

## Sun One Organic Farm Water Supply Data/Discussion

50 Maddox Road Bethlehem, CT 06751

Abstract: This document aims to put Sun One in a Permaculture perspective. This particular perspective is related to identifying all of the water elements present on the property. The goal of the document is to provide deep information into the water elements on the property and how they can be utilized to further goals of Permaculture design and conservation. There will be a discussion on the end with aim to provide appropriate parameters for Permaculture design on the property.

### Table of Contents:

- Existing Source of Supply
  - Soils
  - Springs
  - Wells
- Storage and Flow
  - Watersheds and Boundaries
  - Potential Pollution Sources
  - Flooding, Ponding, and Puddling Areas
- Possible Sources of Supply
- Relevant On-Site/Off-Site Piping
- Erosion: Existing and Potential Areas

## Existing Sources of Supply

### Soils

#### Types of Soils Found on the Property (Prime Farmland Soil or Farmland with Statewide importance) <sup>[1][2]</sup>:

1. Paxton and Montauk fine sandy loams 3-8% slopes (Prime Farmland Soil) [5.4 Acres] {84B} (Soils Class 2e) [11% Land Area]

#### Paxton-

- a. *Depth to restrictive feature:* 20 to 40 inches to densic material
- b. *Natural drainage class:* Well drained

- c. *Runoff class*: Medium
- d. *Capacity of the most limiting layer to transmit water (Ksat)*: Very low to moderately high (0.00 to 0.20 in/hr)
- e. *Depth to water table*: About 18 to 30 inches
- f. *Frequency of flooding*: None
- g. *Frequency of ponding*: None
- h. *Available water storage in profile*: Low (about 3.4 inches)
- i. *Hydrologic Soil Group*: C

#### Montauk-

- a. *Depth to restrictive feature*: 20 to 38 inches to densic material
- b. *Natural drainage class*: Well drained
- c. *Runoff class*: Low
- d. *Capacity of the most limiting layer to transmit water (Ksat)*: Very low to moderately high (0.00 to 0.20 in/hr)
- e. *Depth to water table*: About 24 to 30 inches
- f. *Frequency of flooding*: None
- g. *Frequency of ponding*: None
- h. *Available water storage in profile*: Low (about 3.3 inches)
- i. *Hydrologic Soil Group*: C

## 2. Paxton and Montauk fine sandy loams 8-15% slopes (Farmland with Statewide Importance) [17.3 Acres] {84C} (Soils Class 3e) [31% Land Area]

#### Paxton-

- a. *Depth to restrictive feature*: 20 to 40 inches to densic material
- b. *Natural drainage class*: Well drained
- c. *Runoff class*: Medium
- d. *Capacity of the most limiting layer to transmit water (Ksat)*: Very low to moderately high (0.00 to 0.20 in/hr)
- e. *Depth to water table*: About 18 to 30 inches
- f. *Frequency of flooding*: None
- g. *Frequency of ponding*: None
- h. *Available water storage in profile*: Low (about 3.4 inches)
- i. *Hydrologic Soil Group*: C

#### Montauk-

- a. *Depth to restrictive feature*: 20 to 38 inches to densic material
- b. *Natural drainage class*: Well drained
- c. *Runoff class*: Low
- d. *Capacity of the most limiting layer to transmit water (Ksat)*: Very low to moderately high (0.00 to 0.20 in/hr)
- e. *Depth to water table*: About 24 to 30 inches
- f. *Frequency of flooding*: None
- g. *Frequency of ponding*: None
- h. *Available water storage in profile*: Low (about 3.3 inches)
- i. *Hydrologic Soil Group*: C

3. Sutton fine sandy loam 0-3% slopes (Farmland with Statewide Importance) [1.9 Acres] {50A} (Soils Class 2w) [4% Land Area]
  - a. *Depth to restrictive feature:* More than 80 inches
  - b. *Natural drainage class:* Moderately well drained
  - c. *Runoff class:* Very low
  - d. *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 5.95 in/hr)
  - e. *Depth to water table:* About 18 to 30 inches
  - f. *Frequency of flooding:* None
  - g. *Frequency of ponding:* None
  - h. *Available water storage in profile:* Moderate (about 6.9 inches)
  - i. *Hydrologic Soil Group:* B
  
