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MODULE 3

Horizontal Setbacks in Title 5

Introduction

In Module 2 of this Training Course, we spent considerable time reviewing the concept of vertical separation of leaching systems from groundwater. As we mentioned, vertical separation is the first, and perhaps the most important, line of defense for the removal of a number of contaminants in wastewater, particularly the pathogens. Now that we have gotten that information under our belts, we move on to the issue of **horizontal setbacks**. If you are like my Board of Health, you spend perhaps the majority of your Board of Health variance hearings dealing with this issue. **Horizontal setbacks, or simply "setbacks" refer to the distance between the septic system components (primarily the septic tank or leachfield) and a particular structure, land feature, waterbody, well, or other "sensitive" feature**.

Since variance requests that involve setbacks occupy such a large percentage of Board of Health hearings, this module endeavors to present adequate definition and examples of those items we need to be concerned with in the horizontal plane, and the rationale behind each of the setback or prohibition requirements. Finally, we will suggest standards by which a board can evaluate variance requests. The organization of this Module will be to first go down the items listed in Section 15.211 Minimum Setback Distances, and then to cruise through the code and pick up those items not mentioned in this section (such as velocity zone).

A Short Word About Variances and Local Upgrade Approvals Before We Start

Throughout this Module, perhaps more than all others, we will use the word "variance". You may be confused regarding the differences and similarities between this term and the term "local upgrade approval". As you know, Section 15.402-15.410 describes a "local upgrade approval process" by which the local authority can vary the application of certain provisions of Title 5, without the need for DEP review. Despite the fact that these approvals are not submitted to DEP for review, they are still technically variances. In short, any time the installation of a septic system is allowed that does not meet the full requirement of 310 CMR 15.000, ***it does so by obtaining a variance***. Whether the variance can be approved by the local approving authority (i.e.. granted the approval to upgrade at the local level - local upgrade approval), or whether the variance must also be approved at the state level, they are still both variances.

First things First - What are the key issues with horizontal setbacks ?

You might remember that the main issues with vertical separation to groundwater, covered in Module 2, related to contaminant removal directly beneath the leaching facility (or **S**oil **A**bsorption **S**ystem - SAS) prior to reaching the groundwater. With horizontal setbacks, we now consider the attenuation of contaminants as the effluent mixes with and is carried away from the disposal site by groundwater toward vulnerable receptor sites such as a wells or bathing beaches.

In addition, as you will see below, some lateral setbacks are also predicated on concerns for horizontal migration of noxious gases in the soil, horizontal migration of effluent in the unsaturated zone, or site-drainage concerns. Finally, some horizontal setbacks also address the issue of environmental disruption. To discuss this by example, consider the situation of the coastal bank. Coastal banks are, in some situations, natural landforms which stabilize an area physically, and provide valuable functions to attenuate destructive natural forces such as storms. If a septic system installation subtracts from the ability of a coastal bank to perform these functions, environmental degradation can occur (which, by the way, may result in a public health threat by exposing subsurface septic systems). This is one of those "gray" areas where Title 5 addresses not only a public health, but an environmental issue. Although the dominant theme in Title 5 is public health, it does makes a segue, in some instances, into the regulations having dominant environmental oversight, such as the Wetland Protection Act and its regulations. So, before we really dig into and describe the actual horizontal setback requirements, let's discuss the effect of each contaminant in the horizontal plane.

Gases

The decomposition of organic matter forms a variety of gases, both noxious and innocuous. Under ***aerobic*** conditions, the final products of decomposition are, for the most part carbon dioxide and water. Under ***anaerobic*** conditions such as occurs in the septic tank and occasionally in a SAS, however, bacteria decompose sulfur-containing organic compounds in our waste and produce hydrogen sulfide, which is both toxic and an odor problem. In addition, under strict anaerobic conditions, which generally only occur in the septic tank portion of the septic system, certain bacteria can reduce carbon dioxide in the presence of hydrogen and produce methane gas. This gas is explosive at high concentrations. The potential generation of noxious or explosive gases is the basis of some of the concern for setback distances from habitable or enclosed spaces where migrating gases could collect.

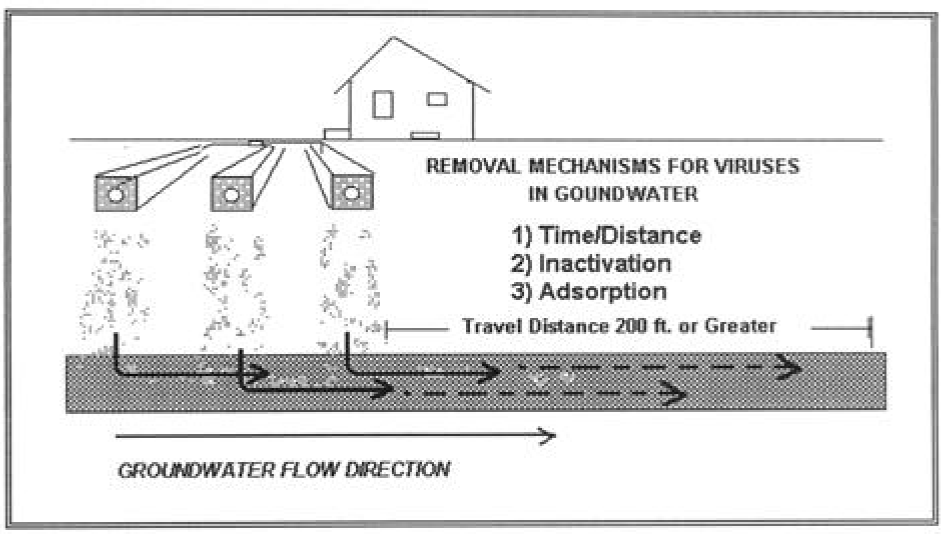
In general, the migration of gas in the soil away from septic systems is limited. Under certain conditions, however, the possibility of harmful gases collecting are increased. Impervious surfaces over a system that prevent the off-gassing to the atmosphere can allow more lateral and contained bands of gases to collect and be conveyed to enclosed areas. One general thought to keep in mind however, is the fact that properly installed septic systems are vented through the house to the roof vent and subsequently into the atmosphere. Thus, the majority of noxious gas production is dispersed into the vast atmosphere above the house and poses no real problem.

Pathogens

Although the majority of treatment for pathogens discharged from an onsite system occurs in the unsaturated zone beneath the SAS, it is inevitable that some pathogenic organisms will reach the groundwater table. This primarily occurs during periods when there is saturated flow to the water table. A prime example of this is during the initial use of a system (see page 11 Module 2), but saturated flow from the bottom of the SAS to the water table can also occur periodically in a mature system. As you recall, during saturated flow less pathogen removal occurs due to less exposure of the effluent to the actual surface of the soil grains. During unsaturated flow, the flow path of the effluent is tortuous, and exposes the effluent to the biologically active soil surfaces where pathogens are removed by various mechanisms including adsorption, predation, and desiccation. If you have questions regarding this concept, you should review Module 2.

Once pathogens reach the water table, they become entrained in the flow of the groundwater and move laterally with ground water under saturated flow conditions. Since saturated flows are less effective in removing pathogens, an elevated concern is warranted in areas where the groundwater flow beneath a SAS is in the direction of a "sensitive" receptor site such as a drinking water well, bathing beach, or shellfish area. For the majority of bacterial and protozoan pathogens, the filtration that takes place in the horizontal groundwater flow is adequate to remove them within ten or so feet. The exception to this, however, is in areas where the effluent encounters large channels or fractures in the material beneath the SAS. Fractured bedrock that occurs along Massachusetts northern shoreline is a prime example of this. Viruses, on the other hand, have been shown to be entrained for much longer distances even in sandy soils. Once a virus reaches the groundwater table, travel distances of over 200 ft. have been reported in soils similar to Barnstable County (see annotated references provided with Module 2 - page 9 of the Addendum, Vaughn et al. ,1983).

The main factors regulating the removal of viruses in groundwater are time (which is a function of the groundwater flow rate and the distance to the nearest sensitive receptor site) and soil texture. Given enough time, even in a moist environment conducive to survival, viruses will eventually become denatured or rendered harmless. This results from the eventual chemical destabilization of the virus' protective protein coating, a type of "aging" for the virus. This destabilization is also be hastened by chemicals produced by the natural flora of groundwater.



Assuming that groundwater flow rates are approximately 1 ft/day (a value widely accepted as a general average for Barnstable County), and making a reasonable assumption that viruses can persist in viable form for 200 or so days[1] in groundwater, it is prudent to be concerned about placement of septic systems within a 200 ft. radius of a sensitive receptor site. This concern over pathogenic viruses has prompted nearly every Board of Health in Barnstable County to increase the required horizontal setbacks from the Title 5-required 50 ft. near certain resource areas, to 100 ft. This is a prudent and defensible modification considering our generally-coarse sandy soil. In tighter soils (particularly those with silts and clays), that generally exhibit a higher ability to adsorb viruses, and where the groundwater flow rates are less, the horizontal setback requirements may not need to be adjusted more than the state minimum.

