations concerning septic tank sizing ensure that high levels of TSS will not regularly leave the septic tank under normal conditions. This eliminates the concerns that led to excluding soils with percolation rates greater than 20 mpi.

The TOS regulations mirror Title V LTAR values as a function of soil class and percolation rate, up to 20 mpi. The TOS regulations do not permit the use of any soils with percolation rates above 20 mpi.

2. PRIMARY ISSUES OF CONCERN

Following is a discussion of the primary issues of concern associated with the focus issues of:

- Increasing TOS maximum percolation rate to greater than 20 mpi
- Decreasing TOS minimum depth to groundwater

2.1. Bacterial Treatment

As stated previously in this report, many, if not predominately, other States, allow septic systems in soils with percolation rates up to 120 mpi. With slower perc soils, bacterial removal is enhanced as longer contact time occurs between wastewater and soils. Also, as reaffirmed by Van Cuyk et al (2001 and 2004), there is no increased bacterial removal with soil depths greater than 3 – 4 feet.

As the Town of Sherborn relies on its groundwater for water supply and wastewater disposal, the Town could require a 6" – 12" Title V sand layer below the drainfield stone for enhanced purification at those locations with percolation rates $\geq$ 2 mpi.

2.2. Emerging Contaminants

Again, as the Town of Sherborn relies on its groundwater for water supply and wastewater disposal, there is a valid concern regarding the introduction of emerging contaminants (chemicals as part of personal care products and pharmaceuticals, including hormones) by septic systems, and their impact on water supply.

Although the science of the contribution and impacts of emerging contaminants is still evolving, general guidelines exist on the required pre-treatment levels to address emerging contaminants discharged into water supply aquifers. Generally, these guidelines state that as a percent of the water supply that is wastewater derived increases, wastewater treatment levels increase. To assess this issue in the Town of Sherborn requires a quantification of wastewater discharges, understanding of Sherborn's groundwater water supply aquifer to determine the percent of water supply that is wastewater derived. This analysis, beyond the scope of this project, would enable the best determination at this time of the significance of this issue, as it may be determined that the existing density of septic systems in Sherborn is such that existing systems need to be upgraded.

For new construction, wastewater treatment technologies exist to mitigate this concern. Consequently, it may be appropriate that new construction and septic system repairs include the advanced wastewater treatment technologies to address the issue of emerging contaminants.

2.3. Growth Impacts

Although changing TOS regulations to be more in line with Title V requirements would increase the amount of buildable land in Sherborn, an analysis of this issue is beyond the Scope of this Study. It is respectfully submitted that septic systems regulations cannot be used to control growth. There are numerous other legal mechanisms appropriate for managing growth.

2.4. Town of Dover Regulations

As a comparison, LAI has reviewed the Town of Dover's Board of Health regulations relative to septic system design relative to Dover's requirements for depth to groundwater and maximum percolation rates. Dover's requirements are:

- Maximum allowable percolation rate - 25 minutes per inch
- Mound is allowed provided that groundwater is greater than 3 feet
- No additional groundwater separation requirements beyond those of Title 5

3. CONCLUSIONS

LAI has reviewed the TOS regulations with respect to septic system requirements. The two areas of focus were on depth of drainfield requirements and allowable percolation rates. LAI has concluded the following:

- There is no technical basis for requiring a 5 foot separation from high groundwater and a 6 foot separation from bedrock. The Title V requirement of 4 foot separation for all cases with the exception of soils that have percolation rates less than 2 mpi is sufficiently conservative to ensure that public health and safety are not adversely affected.

- Percolation rates up to 120 mpi have been documented to sustain soil adsorption systems. The Title V limitation of 60 mpi is sufficiently conservative to ensure that public health and safety are not adversely affected. Therefore, it is appropriate that the TOS BOH increase its maximum percolation rate to be more consistent the Title V requirements.

To facilitate the TOS implementation of less restrictive Title 5 standards and minimize impacts associated with secondary impacts of revisions, the Town of Sherborn may wish to adopt less restrictive Title 5 requirements in stages and initially adopt the following revisions that the Town of Dover uses:

- Maximum allowable percolation rate - 25 minutes per inch
- No additional groundwater separation requirements beyond those of Title 5

4. REFERENCES

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