4. Woodbridge fine sandy loam 8-15% slopes (Farmland with Statewide Importance) [4.4 Acres] {45C} (Soils Class 7s) [7% Land Area]
  - a. *Depth to restrictive feature:* 20 to 40 inches to densic material
  - b. *Natural drainage class:* Moderately well drained
  - c. *Runoff class:* Medium
  - d. *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
  - e. *Depth to water table:* About 18 to 30 inches
  - f. *Frequency of flooding:* None
  - g. *Frequency of ponding:* None
  - h. *Available water storage in profile:* Low (about 3.9 inches)
  - i. *Hydrologic Soil Group:* C
  
5. Canton and Charlton fine sandy loam 3-8% slopes (Prime Farmland Soil) [1.3 Acres] {60B} (Soils Class 3e) [3% Land Area]

Canton-

  - a. *Depth to restrictive feature:* More than 80 inches
  - b. *Natural drainage class:* Well drained
  - c. *Runoff class:* Low
  - d. *Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
  - e. *Depth to water table:* More than 80 inches
  - f. *Frequency of flooding:* None
  - g. *Frequency of ponding:* None
  - h. *Available water storage in profile:* Low (about 5.6 inches)
  - i. *Hydrologic Soil Group:* B

Charlton-

  - a. *Depth to restrictive feature:* More than 80 inches
  - b. *Natural drainage class:* Well drained
  - c. *Runoff class:* Low
  - d. *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 5.95 in/hr)
  - e. *Depth to water table:* More than 80 inches

- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 5.9 inches)
- i. *Hydrologic Soil Group:* B

6. Occum fine sandy loam (Prime Farmland Soil) [1.0 Acres] { 101 } (Soils Class 1) [2% Land Area]

- a. *Depth to restrictive feature:* More than 80 inches
- b. *Natural drainage class:* Well drained
- c. *Runoff class:* Very low
- d. *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 5.95 in/hr)
- e. *Depth to water table:* About 60 to 72 inches
- f. *Frequency of flooding:* Occasional
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 5.4 inches)
- i. *Hydrologic Soil Group:* B

### **Types of Soils Found on the Property (Non-Prime Farmland Soil) <sup>[1]</sup>:**

1. Woodbridge fine sandy loam 2-15% slopes (Extremely Stony) [14.2 Acres] {47C} (Soils Class 7s) [27% Land Area]

- a. *Depth to restrictive feature:* 20 to 40 inches to densic material
- b. *Natural drainage class:* Moderately well drained
- c. *Runoff class:* Medium
- d. *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
- e. *Depth to water table:* About 18 to 30 inches
- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 3.9 inches)
- i. *Hydrologic Soil Group:* C

2. Canton and Charlton soils 15-25% slopes (Extremely Stony) [2.5 Acres] {62D} (Soils Class 7s) [5% Land Area]

Canton-

- a. *Depth to restrictive feature:* More than 80 inches
- b. *Natural drainage class:* Well drained
- c. *Runoff class:* Medium
- d. *Capacity of the most limiting layer to transmit water (Ksat):* High (1.98 to 5.95 in/hr)
- e. *Depth to water table:* More than 80 inches
- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 5.6 inches)
- i. *Hydrologic Soil Group:* B

## Charlton-

- a. *Depth to restrictive feature:* More than 80 inches
- b. *Natural drainage class:* Well drained
- c. *Runoff class:* Medium
- d. *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 5.95 in/hr)
- e. *Depth to water table:* More than 80 inches
- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 5.9 inches)
- i. *Hydrologic Soil Group:* B

3. Charlton-Chatfield Complex 3-15% slopes (Very Rocky) [1 Acre] {73C} (Soils Class 6s) [2% Land Area]

## Charlton-

- a. *Depth to restrictive feature:* More than 80 inches
- b. *Natural drainage class:* Well drained
- c. *Runoff class:* Low
- d. *Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.57 to 5.95 in/hr)
- e. *Depth to water table:* More than 80 inches
- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 5.9 inches)
- i. *Hydrologic Soil Group:* B