In summary, the body of information regarding virus entrainment in groundwater supports a Board of Health's ardent adherence to the horizontal setback requirements of Title 5 and, in cases involving sandy soils, local Board of Health Regulations that require greater horizontal setbacks. While the maintenance of vertical separations discussed in Module 2 maximize the removal of pathogens beneath the SAS, vertical separation can not be totally relied upon for this task. Horizontal setbacks are predicated on the premise that some pathogens will, at least occasionally, reach the groundwater table and be entrained in groundwater moving away from the site. A prime mandate of a Board of Health is to maintain a safe horizontal separation between sources of pathogens and points of possible human exposure.

The solution to pollution is dilution. anonymous

Nutrients

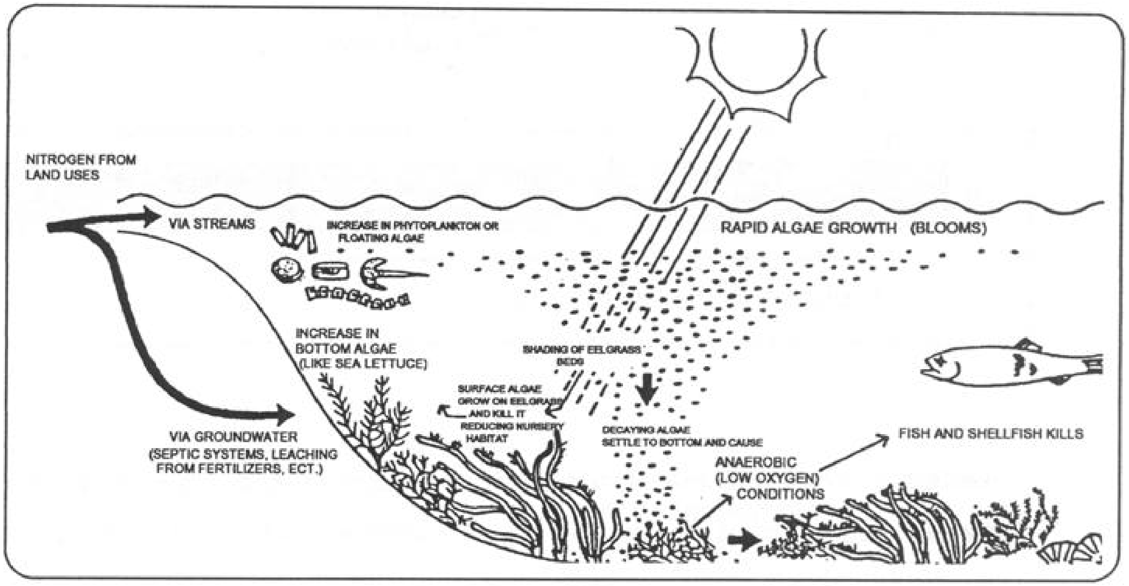
In recent years nutrients have become a key issue in the deliberations about septic system placement, and it is a common misconception that horizontal setbacks are an attempt to address this issue. The reader should realize however, that nutrient contamination is only marginally addressed in the setback requirements that are presently in Title 5. The issue of nutrients is more adequately addressed in the provisions for alternative onsite septic system technologies which will be the subject of a separate Module.

Two nutrients commonly associated with septic systems are phosphorus (which is of prime importance in <u>freshwater</u> ecosystems which are typically growth-limited by this element) and nitrogen (which is of prime importance for <u>marine</u> ecosystems which are typically growth-limited by nitrogen). By "growth-limiting" we mean that, if supplied to the environment in above-normal levels, they usually stimulate undesirable levels of algae growth and aquatic weeds. Subsequent impacts of diminished oxygen levels and fishkills can also result.

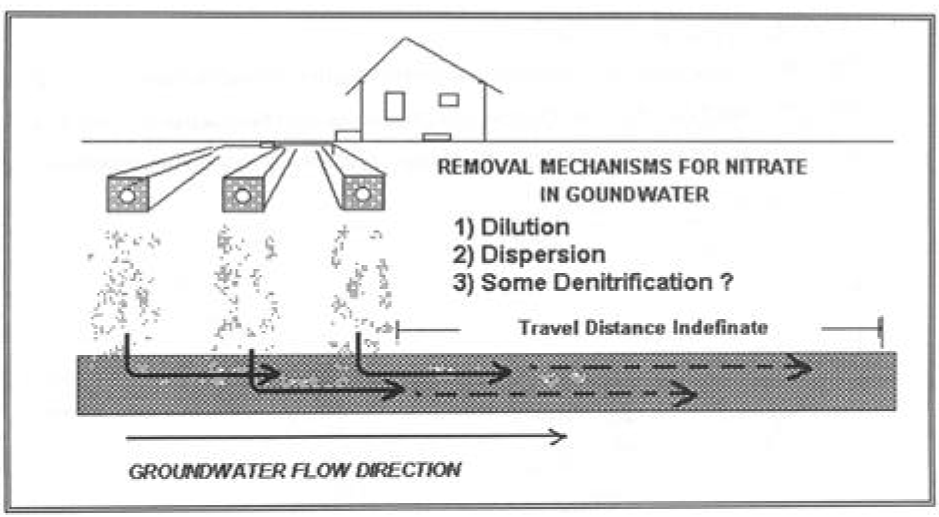
Since nitrogen and phosphorus act quite differently from each other in the subsurface environment and groundwater, they are discussed separately.

<u>Nitrogen</u>

The primary form of nitrogen in the groundwater beneath a SAS is nitrate-nitrogen, although some ammonium and dissolved organic nitrogen also exist. Title 5 setback requirements presently do not address the issue of nitrogen impacts to sensitive marine environments.

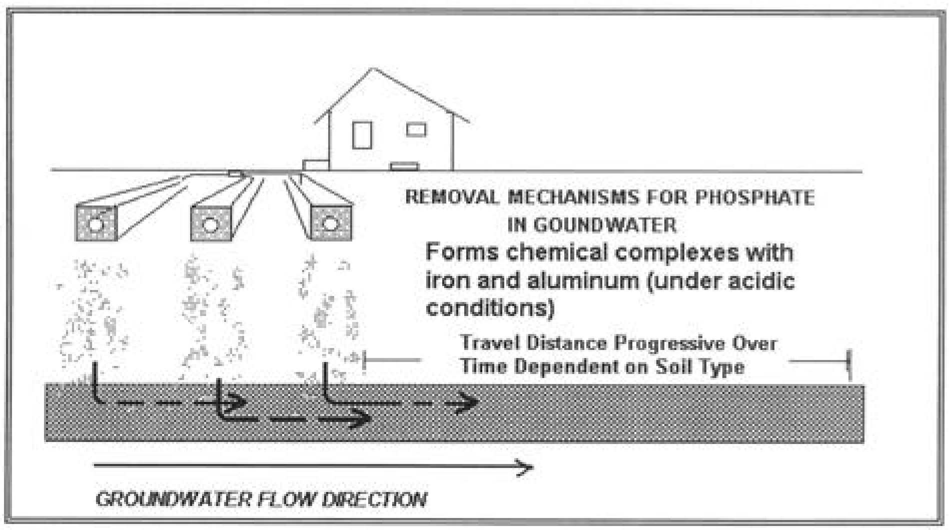


In addition, the setback requirements only address the nitrogen issue near drinking water resources somewhat indirectly. The prohibition of SAS in a Zone I and restrictions in Zone IIs discussed in detail later, reflects the concern that nitrate nitrogen may cause levels in drinking water wells to exceed the Maximum Contaminant Level of 10 ppm allowed in the drinking water regulations. But the reader should understand that nitrate nitrogen travels very conservatively in groundwater, which means it is neither appreciably transformed into something else nor is it removed. Accordingly, the primary method of reducing nitrogen levels in groundwater is dilution. This is achieved by providing enough undeveloped surface area into which rain can percolate near the SAS to provide dilution water for the nitrate. So basically, the prohibitions and the density restrictions in Section 15.214[2] reflect the strategy of dilution to reduce this particular pollutant concentration at the receptor site as opposed to removal.



Phosphorus

Unlike nitrogen, certain conditions in soils native to Barnstable County (iron-rich sands) may be conducive to some (perhaps significant) removal of phosphorus in wastewater. The geochemistry of phosphorus in soils is extremely complex, and an in-depth discussion of it is outside the realm of this course, however, it can be broadly stated that, as wastewater filters down beneath the SAS, soluble phosphate forms complexes with iron in the soil to form insoluble species such as iron phosphate ($FePO_4$ for you chemistry buffs). These insoluble compounds precipitate on the soil grains and are immobilized. This removal or sequestering of phosphorus will occur as long as there is both available iron to form the various insoluble iron-phosphorus complexes, and aerobic conditions. The removal or sequestering of phosphorus will eventually wane as the iron coating the sand grains is successively bound with the phosphate and iron becomes unavailable for further complexing. In one instance, our research with sand filters indicated that over 50 % of the phosphorus was removed from septic effluent in 3 ft. of soil passage for the first year. As iron became less available in successive years in our experiment, phosphorus (in the form of soluble phosphorus) merely percolated unimpeded though our sand. Thus, the phenomena of phosphorus reduction or sequestering occurs to a great extent in the unsaturated zone beneath the SAS and the aerobic areas of groundwater flow. If subsurface conditions become anaerobic and reducing, however, the insoluble complexes of phosphorus are reduced to soluble compounds, such as $Fe_3(PO_4)_2$, and phosphorus can move down to and with the groundwater. The anaerobic conditions that promote phosphorus mobilization could conceivably occur beneath heavily loaded septic systems with saturated flows beneath the SAS.



Again, the reader should understand that setback requirements in Title 5 have not been predicated on the concern for phosphorus. Although there has been recent suggestion that a 300 foot setback of septic systems from freshwater ponds might reduce the phosphorus inputs and prevent eutrophication, further research is necessary to verify the long term efficacy of this approach. As implied by previous statements, using this approach will eventually result in the saturation of all sites for insoluble phosphorus complex formation, and any remaining phosphorus will simply pass through to the receiving waters.

Other Contaminants

Although there are a number of other contaminants in wastewater, setback requirements were not designed specifically to safeguard against their eventual interception with receptor sites. It can, however, be generally stated that , with the exception of some synthetic organic compounds, the on-site septic system, installed in accordance with minimum setbacks, renders most other constituents of household wastewater harmless by the time they reach locations of possible human exposure. The exceptions to this, of course, are situations where the system receives industrial-type wastes that require specialized treatment to render them harmless. The revisions to Title 5 provide a list of industries (Section 15.004(6)) which the reader can review to get an indication of the types of wastes Title 5 systems were not meant to handle.

With that out of the way, let's dig in !

If you are like me, you have likely dog-eared that page of your copy of the code that references setbacks. The Table presented below is the replication of Section 15.211: Minimum Setbacks, and since we will constantly be referring to it, you might want to dog-ear the page in this course book. Our discussions below will vary slightly from the order in which the various setback items are presented in the table. This was done to present a more logical grouping of our discussions.

Section 15.211: Minimum Setback Distances

{PRIVATE}**Feature**	**Septic Tank Setback (ft)**	**Soil absorption system setback (ft)**
Property Line	10	10
Cellar Wall or Swimming Pool (inground)	10	20
Slab Foundation	10	10
Water Supply Line (pressure)	10*	10*
Surface Waters (except wetlands)	25	50
Bordering Vegetated Wetland (BVW),Salt Marshes, Inland and Coastal Banks	25	50
Surface Water Supply - (Reservoirs and Impoundments)	400	400
Tributaries to Surface Water Supplies	200	200
Wetland bordering Surface Water Supply or Tributary thereto	100	100
Certified Vernal Pools	50	100*
Private Water Supply Well or Suction Line	50	100
Public Water Supply Well	special note*	special note*

Irrigation Well	10	25
Open, Surface or Subsurface Drains which discharge to Surface Water Supplies or Tributaries thereto	50	100
Other Open, Surface or Subsurface Drains (excluding foundation drains) which intercept seasonal high groundwater table*	25	50
Other Open, Surface or Subsurface Drains(excluding foundation drains)	5	10
Leaching Catch Basins & Dry Wells	10	25
Downhill Slope	not applicable	15*

* Special notes that will be described in detail under the specific headings below

Property Line: Required Setback Septic Tank to Property Line - 10 Feet

Required Setback SAS to Property Line - 10 Feet

There is an old expression that goes "good fences make good neighbors", and perhaps it's true. Despite the fact that this it is one of the more minor requirements of Title 5, Boards of Health often spend the good part of an hour (sometimes more) discussing with abutters a proposed septic system that will be less than the required ten feet from their property. You have probably all heard objections from abutters ranging from "I don't want the sewage to leach under my property" to "they will have to take out the trees that shade my yard". So, what are the key issues to be concerned with when someone requests a variance from this provision in the code ?

With revisions to Title 5 that essentially eliminated the use of leaching pits and deeper leaching structures[3], and the resulting more expansive area requirements for SAS, Boards of Health will likely see an increase in requests to vary this requirement in the code. This will especially be the case where leaching pits once prevailed since there was likely little foresight at the time of the original system placement, that the code would change and require large reserve areas. Small lots, building configuration, and the desire to maximize the compliance with flow capacity requirements are all reasons why someone might apply to the Board of Health for a variance to the property line-setback requirement of ten feet.

There is a popular misconception that states that the 10 ft. property line-setback requirement is to prevent contamination from exiting the lot and going under the adjacent property. As Board of Health members and agents, we know that this is not true. Most of the sewage disposed of on a particular lot will eventually move away from the property and across property lines. Still however, we may often have to address a confused abutter that receives notice of the hearing and feels that something is being decided upon which impacts them. The best thing that a Board of Health can do to address abutters' concerns is to understand the rationale behind the property line setback requirements, and receive requests for variances accordingly.

So, what are the reasons for a property line-setback requirement ?

The primary reason for the 10' setback requirement between property lines and septic systems is one of access. In reviewing an application for a variance from this provision, the **Board of Health should require assurances from the applicant that the septic system about to be installed can be constructed and maintained from property under the control of the applicant**. This is particularly important if the Board of Health ever has to order the repair of the system. If the system can only be accessed over a neighbor's property, and there is no easement for such, legal issues can delay the repair of a system that might be a threat to public health. Thus, *the first concern of the Board of Health relative to this issue should be that the owner of the property be able to construct, maintain, and repair the septic system from property under his/her control.*

In addition to ensuring that the septic system can be maintained and repaired from property under the proponent's control, *Boards of Health should also be careful not to approve a septic system so close to the property line as either to encroach upon the present SAS on an adjacent lot or so as to prevent the adjacent property owner from repairing their system*. For this purpose, it is prudent for a Board of Health to require information about where the septic system on the adjacent property is, and where a repair to that system most likely would be. Remember, Section 15.405: Contents of Local Upgrade Approval, subsection (a) states:

> "Reduction of system location setbacks otherwise established in 310 CMR 15.211 for property lines provided that a survey of the property line shall be required if a component is to be placed within five feet of a property line, and no such reduction shall result in the soil absorption system being located less than ten feet from a soil absorption system on an abutting property;"

At this point, the Board of Health needs to be reasonable. On the one hand, it is certainly reasonable for the Board of Health to make sure the applicant for this variance has supplied sufficient information to ensure that his/her SAS will meet all required setbacks from present and proposed SAS on the adjacent lot from which the varianced system is to be located. On the other hand, the Board of Health should not require full engineered plans of the adjacent lot.

A final point to be made regarding property line setbacks relates to what I will call "marginal issues". It is not the responsibility of the Board of Health to respond to issues like the shade trees previously mentioned. But it is conceivable that an abutter would have a valid concern not covered under issues of access or infringement on SAS. In Provincetown, for example, when buildings are very close, there might be a legitimate concern that allowing a variance to the property line setbacks might jeopardize a structure. In no way, does the Board of Health approval for any project absolve an owner or contractor from responsibilities to the abutter to prevent damage to the abutter's property due to system construction. Any person constructing a septic system is responsible for, among other things, maintaining the site in a safe condition, taking proper precautions to protect structures which they are working near, and making reparation for any damages. If necessary, during construction, the installer should be urged, and in some instances required, to have a structural engineer review the plan prior to its execution. In addition, an abutter does not have to allow access across their land for a repair or replacement of a neighbor's septic system. The key to addressing abutters' "marginal" concerns at a variance hearing for property-line setbacks is being reasonable.

Cellar Wall or Inground Swimming Pool:

Required Setback from Septic Tank - 10 Feet

Required Setback from SAS - 20 Feet

Slab Foundations [4]

Required Setback from Septic Tank - 10 Feet

Required Setback from SAS - 10 Feet

Setback requirements from septic system components and structures such as buildings and swimming pools stem from two main concerns. Foremost, in certain instances, septic effluent discharged to soil can travel horizontally when its downward path is obstructed. This happens naturally if there are restrictive layers, such as bedrock, peat or clays, underneath the leachfield. Horizontal movement can also occur, to some extent, as the clogging layer develops in the leachfield. If the horizontal travel path of the effluent intercepts a building foundation, cellar or swimming pool wall, effluent could conceivably enter these areas through cracks and fissures and pose a public health risk. This is particularly true if the foundation/cellar contains drains which may have an open sump.

To address this issue, nearly every state has adopted these types of setback distances. Nationwide, the setback of SAS to buildings ranges from 5 ft. to 40 ft. The setbacks from septic tanks and building foundations recognizes the fact that septic tanks can and do leak their contents prior to being able to discharge to the SAS and liquid from tanks can also travel horizontally in soil in the same manner as effluent from leachfields under certain conditions.

Another concern relative to the location of septic system elements and building foundations is that of gases. The natural processes of wastewater treatment in the septic system produce various gases, some of which are harmful to breathe (hydrogen sulfide for instance) and some of which are explosive (i.e.. methane) in higher concentrations. Since soils may convey gases (remember about 30 % of sandy soil is void space in which gases move freely), the above-referenced separation distances between wastewater treatment units and living spaces into which the gases could diffuse are required.

A final albeit minor consideration in the placement of septic system elements relative to buildings is drainage. Since precipitation sheds off rooftops, it is important not to place, particularly the SAS, at the point where roof surfaces drain or collect. This is a minor consideration, however in some instances, excessive drainage in this manner can negatively affect the performance of the SAS.