## Chatfield-

- a. *Depth to restrictive feature:* 20 to 40 inches to lithic bedrock
- b. *Natural drainage class:* Well drained
- c. *Runoff class:* Low
- d. *Capacity of the most limiting layer to transmit water (Ksat):* Low to high (0.01 to 5.95 in/hr)
- e. *Depth to water table:* More than 80 inches
- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 3.3 inches)
- i. *Hydrologic Soil Group:* B

4. Paxton and Montauk soils 15-25% slopes [4.3 Acres] {84D} (Soils Class 4e) [8% Land Area]

## Paxton-

- a. *Depth to restrictive feature:* 20 to 40 inches to densic material
- b. *Natural drainage class:* Well drained
- c. *Runoff class:* Medium
- d. *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

- e. *Depth to water table:* About 18 to 30 inches
- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 3.4 inches)
- i. *Hydrologic Soil Group:* C

#### Montauk-

- a. *Depth to restrictive feature:* 20 to 38 inches to densic material
- b. *Natural drainage class:* Well drained
- c. *Runoff class:* Low
- d. *Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)
- e. *Depth to water table:* About 24 to 30 inches
- f. *Frequency of flooding:* None
- g. *Frequency of ponding:* None
- h. *Available water storage in profile:* Low (about 3.3 inches)
- i. *Hydrologic Soil Group:* C

### Springs

There is one spring house that is in use. The location is pictured here. The quantity is low it recharges about 1 Gallon per minute.. Its dependability is variable depending on the season, but the dependability is typically low because the recharge rate is low. Its sustainability is good; springs recharge themselves without human intervention. It moves through the ground via pipes?

### Wells

There is one well that was installed on the property on Friday September 12, 2014. It is located to the south side of the workshop. It is 440ft deep and recharges at 6.5 gallons per minute.

### Storage & Flow

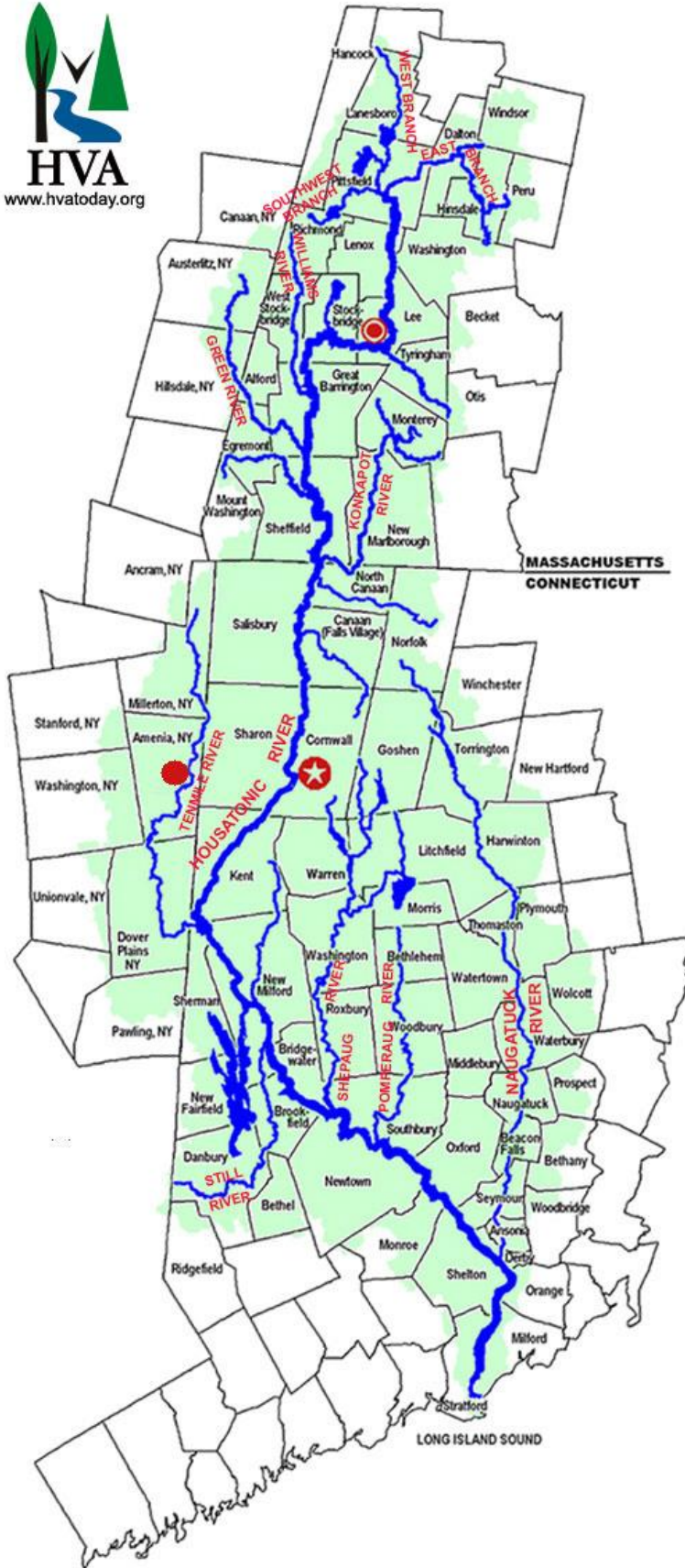
### Watershed Boundaries [3][4][5]