What happens if you can't meet the setbacks to cellar walls, inground pools or slab foundations ?

Boards of Health have adopted various strategies when these particular setback distances can not be achieved. The most common compensatory requirement has been the impervious barrier. In various instances where the lateral movement of effluent must be restricted, septic system designers require a barrier of polyethylene or other suitable nonbiodegradeable material between the SAS and the cellar wall, building foundation or inground pool. The barrier is placed at elevations from the top elevation of the SAS to an elevation below the exposure point of the structure. In most instances, particularly in well drained soils, this is adequate to address the concerns of the code.

Water Supply Line (pressure):

Required Setback from Septic Tank - 10 Feet[1]

Required Setback from SAS - 10 Feet[1]

Before you get started on this one, you might check your copy of the code. Certain older copies contained a misprint for this item. In any event, you should also note the qualifying/clarifying statement [1] which states:

> 15.211: Minimum Setback Distances [1]
> "Disposal facilities shall also be at least 18 inches below water supply lines. Whenever sewer lines must cross water supply lines, both pipes shall be constructed of class 150 pressure pipe and shall be pressure tested to assure water tightness"

As you might guess, this is an extremely important requirement in the code. There is perhaps no more important item to protect against sewage contamination than elements of a water supply system. The pressure-rated line requirement reflects the concern that, in certain situations, even pressurized water supply lines are vulnerable to contamination. While most folks think that if a pressurized water line breaks the water only exits the supply line, this is not always the case. A pressurized water line, surrounded by contamination, might first only leak outward. Following a demand on the system and drop in water pressure, however, the surrounding leaked water can be sucked back into the supply line, carrying contamination with it.

If a public water supply line is involved in a variance from this requirement of the code, Boards of Health should consult with the water superintendent or operator of the system. In the majority of cases, it is recommended that, if the proposed system can not meet the setback requirements of this section, the waterline should be moved or the system be reconfigured. In some instances, the Board of Health or its agent should guide the applicant toward infringing on a more "minor" setback requirement (such as the property line or foundations previously described), in order to avoid infringing upon the water supply line.

In the case of private well supply lines, which contain pressurized sections of line, all requirements of the code apply. Again, if at all possible, water lines should be moved or the system should be reconfigured to avoid variances from this provision. In the rare event that a variance is needed, Boards of Health should consult with water supply professionals at DEP or in the town to ensure that water supply and sewage have no chance to mix.

Up to this point, the issue of setbacks has been pretty cut and dry. From this point forward, however, it gets a little dicey. In the issue of wetland and water resources, the Board of Health and Conservation Commission oversight has some overlap. While Title 5 is an environmental regulation, the chief guardian of the surface water resources and wildlife is the Conservation

Commission. It is, however a fine line. The remainder of this Module contains statements regarding the intent of the code in relation to setbacks from wetland resources. This author does not claim to be the ultimate authority on this issue, but has stated his best professional opinion. It should be stated that some of the areas are still sufficiently vague as to be controversial. What I hope to present is enough discussion of the various topics to enable you, as Boards of Health and agents, to make decisions in a reasonable fashion. As a Board of Health member myself, I would urge you to take advantage of your local Conservation Commission's expertise as far as delineating the resources described below. In some towns, all plans submitted to the Board of Health for review must have environmentally-sensitive area boundaries agreed upon by the Conservation Commission before they can be reviewed by the Board of Health. This not only assures a more accurate boundary, but builds consistency in the review process for the applicant.

Although many Boards of Health relegate responsibility of wetlands protection to Conservation Commissions, there are compelling arguments which suggest that wetlands protection is also a Board of Health function since, in some instances, it constitutes a protection of the public health. As you will see, in addition to the mere physical and hydraulic benefits associated with wetlands as defined (flood storage, maintenance of base flow, prevention of storm damage), it can be argued that some wetlands afford significant treatment and reduction of pollutants such as nutrients, heavy metals, organic compounds, etc. In some instances, therefore, they offer an added natural treatment mechanism for drinking water supplies (even aquifers) and surface waters used for contact recreation or shellfish harvesting.

The revised Title 5 attempts to unify the language used by Boards of Health and Conservation Commissions when referring to areas of overlapping jurisdiction. Accordingly, in the references to wetlands, coastal beach, dunes, and elsewhere, Title 5 in turn refers to two documents: M.G.L. c. 131, s. 40 and 310 CMR 10.00. These documents are:

> **M.G.L. c. 131**, s. 40 or **M**assachusetts **G**eneral **L**aw, **c**hapter 131, **s**ection 40 is commonly referred to as **The Wetlands Protection Act,** and;
>
> **310 CMR 10.00** or **C**ommonwealth of **M**assachusetts **R**egulation 10.00, contains regulations promulgated by the Department of Environmental Protection under the authority of the Wetland Protection Act and commonly called **The Wetlands Regulations**.

Rather than read these entire documents, we will present citations from these documents in the discussions below. The full documents can be obtained through the state bookstore or they can be viewed (perhaps a copy borrowed) from the main administrator of the regulations - your Conservation Commission.

Also - try not to get too frustrated. Where water resources are concerned, one definition might have within it words that have their own definition. In the following section, we will attempt to carefully construct the "spider web" of definitions. But be will be weaving in and out of Title 5 and the Wetlands Regulations. So please bear with us as we try to make sense of it all, and remember, if you have any further suggestions on how we might better handle it for future course participants, let us know.

Surface Waters (except wetlands):

Required Setback from Septic Tank - 25 Feet

Required Setback from SAS - 50 Feet

The fifth item in the list of required setbacks is "Surface Waters **(except wetlands)**." Surface waters include all those waterbodies that we commonly think about, and are by definition:

> Section 15.002 Definitions
> Surface Water - All water other than groundwaters within the jurisdiction of the Commonwealth, including without limitation, river, streams, lakes, ponds, springs, reservoirs, impoundments, estuaries, wetlands, coastal waters, and certified vernal pools"

The reason for the curious qualification of **"(except wetlands)**" in this minimum setback distance section is unknown. It may have been meant to address the situation where a body of water (surface water) had no peripheral area of vegetation or wetland, and thus would emphasize that the edge of the water would then serve as a point from which the setback is to be observed. Or it could be that the "wetlands" issue was thought best to be covered in the succeeding setbacks (see below). But this is only conjecture. The mystery deepens when the next set of features includes in the setback requirements "Bordering Vegetated Wetlands (BVW), Salt Marshes, Inland and Coastal Banks" **with the same setbacks as surface waters!**

So, lets take them one at a time and describe each feature. First, what is a surface water? Again, Section 15.002 Definitions states:

> Surface Water - All water other than groundwaters within the jurisdiction of the Commonwealth, including without limitation, river, streams, lakes, ponds, springs, reservoirs, impoundments, estuaries, wetlands, coastal waters, and certified vernal pools"

This is one of those situations where the definition has words within it that need further definition. To get at most of these, we refer to the wetlands regulations.

Definitions from 310 CMR 10.04 (Wetlands Regulations) except where noted

river means a natural flowing body of water that empties to any ocean, lake or other river and flows throughout the year.

stream means a body of running water, including brooks and creeks, which moves in a definite channel in the ground due to a hydraulic gradient, and which flows within, into or out of an Area Subject to Protection Under M.G.L. c. 131, 40. A portion of a stream may flow through a culvert or beneath a bridge. Such a body of running water which does not flow throughout the year (i.e., which is intermittent) is a stream except for that portion upgradient of all bogs, swamps, wet meadows and marshes.

lake means any open body of fresh water with a surface area of ten acres or more, and shall include great ponds.

pond (inland) means any open body of fresh water with a surface area observed or recorded within the last ten years of at least 10,000 square feet. Ponds may be either naturally occurring or man-made by impoundment, excavation, or otherwise. Ponds shall contain standing water except for periods of extended drought. For purposes of this definition, extended drought shall mean any period of four or more months during which the average rainfall for each month is 50% or less of the ten year average for that same month. Notwithstanding the above, the following man-made bodies of open water shall not be considered ponds: (a) basins or lagoons which are part of wastewater treatment plants; (b) swimming pools or other impervious man-made basins; and (c) individual gravel pits or quarries excavated from upland areas unless inactive for five or more consecutive years.

pond **(coastal)** means *Salt Pond* as defined in 310 CMR 10.33(2).
310 CMR 10.33(2) Definition. ***Salt Pond*** means a shallow enclosed or semi-enclosed body of saline water that may be partially or totally restricted by barrier beach formation. Salt ponds may receive freshwater from small streams emptying into their upper reaches and/or springs in the salt pond itself.

***springs, reservoirs, impoundments* -** there is no strict definition in Title 5 or the Wetlands Regulations, so the following is common sense definition

> ***spring* -** an issuance of water from the ground surface
> ***reservoirs* -** a lake or pond where water is stored for use (i.e. for irrigation or other use)
> ***impoundments* -** similar to reservoir, with the implication that there is an artificial means of preventing the natural flow, such as in a cranberry bog impoundment that has an earthen dam or slot-board sluice gate.

estuary means: (a) any area where fresh and salt water mix and tidal effects are evident; or (b) any partially enclosed coastal body of water where the tide meets the current of any stream or river.

wetlands* -** *REMEMBER THIS IS EXCLUDED FROM THE SETBACK WE ARE NOW DISCUSSING.* But just for your information at this point, but certainly not meant to be an exhaustive definition, wetlands include both ***freshwater wetlands **and** ***coastal wetlands*.** ***Freshwater wetlands*** include "wet meadows, marshes, swamps, bogs, areas where groundwater, flowing or standing surface water or ice provide a significant part of the supporting substrate for a plant community for at least five months of the year; emergent and submergent plant communities in inland waters; that portion of any bank which touches any inland waters". The terms "wet meadow, marshes, swamps, and bogs" are defined in the Wetland Protection Act in relation to the plant communities that they support. Coastal wetlands include "any bank, marsh, swamp, meadow, flat or other lowland subject to tidal action or coastal storm flowage".

***coastal waters* -** there is no strict definition in the wetlands regulations or Title 5, but the implication here is any marine waters or any water bordering saltwater bodies.

***certified vernal pools* -** is defined in Title 5 as " A surface water body that has been certified by the Massachusetts Division of Fisheries and Wildlife as a vernal pool in accordance with the "Vernal Pool Certification Guidelines" pursuant to the Massachusetts Natural Heritage and Endangered Species Program administered by the Massachusetts Department of

Fisheries and Wildlife and Environmental Law Enforcement at the time a permit application is submitted to the approving authority[5].

Why is it so necessary to observe setbacks from these resources? As we have stated in the introductory remarks of this module, a chief reason to observe setbacks to points of possible human exposure is to prevent the contamination with pathogens and the subsequent spread of human disease. Pathogens introduced into surface waters can infect individuals through exposure of open cuts or incidental ingestion while swimming or wading. In addition, many of our estuaries serve as culturing grounds for shellfish which are consumed. Shellfish that are harvested from pathogen contaminated waters actually magnify the human health risk to the consumer due to the fact that their mode of feeding (filter feeding) actually concentrates pathogenic organisms in their gut which is often consumed.

Bordering Vegetated Wetlands (BVW), Salt Marshes, Inland and Coastal Banks:

Required Setback from Septic Tank - 25 Feet

Required Setback from SAS - 50 Feet

All the terms in this series of setback requirements are referenced in Title 5 as being defined in the wetlands regulations. But, just to review their reference in Title 5

TITLE 5 310 CMR 15.002 Definitions

Bordering Vegetated Wetland - shall mean any land or surface area so defined by the Massachusetts Wetlands Protection Act, M.G.L. c. 131, Section 40 and 310 CMR 10.55(2)

Salt Marshes - A coastal wetland as defined in the Massachusetts Wetlands Protection Act, M.G.L. c. 131, Section 40 and the regulations promulgated pursuant thereto at 310 CMR 10.32(2).

Bank (Coastal) - The seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland as defined by M.G.L. c. 131, Section 40 and 310 CMR 10.30(2).

Bank (Inland) - A portion of land surface which normally abuts and confines a water body as defined in M.G.L. c. 131, Section 40 and 310 CMR 10.54(2).

Now, to their references in the Wetland Regulations 310 CMR 10.00. They are presented below **(with emphasis added)**:

310CMR 10.55(2)

Bordering Vegetated Wetland
(2) Definition, Critical Characteristics and Boundary. (a) Bordering Vegetated Wetlands are freshwater wetlands which border on creeks, rivers, streams, ponds and lakes. The types of freshwater wetlands are wet meadows, marshes, swamps and bogs. **Bordering**

Vegetated Wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants. The ground and surface water regime and the vegetational community which occur in each type of freshwater wetland are specified in M.G.L. c. 131, 40. (b) The physical characteristics of Bordering Vegetated Wetlands, as described in 310 CMR 10.55(2)(a), are critical to the protection of the interests specified in 310 CMR 10.55(1). (c) **The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.** Wetland indicator plants shall include but not necessarily be limited to those plant species identified in the Act. Wetland indicator plants are also those classified in the indicator categories of Facultative, Facultative+, Facultative Wetland-, Facultative Wetland, Facultative Wetland+, or Obligate Wetland in the National List of Plant Species That Occur in Wetlands: Massachusetts (Fish & Wildlife Service, U.S. Department of the Interior, 1988) or plants exhibiting physiological or morphological adaptations to life in saturated or inundated conditions. 1. Areas containing a predominance of wetland indicator plants are presumed to indicate the presence of saturated or inundated conditions. Therefore, the boundary as determined by 50% or more wetland indicator plants shall be presumed accurate when: a. all dominant species have an indicator status of obligate, facultative wetland+, facultative wetland, or facultative wetland- and the slope is distinct or abrupt between the upland plant community and the wetland plant community; b. the area where the work will occur is clearly limited to the buffer zone; or c. the issuing authority determines that sole reliance on wetland indicator plants will yield an accurate delineation. 2. When the boundary is not presumed accurate as described in 310 CMR 10.55(2)(c)1.a. through c. or to overcome the presumption, credible evidence shall be submitted by a competent source demonstrating that the boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist. **The issuing authority must evaluate vegetation and indicators of saturated or inundated conditions if submitted by a credible source, or may require credible evidence of saturated or inundated conditions when determining the boundary.** Indicators of saturated or inundated conditions sufficient to support wetland indicator plants shall include one or more of the following: a. groundwater, including the capillary fringe, within a major portion of the root zone; b. observation of prolonged or frequent flowing or standing surface water; c. characteristics of hydric soils. 3. Where an area has been disturbed (e.g. by cutting, filling, or cultivation), the boundary is the line within which there are indicators of saturated or inundated conditions sufficient to support a predominance of wetland indicator plants, a predominance of wetland indicator plants, or credible evidence from a competent source that the area supported or would support under undisturbed conditions a predominance of wetland indicator plants prior to the disturbance.

310 CMR 10.32(2)

Salt Marsh means a coastal wetland that extends landward up to the highest high tide line, that is, the highest spring tide of the year, and is characterized by plants that are well adapted to or prefer living in, saline soils. Dominant plants within salt marshes are salt meadow cord grass (Spartina patens) and/or salt marsh cord grass (Spartina alterniflora).

A salt marsh may contain tidal creeks, ditches and pools.

Spring Tide means the tide of the greatest amplitude during the approximately 14-day tidal cycle. It occurs at or near the time when the gravitational forces of the sun and the moon are in phase (new and full moons).

310 CMR 10.30(2)

(2) Definition. ***Coastal Bank*** means the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland.
WHEN A COASTAL BANK IS DETERMINED TO BE SIGNIFICANT TO STORM DAMAGE PREVENTION OR FLOOD CONTROL BECAUSE IT SUPPLIES SEDIMENT TO COASTAL BEACHES, COASTAL DUNES OR BARRIER BEACHES, 310 CMR 10.30(3) through (5) SHALL APPLY:

310 CMR 10.54(2)

(2) Definition, Critical Characteristics and Boundary. (a) A **Bank** is the portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent flood plain, or, in the absence of these, it occurs between a water body and an upland. A Bank may be partially or totally vegetated, or it may be comprised of exposed soil, gravel or stone. (b) The physical characteristics of a Bank, as well as its location, as described in the foregoing 310 CMR 10.54(2)(a), are critical to the protection of the interests specified in 310 CMR 10.54(1). (c) The upper boundary of a Bank is the first observable break in the slope or the mean annual flood level, whichever is lower. The lower boundary of a Bank is the mean annual low flow level.

In this series of setback requirements, we again see an attempt to express common terms with the wetlands protection regulations and echo the understanding that wetlands surrounding our surface waters are the last line of defense for pollution reduction from adjacent septic systems. Although these particular setbacks appear to place Title 5 more squarely in the environmental protection mode (as opposed to the more obvious public health efficacy of setbacks from surface and drinking waters), the reader should understand that there is no clear line between these two roles. By protecting the integrity of the wetland, we ensure that groundwater discharge to the adjacent surface water, where the actual human exposure to effluent might take place, has received the final "polishing" treatment that a healthy natural system can afford. A well balanced and healthy ecosystem is generally antagonistic to organisms that are adapted as human pathogens. Wetlands also have a significant role in floodwater storage. By protecting the mechanisms of floodwater control, we prevent the disruption of septic systems during times of flood. Wetlands can also of assimilate certain levels of human waste and mediate their effect on the adjacent surface waters. Thus, Boards of Health should give careful consideration to requests for approval at the local level to vary from this requirement of the code. The issue of coastal and inland banks will be discussed a little bit later under discussions about velocity zones and regulatory floodways, but briefly, the setbacks from these landforms recognizes their overall importance in maintaining the physical integrity of areas at risk by storms and floods and their overall importance in being able to attenuate the effects of these events.

{PRIVATE}Side Note: At some point (perhaps at this point), the reader should familiarize themselves with the concept of "prioritizing" in the local upgrade approval process. Take, for instance a request for approval for relief from setback requirements of a bordering vegetated wetland discussed above. Review the list of local upgrade approval possibilities listed in Section 15.405 Contents of Local Upgrade Approval. (1)(a) through 1(i). 15.405 states that "the options set forth below (a-i) should be considered in the order in which they appear with 310CMR 15.405(1)(a) being the first option considered and rejected or adopted and 310 CMR 15.405(1)(i) being the last option to be considered and rejected or adopted." In short, for instance, the Board should move folks toward a property line setback variance before a setback from bordering vegetated wetlands variance. The Board of Health should perhaps spend some time discussing this concept with their agent at a Board meeting designed for discussion only.