What is a watershed?

“It is that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settles, simple logic demanded that they become part of a community” –Wesley Powell, scientist geographer. [3]

“As a way of describing Connecticut’s water resources in terms of the landscape, CT DEP has divided the state along natural drainage divides into eight ‘major basins’ or watersheds. These, in turn, are divided into increasingly smaller watersheds which are described as ‘regional’, ‘subregional’ and ‘local’ drainage basins. At each level, these watersheds are named after the brook, river or water body into which all of the water within that topographically defined area ultimately flows. In other words, every water feature, no matter how small, has its own distinct watershed. Smaller watersheds make up larger watersheds which, in turn, make up ever larger watersheds.” (King’s Mark 14)

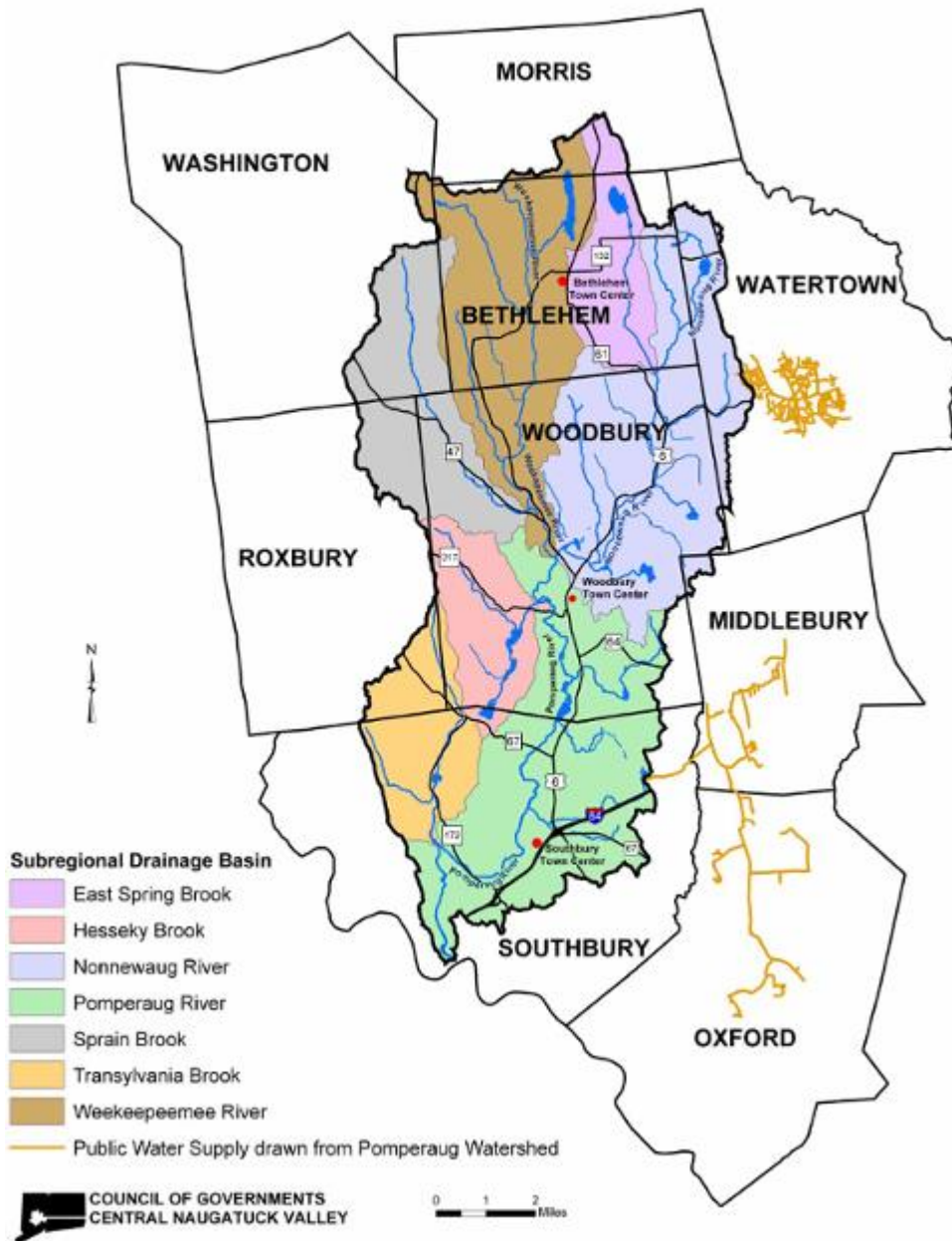
Major Watershed (Basin): Housatonic [4]