Certified Vernal Pools:

Required Setback from Septic Tank - 50 Feet

Required Setback from SAS - 100 Feet[6]

Remember the definition of Certified Vernal Pools? A ***certified vernal pool*** is defined in Title 5 as " A surface water body that has been certified by the Massachusetts Division of Fisheries and Wildlife as a vernal pool in accordance with the "Vernal Pool Certification Guidelines" pursuant to the Massachusetts Natural Heritage and Endangered Species Program administered by the Massachusetts Department of Fisheries and Wildlife and Environmental Law Enforcement at the time a permit application is submitted to the approving authority.

Now that we know who certifies vernal pools, what are they and why should we protect them? Vernal pools, as their name implies (from the Latin *vernalis* or *vernus* - belonging to spring), are pools of water that occur in the spring and persist for various time periods. These pools serve a very important ecological function for the reproduction of certain amphibians and invertebrates. In this area, the spotted salamander is often mentioned as using vernal pools to lay their eggs. The primary concern of Title 5 is apparently to ensure that effluent from a septic system does not hydraulically connect with the vernal pool without the treatment and/or dilution afforded by at least 100 ft of horizontal passage through soil. This contention is based on the qualifying statement in Title 5(Section 15.211 (1)[2]) which states "The required setback shall be 50 feet where the applicant has provided hydrogeologic data acceptable to the approving authority demonstrating that the location of the soil absorption system is hydraulically downgradient of the vernal pool. Surface topography alone is not determinative". The reader should understand that any surface expression of water that is hydraulically connected with the same water table that receives sewage effluent, may represent a possible location for human exposure. While not too many people wade, swim or drink from vernal pools, there are albeit more remote possibilities that household pets and children (who hasn't had one or two frog or salamander "hunters" in their household ?) are exposed to the water of a vernal pool. The closer hydraulic connection of septic systems and vernal pools can also, in some instances, disturb the natural ecology of that system by increasing nutrients and artificially extending its seasonal appearance.

In short, although septic systems located near vernal pools appears more of an environmental and ecological issue, there are some clear public health concerns that should be weighed when an applicant requests a variance from the provisions of Title 5. Only in the presence of credible hydrogeologic data should the Board of Health consider varying these requirements.

{PRIVATE}Please Note

These next four resource areas reference surface drinking water supplies !

Surface Water Supply - (Reservoirs and Impoundments):

Required Setback from Septic Tank - 400 Feet

Required Setback from SAS - 400 Feet

Tributaries to Surface Water Supply:

Required Setback from Septic Tank - 200 Feet

Required Setback from SAS - 200 Feet

Wetland Bordering Surface Water Supply or Tributary thereto:

Required Setback from Septic Tank - 100 Feet

Required Setback from SAS - 100 Feet

Open, Surface or Subsurface Drains which discharge to Surface Water Supplies or tributaries thereto:

Required Setback from Septic Tank - 50 Feet

Required Setback from SAS - 100 Feet

The protection of drinking water supplies is the highest priority item in the enforcement of Title 5. The reasons for this are obvious. The fastest, most direct route for disease transmission is the connection of wastewater with drinking water. This part of the code recognizes the particular vulnerability of surface drinking water supplies to contamination. Although in Barnstable County there is only one surface water supply (Falmouth's Long Pond), surface water supply is a more common scenario state and region-wide.

The diminishing setback distance requirements from the actual surface water supply to near a tributary of the surface water supply to near a wetland that abuts a surface water supply or its tributaries to open, surface or subsurface drains which discharge to Surface Water Supplies (or tributaries thereto) reflects the diminishing risk as one sites a septic system further from the actual surface water supply itself. Obviously, an open surface water supply is the most susceptible to contamination both from the subsurface environment, as well as the surface runoff. The lesser requirements for siting of septic systems near tributaries and bordering wetlands presumes some level of protection either through treatment, dilution effects, or the effects of longer travel times from the points of possible pathogen inputs and the receiving water supply. This longer residence time in the environment reduces many bacterial and viral pathogens.

In each case where a Board of Health is asked to vary the setback requirements to a surface drinking water supply or its tributaries or adjacent wetlands, it should insist on mechanisms or treatment means to compensate for the amount varied. These mechanisms should have proven efficacy in removing the threat of pathogen transmission.

Private Water Supply Well or Suction Line:

Required Setback from Septic Tank - 50 Feet

Required Setback from SAS - 100 Feet

Again returning to concerns of direct sewage-drinking water connection, this setback requirement in the primarily code reflects the public health concern. It is self explanatory. Although approvals can be obtained locally to vary this requirement down to 50 feet from SAS to well [7] again the Board should do so only after exhausting all other "lesser" variance possibilities (see Side-bar Note under Bordering Vegetated Wetlands). These would include property line, cellar wall and wetland setbacks. In addition, a 25 % reduction in leachfield size is also preferable to relief from drinking water well setback requirements.

Public Supply Well

Required Setback from Septic Tank - (2)

Required Setback from SAS - (2)

> **(2) No system shall be constructed within a Zone I of a public supply well or wellfield. No system shall be upgraded or expanded within a Zone I of a public water supply well or wellfield unless a variance is granted pursuant to 310 CMR 15.410 through 15.415.**

Since septic systems can not be located in Zone I's of public supply wells, let's first review the definition of Zone I.

310 CMR 15.002: Definitions
Zone I - The protective radius required around a public water supply well or wellfield, as defined in Massachusetts drinking water regulations, 310 CMR 22.02. For public water supply system wells with approved yields of 100,000 gpd or greater, the protective radius is 400 ft. Tubular well fields require a 250 (presumably ft.) protective radius. Protective radii for all other public water system wells are determined by the following equation: Zone I radius in feet = [150 x log of pumping rate in gpd] - 350 [8].

Also for comparison

Zone II - That area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can realistically be anticipated, as defined in Massachusetts drinking water regulations, 310 CMR 22.02.

Again, it is quite clear that the code places the highest priority in the protection of public supply wells. Remember, public supply wells aren't just the large, high volume wells that a town or municipality operates. Public Supply Wells include a variety of classes of wells including those serving the public at restaurants, motels and hotels, schools, rest stops, various cottage colonies and condominiums. These "non-community" public supply wells are defined in the state drinking water regulations 310 CMR 22.00. Even these very small volume wells have a protective radius, or Zone I, of 100 ft. around the well, within which no portion of the septic system may be located. Boards of Health should not consider variances to this requirement without consulting with DEP, Division of Water Supply, since the variance may put the well owner out of compliance with state drinking water regulations.

Although the major restrictions here relative to setbacks reference the Zone I's, remember that there are nitrogen loading regulations which must be met in the Zone II areas of public supply wells (See 310 CMR 15.214: Nitrogen Loading Limitations and 310 CMR 15.215: Designation of Nitrogen Sensitive Areas).

Irrigation Well:

Required Setback from Septic Tank - 10 Feet

Required Setback from SAS - 25 Feet

Irrigation wells pose a unique problem in relation to setback requirements. On the one hand, since by definition, these wells are not used for direct human consumption, they have lesser setback requirements compared to a drinking water supply well. On the other hand, irrigation wells are often used to water crops that are consumed by people. This initiates some concern that irrigation wells serve as a conduit from pathogen-containing wastewater and a consumable product or crop. In reality, the exposure of water in an irrigation environment does reduce some of the public health risk from pathogens. This is due to both the exposure of the water to disinfecting ultraviolet light, and the general instability of most viruses in the environment outside their hosts. Still, in considering the placement of irrigation wells near septic systems, or vise versa, care should be taken that the irrigation wells are properly marked and noted that water from them is not for consumption.

Other Open, Surface or Subsurface Drains (excluding foundation drains) which intercept seasonal high groundwater table [3]:

Required Setback from Septic Tank - 25 Feet

Required Setback from SAS - 50 Feet

> **Section 15.211(1)[3] Surface or subsurface drains which regularly or periodically intercept the seasonal high groundwater table and carry that groundwater away from an area must meet the specified setbacks.**

Other Open, Surface or Subsurface Drains (excluding foundation drains):

Required Setback from Septic Tank - 5 Feet

Required Setback from SAS - 10 Feet

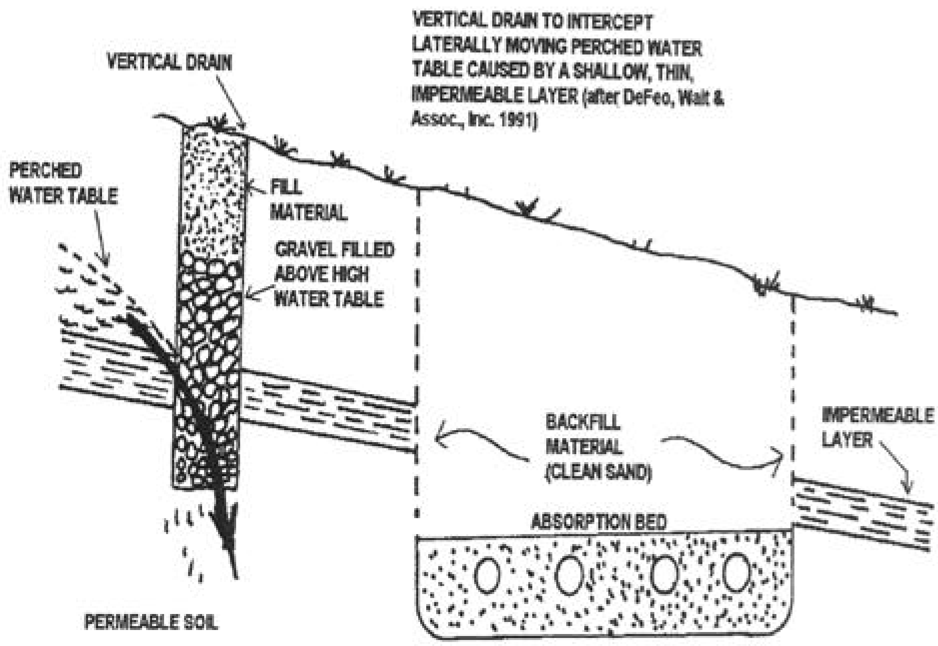
Surface and Subsurface Drains - General

These two setback requirements concern open, surface or subsurface drains. Although rarely seen in Barnstable County, drains of this type are more common elsewhere. Their purpose is to shunt or convey groundwater away from a site. As you might guess, the design and installation of these drains, which are variously called curtain drains, perimeter drains, French drains or collector drains requires a detailed knowledge of the drainage and hydrogeological characteristics of the site and surrounding area. You were first introduced to the concept on page 31 of Module 2 and two types of such drains are illustrated below.

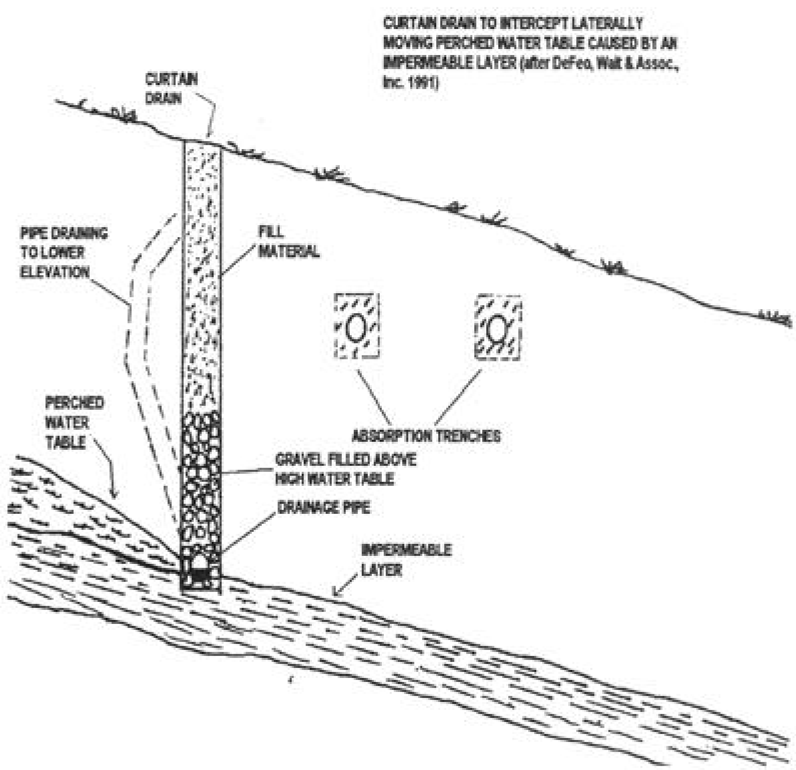
These two sets of setbacks differentiate between the more "minor" case where a drain is constructed to divert a limited perched water table to the underlying groundwater table, and the more "major" case where the drain is relied upon to more consistently drain a seasonally high groundwater table. In general, seasonally high groundwater is a quite different phenomena than a limited perched water table, and proper drain design requires a higher degree of understanding of the hydrological characteristics of an area. As its name implies, seasonally high groundwater occurs in the wetter seasons of the year, when the groundwater is at its highest level. Most often, seasonally high ground water occurs in areas of poorly draining soils. To address the issue of seasonally high ground water for various purposes, drains may be constructed around a site to intercept the groundwater and convey it away from an area for various purposes. It is not recommended for accommodating septic system placement. Nationwide, there are significant restrictions on their use to overcome septic system siting limitations and in many places they are not allowed. The given setback requirements for drains "regularly or periodically" intercepting seasonal high groundwater table, although seemingly rather restrictive, recognize the potential for the contamination of groundwater which occasionally breaks out at the surface or is conveyed in surface channels. The restrictions also recognize the hydraulic problems that can occur when septic systems are located too close to a "dumping spot" for the seasonally high groundwater being drained away. In general, it is not recommended that drains of this type be used for lowering the water table to meet the vertical separation requirement. The reason for this is that if they do not function properly, the vertical separation is violated and treatment for pathogens may be significantly reduced.

The more "minor" case, where a limited perched water table is diverted from near a septic system is more common in Barnstable County and elsewhere. To compensate for possible problems that can occur if they do not function, Boards of Health generally insist that the perched water table elevation be used as the groundwater elevation for design purposes. That is, the bottom of the SAS must be 4 or 5 feet [9] above the perched water table.

By the way, foundation drains are simply drains installed to prevent water from entering a basement. The exclusion of foundation drains in each of the setbacks recognizes the fact that in many places foundation drains are installed as a precautionary measure to prevent wet basements and do not usually represent a problem. In addition, setbacks from foundation drains are covered somewhat by the required setbacks from the foundations themselves.



Vertical Drain



Curtain Drain

Leaching Catch Basins & Dry Wells:

Required Setback from Septic Tank - 10 Feet

Required Setback from SAS - 25 Feet

A very common answer to surface runoff problems in Barnstable County is the catch basin or drywell. These are basically open-jointed structures used for conveying surface runoff from impervious surfaces such as rooftops, roadways and parking lots, to the subsurface. Many times, when used in roadways, catch basins are interconnected with pipes that convey the overflow into surface waters or sometimes low-lying areas. The required setbacks recognize that, on occasion, during high precipitation events, leaching components of septic systems and the leaching catch basin or drywell may become hydraulically connected. This occurs when the drainage capacity beneath each of the two leaching components is exceeded (inducing saturated flows) and some lateral movement in the zone which is usually unsaturated, occurs. If the catch basin or drywell overflows at this point, there is potential for human exposure. This can occur directly, or the overflow can be conveyed by surface routes to various sensitive receptor sites, such as shellfish areas, beaches, wells, etc. To compensate for this, in areas where it is not possible to achieve separation, impervious barriers may be installed on the walls of the septic system excavation to an elevation below the bottom of the leaching catch basin or dry well. This can also be addressed, if necessary by discontinuing use of the dry well or catch basin.

Downhill Slope:

Required Setback from Septic Tank - not applicable

Required Setback from SAS - 15 Feet[4]

> **Section 15.211:(1)[4] The setback distance shall be measured from a naturally-occurring downhill slope which is not steeper than 3:1 (horizontal:vertical). A minimum 15 foot horizontal separation distance shall be provided between the top of the peastone in the soil absorption system and the adjacent downhill slope. For a system located in an area with any adjacent naturally occurring downhill slope steeper, slope stabilization shall be provided in accordance with best engineering practice which may include construction of a concrete retaining wall constructed in accordance with 310 CMR 15.255(2)**

What does all that mean? Essentially, if you look at the plan, note the elevation on the peastone and measure out 15 feet. Within that distance you should not see the elevation of the land surface drop beneath the elevation of the top of the peastone. The reason for this requirement is to conservatively protect against sewage breakout onto the ground surface downslope of a SAS. In those situations where the "slope-breakout", as it is commonly called, can not be met, impervious walls may be constructed in accordance with 310 CMR 15.255(2) which states:

> <u>Section 15.255: Construction in Fill</u>
>
> (a) The retaining wall shall be constructed of reinforced concrete, shall have no weep holes, and shall be waterproof.
> (b) The retaining wall shall be designed by a Registered Professional Engineer, who shall certify the above condition is met by the submitted design.

(c) The upgradient side of the retaining wall shall be waterproofed.
(d) Construction of the retaining wall shall be supervised by the design engineer.
(e) An as-built plan shall be prepared and certified by the design engineer that the wall has been constructed in accordance with his approved design plan.
(f) The elevation of the top of the retaining wall shall be no lower than the "breakout" elevation, which is the elevation of the top of the two inch layer of 1/8 inch to 1/2 inch washed stone aggregate cover.
(g) The distance from the wall to the edge of the leaching area should be at least ten feet.

Following these criteria is considered to adequately compensate for the slope requirement where it can not be met.