Regional Watershed (Basin): Pomperaug [5]

### Subregional Drainage Basins of the Pomperaug River Watershed



## Sub-Regional Watershed (Basin): East Spring Brook



## Roads

There is a main road (Maddox Road) that connects the property to Nonnewaug Road to the west. Maddox Road is paved up until where the second built house driveway and Maddox Road intersect. There is various slope that the road is paved over which changes the runoff potential of rainfall. The road square footage should be recorded so that total runoff can be estimated per year. The water running off of this pervious layer can be captured and utilized with various earthworks and connecting swales.

## Buildings

There are about 7 structures on the property that are fit for rain catchment. The red barn, the pole barn, the workshop, the three grain silos, and the spring shed. All structures besides the grain silos would be easy installations. The grain silos will take more work due to their shape and their height. The buildings' square footage shall be recorded and displayed on this document in order to estimate the amount of water that can be stored per year. The water running off of

these structures can be stored in catchment containers or earthworks. There is also the movable greenhouse which is an impervious surface that will be of higher difficulty to outfit with water catchment. Gutter points would have to be installed around ground level and the mobility of the greenhouse makes permanent diversion to earthworks unfeasible. Everything would have to be mobile.

### Compacted Dirt & Parking Lots

In the barn area there is highly compacted dirt and gravel that serves as a parking lot for the CSA members, delivery trucks, and worker cars. The water of course moves downhill and there is some washout and erosion on the path leading to the entrance to the pole barn (east facing) and the entrance to the workshop (north facing). The path is to the southwest of the red barn.

### Site Specific Watershed

Topography maps will indicate what kind of watershed is present at the site level. Water moves downhill and flows together at points perpendicular to contour.

### Concentration and Dispersion Areas

Water is concentrated in the areas that have been mentioned previously. Water is predominately concentrated in flow areas, wetlands, and perennial wet spots.

### Gutters & Downspouts

On Sun One Organic Farm there are no gutters or downspouts installed on any of the buildings. The runoff from the buildings falls onto the ground along the length of the roof with no specific course.

## Potential Pollution Sources

Road Runoff – There is a source of pollution via Maddox Road. Gasoline powered vehicles move across the road in small numbers but do so every day. When the rains come there is runoff of petrochemicals and other things from tires.

Chemical Runoff – There is a source of pollution from the neighbor to the east. The neighbor property is a conventional agriculture farm with animals. There is also some land mismanagement that has resulted in more water draining into Sun One property.

Road Fill – A number of years ago there was a lot of road fill put around the Red Barn. This was done before the farm was in organic vegetable production. The fill is from an old road and therefore possibly contains some pollution.

Tractors – Tractors are good for use on the farm but are also powered by petroleum, therefore leakage is always a possibility from either our tractors or those of our neighbors harvesting the hay.

### **Flooding, Ponding, and Puddling Areas**

There are areas on the property where the vegetation indicates that the ground is wetter throughout the season. Southwest of the current potato field (2014) there is an area where cattails and other wetland species are growing. This is the highest concentration of wetland plants that has been observed on the property save the floodplain areas. About 20-30' west of the grain silos there is a perpetual wet spot that may be a spring or drainage ways from previous farm activity. This spot could just as well be wet from unknown origin. East of the elbow of the access road there is a pipe that was installed by Rob. The pipe was installed because of the wetness present at this area. The pipe now transfers the water to the other side of the road. This causes more wetness to be present on the other side of the road and the lower side of the slope has seasonal wetness regardless of the pipe's presence. Also the pipe will be a source for water for the proposed pond on the property. Flooding may occur from this lower area and there is a map that shows possible 100 year flooding. Southwest of the springhouse is another spring at the edge of the field. Below is a picture via Google Earth showing these areas. There is also chance of flooding around the East Spring Brook; the soil in the area is floodplain soil.

### **Possible Sources of Supply**

#### **Springs**

There are multiple areas on the property where there are springs or suspected spring present. The spring house that is present Northeast on the property is the only structured spring house. The rest of the springs are still untouched and create wet spots on the property. These wet spots include an area above one of the pipes in the northern part of the property. A wet spot on the easterly part of the property is a possible spring site.

#### **Water Flow**

There are areas on the property where there is constant flowing water or places where water flows during certain times. The major waterway that goes through the property is East Spring Brook. There are two other waterways on the property, one that has a source up north in a swamp. The other has a source easterly most likely via spring or from the neighbors to the east. To the east is Hard Hill Road South, there is a lot of runoff from this road and it feeds the waterways on the east of the property. These three features are the only ones that flow regularly. There is a water flow from the cattail lagoon area that flows to the most southerly pipe and then eventually ends up in the East Spring Brook.

### **Relevant On-Site/Off-Site Piping**

- Culverts
  - On-Site – There are three culverts currently on the site.
  - Off-Site – Currently no data on proximal off site culverts. \*Mission\*
- Wells
  - On-Site – There is one well on-site.
  - Off-Site – There is one well nearby off-site, it is located at 49 Maddox Road.
- Water Lines – Non-existent in Bethlehem, CT.
- Sewage Lines – Non-existent in Bethlehem, CT.
- Septic Systems
  - On-Site – Currently no septic systems on the site property. However there is approval for a septic system in the future.
  - Off-Site - Two Septic systems existent at the two homes that exist on Maddox Road.
- Old Wells
  - On-Site - None
  - Off-Site – One at 49 Maddox Road.

### **Erosion**

#### Existing

There are three areas of existing erosion. One is the gully at the north part of the site. The function of it is to prevent contamination from surrounding areas, and to deal with excess storm water. Another area is in the barnyard directly east of the red barn. There is road fill there and it is slowly eroding into gulleys because of use and unconsolidated small materials moving with rainwater. The last known existing area is on the pathway to the more southern fields.

#### Potential

There is one potential area where erosion could occur. This area is on the slope directly southwest of the growing field southwest of the barnyard. The slope is steep and the cultivation of the field can result in soil that is subject to runoff.

[1] Henry, Thomas W. *Real Estate Appraisal*. Bethlehem, CT: T.W. Henry Real Estate Appraisals L.L.C., 2011. Print.

[2] Official Soil Descriptions

[3] <http://water.epa.gov/type/watersheds/whatis.cfm> - watershed definition.

[4] [http://www.pomperaug.org/pdf/Maps/PompWatershedMap\\_PublicWater.pdf](http://www.pomperaug.org/pdf/Maps/PompWatershedMap_PublicWater.pdf) - local watershed map

[5] <http://newenglandboating.com/wp-content/uploads/2011/04/Watershed-Map.jpg> (Housatonic Watershed Source).

[http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325628&deepNav\\_GID=1654%20](http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325628&deepNav_GID=1654%20) – CT major watersheds.

King's Mark. *Nonnewaug Falls Open Space and Agricultural Preservation Area*. Bethlehem, Woodbury, Watertown: King's Mark Resource Conservation and Development Area, 2001. Print.