"__it Happens "Forrest Gump

Velocity Zones and Floodways

Section 15.213: Construction in Velocity Zones and Floodways

(1) No septic tank or humus/composting toilet shall be constructed in a velocity zone on a coastal beach, barrier beach, or dune, or in a regulatory floodway, except a tank that replaces a tank in existence on the site as of March 31, 1995 that has been damaged, removed, or destroyed, where placement of the tank outside the velocity zone or regulatory floodway, either horizontally or vertically, is not feasible. Where reconstruction of a system in existence on March 31, 1995 occurs or reconstruction of a building or buildings is allowed in accordance with the wetlands protection act and 310 CMR 10.00, it shall be presumed to be feasible to elevate the tank if the building is elevated above the velocity zone or regulatory floodway.

(2) No soil absorption system shall be constructed in a velocity zone on a coastal beach, barrier beach, or dune, or in a regulatory floodway, unless
(a) the system is to serve a building or buildings that were in existence on March 31, 1995 or reconstruction of such building or buildings were allowed in accordance with the wetlands protection act and 310 CMR 10.00;
(b) there is no increase in design flow from such building or buildings;
(c) no connection to a public sewer or shared system is available;
(d) the owner or applicant can not site the system elsewhere;
(e) the septic tank or humus/composting toilet is sited outside the velocity zone or regulatory floodway, either horizontally or vertically;
(f) the system achieves required separation from high groundwater elevation required by 310 CMR 15.212; and
(g) any portion of the soil absorption system that is within the velocity zone or regulatory floodway is a leaching bed or trench system or any other system constructed in accordance with the wetlands protection act and 310 CMR 10.00.

Section 15.002: Definitions

Velocity Zone or V-zones - A coastal area of special flood hazard which extends from the mean low water line to the inland limit of the 100-year floodplain supporting waves greater than 3 feet in height. The boundary of a velocity zone shall be determined by reference to the National Flood Insurance Program flood data and Flood Insurance Rate Maps for each community.

Regulatory Floodway - The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height (typically one foot), the boundary of which is the area designated as floodway on the most recently available flood profile data prepared for the community within which the site is located under the National Flood Emergency Program (NFIP, currently administered by the Federal Emergency Management Agency, successor to the U.S. Department of Housing and Urban Development). Within this area flooding characterized by a significant velocity of flow is likely to occur.

It seems that in recent years, no part of the country has escaped natural disasters that threaten life and property. In the coastal areas, hurricanes and storms have reshaped the coastline and, in some instances, forced a retreat of homes from prior-stable land. This part of the code recognizes the dynamic nature of the velocity zone and its function as a "buffer" of the destructive forces of moving water. We would also like to revisit the discussion here regarding the coastal bank, which is an integral part of the shoreline.

The foremost concern of a Board of Health in locating septic systems near the shoreline (or anywhere for that matter) is to prevent their location in areas that are subject to disruption. The obvious concern here is that the contents of the system should be kept from the possibility of spilling their content onto the surface or surface waters and present a public health hazard. Shorelines and floodways are dynamic areas that are periodically reshaped by moving water. The primary intent of the code in this regard then is to make sure that septic systems are located outside of these dynamic and changing areas to minimize the risk of system exposure to the surface.

A secondary concern of Title 5 in this regard is the protection of the integrity of those natural landforms which minimize the impact of storms and floods on property. This is where banks (both inland and coastal) play an important part. Beaches, dunes, barrier beaches and coastal banks are made up of unconsolidated sediment materials which change in form when subject to wave action. Doing so, they dissipate some of the energy of moving water and reduce its more destructive actions. Banks, which are more elevated landforms, as mentioned, also contain the energy of the moving water both when located within or outside the velocity zone. Setbacks in Title 5 from coastal and inland banks, and the prohibition of systems in velocity zones recognizes that construction in these areas risks disturbing and/or altering their ability to function as they should. In the case of banks, construction activities associated with installation and maintenance of Title 5 systems may disrupt the plant communities or modify the grade or physical character of the bank. Changing these features may destabilize to some extent the physical structure of the bank by changing surface flow patterns (during runoff events), causing different erosion patterns and destruction of the bank. We hypothesize that the reason for the difference in setback distance requirements between septic tanks and leaching facilities and coastal and inland banks (25 ft and 50 ft respectively) is due to the more extensive excavation (and hence more possibility of altering its function) required to install the latter.

In the case of velocity zones, the primary feature that allows them to function as attenuators of destructive forces of moving water is their unconsolidated nature. Unconsolidated sediments such as sand "give way" when acted upon by moving water, but in doing so dissipate the water's energy. The allowance of hard structures in these unconsolidated sediments can cause significant reduction in their function. When hard structures, such as septic tanks are placed in the floodways and velocity zones, they change the natural flow and energy dissipation and may cause scouring and erosion down current from the structure that otherwise would not take place. Section 15.213 (g)[10], which specifies that the SAS must be a trench or leaching bed system bears note. Since the intent of the code here is to maintain the unconsolidated nature of the velocity zone or floodway, "hard" leaching structure such as flow diffusors or galleries in trench or bed configuration should not be allowed. The trench and bed configurations referenced in the regulation are intended to reference stone aggregate and pipe type trenches and beds.

So, How do we know where V-Zones and Regulatory Floodways are? FIRM up !

FIRM refers to the Flood Insurance Rate Maps produced by the National Flood Insurance Program of the Federal Emergency Management Agency (FEMA). Some people refer to them as the FEMA maps. They are a series of maps which you likely have many copies of in your town or city hall. The purpose of the maps are to determine the hazard rating of different areas. It might be worth it to pick up a copy of a map as you go though this exercise. On Barnstable County maps you will note different zone designations (to my knowledge no areas in Barnstable County have regulatory floodways, but these may be present in other flood area maps). For additional information, the reader is referred to the "Handbook for Local Officials for Projects in the Floodplain" available from the Massachusetts Executive Office of Environmental Affairs, Division of Resource Conservation, 100 Cambridge Street, Room 1304, Boston 02202 (Phone 617-7272-3267). There are basically two designations that you should become familiar with. Foremost, the V-Zone or Velocity Zone is that area that during a 100-year flood would be expected to receive wave heights of 3 ft or greater. You will note on the map a designation like below:

ZONE
V4
(EL 14)

The "V" simply refers to velocity. The number immediately following the "V", in this case "4" refers to a risk rating set for insurance rate determination, and the "(EL 14)" indicates that the velocity zone is at elevation 14 ft. using National Geodetic Vertical Datum (NGVD). Note here that the velocity zone is tied to a vertical datum. There are essentially two zones or areas of flooding that the Board of Health should know about. The first zone is referred to as the "A" zone. This is an area that is flooded by a 100-year storm (or the magnitude of a storm that is the greatest to be expected every 100-years). During some storms, these areas would be flooded by still waters. That is, these areas would likely not be subjected to wave heights that are considered destructive. Do not confuse A Zones with regulatory floodways, they are not the same. The second zone of interest is the Velocity or "V" Zone. This refers to areas where the wave height during the 100 year storm might be expected to exceed 3 feet in height.

As you might guess, the highest risk for the disruption of a septic system is in the velocity zone. While the code makes certain allowances for those buildings in existence prior to the revisions to the Title 5, it is clear that every attempt should be made to locate hard structures outside the velocity zone. A detail that bears particular attention is the fact that the velocity zone bears a vertical reference elevation. For instance, if a house is located in the velocity zone, and the vertical datum states that the velocity zone is elevation 14, then raising the building vertically above elevation 14, without relocating it horizontally moves it out of the velocity zone. Similarly, septic tanks and composting toilets can be raised vertically out of the velocity zone.

Perhaps no place else in Title 5 is it more important for the Board of Health and the Conservation Commission to be "on the same page". In each instance where the Board of Health is reviewing a request from an applicant, they should carefully make sure that all the conditions set forth in Section 15.213 (2) (a-g) are met. We would strongly suggest that, at some point, the Board of Health meet with the Conservation Commission to clearly outline and define each boards' standards of review on project in the velocity zone (and wetlands for that matter) so that there will be no misunderstandings when the next destructive event occurs and applicants are hastening to repair their property. It serves the public best when there is a consistent and predicable level of review. .

Had Enough For Now?

Well, what he have hoped to accomplish in this module is to instruct you regarding horizontal setbacks and provide the rationale for the various setback requirements so that you can make sound decisions in context of variance hearings. For many Boards of Health in Barnstable County, this occupies the lion's share of variance requests. The key point to remember in variance requests involving horizontal setbacks is that the primary goal is to prevent the direct transmission of disease. Accordingly there should be a hierarchy of importance for each of these setbacks. For instance, if an applicant comes before the Board of Health with a request to reduce the horizontal setback to a drinking water well, all attempts to avoid or minimize this variance at the cost of granting a property line or foundation variance should be made. Get the principle? Normally, the Health Agent will work with the designer to minimize the public health risks by prioritizing variances in this manner prior to the hearing. This can greatly assist a Board of Health, since the Health Agent is generally more aware of site conditions (remember he/she has witnessed the percolation and soil testing).

The next two modules will discuss more in detail the variance process. We will present, by use of examples, suggested ways to prioritize variance requests that are mixed requests for relief from horizontal setbacks, vertical setbacks, and various other requests.

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