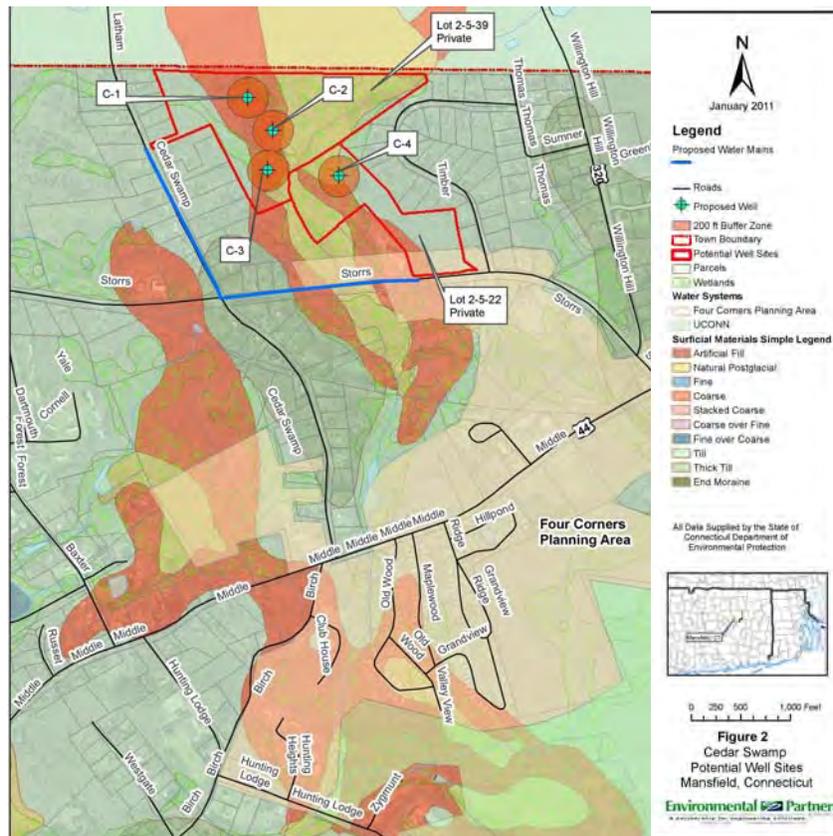


# Town of Mansfield, CT

## Draft Report

### Water Source Study for the Four Corners Area

#### January 6, 2011



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# TABLE OF CONTENTS

	<u>Page</u>
<b>LIST OF TABLES.....</b>	<b>3</b>
<b>LIST OF FIGURES.....</b>	<b>3</b>
1.0 INTRODUCTION .....	4
1.1 PURPOSE .....	4
1.2 SCOPE OF WORK.....	4
2.0 PROPOSED WATER SYSTEM DEMANDS .....	6
3.0 WATER SUPPLY ALTERNATIVES AND EVALUATION FACTORS .....	7
3.1 WATER SUPPLY ALTERNATIVES.....	7
3.2 EVALUATION FACTORS .....	8
3.2.1 WATER QUANTITY .....	8
3.2.2 WATER QUALITY .....	8
3.2.3 DEP DIVERSION PERMITTING .....	8
3.3.4 DPH REQUIREMENTS FOR NEW WELL .....	9
3.3.5 DPH REQUIREMENTS FOR SYSTEM CAPACITY AND REDUNDANCY .....	9
3.3.6 DPH INTERCONNECTION REQUIREMENTS .....	9
3.3.7 WATER STORAGE AND FIRE FLOW .....	10
3.3.8 CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY.....	10
3.3.9 PROPERTY PURCHASES.....	11
3.3.10 OTHER ENTITIES.....	11
3.3.11 COSTS .....	11
4.0 GROUNDWATER ALTERNATIVES.....	12
4.1 INTRODUCTION.....	12
4.2 INVESTIGATION APPROACH.....	12
4.3 CEDAR SWAMP.....	13
4.3.1 WATER SUPPLY POTENTIAL .....	13
4.3.2 POTENTIAL WELL SITES .....	13
4.3.3 INFRASTRUCTURE.....	14
4.3.4 OPERATIONS.....	15
4.3.5 ADVANTAGES AND DISADVANTAGES.....	15
4.4 WILLIMANTIC SITES NEAR MANSFIELD DEPOT .....	15
4.4.1 WATER SUPPLY POTENTIAL .....	15
4.4.2 POTENTIAL WELL SITES .....	16
4.4.3 INFRASTRUCTURE.....	17
4.4.4 OPERATIONS.....	18

4.4.5 ADVANTAGES AND DISADVANTAGES .....	18
4.5 WILLIMANTIC SITES NEAR EAGLEVILLE LAKE .....	18
4.5.1 WATER SUPPLY POTENTIAL .....	18
4.5.2 POTENTIAL WELL SITES .....	18
4.5.3 INFRASTRUCTURE.....	19
4.5.4 OPERATIONS.....	21
4.5.5 ADVANTAGES AND DISADVANTAGES.....	21
4.6 MANSFIELD HOLLOW .....	21
4.6.1 WATER SUPPLY POTENTIAL .....	21
4.6.2 POTENTIAL WELL SITES .....	22
4.6.3 INFRASTRUCTURE.....	23
4.6.4 OPERATIONS.....	23
4.6.5 ADVANTAGES AND DISADVANTAGES.....	24
4.7 OTHER TOWN-OWNED PROPERTIES .....	24
4.8 DIVERSION PERMITTING.....	25
5.0 INTERCONNECTION ALTERNATIVES .....	27
5.1 INTERCONNECTION WITH CONNECTICUT WATER COMPANY .....	27
5.1.1 DESCRIPTION.....	27
5.1.2 ADVANTAGES AND DISADVANTAGES.....	28
5.2 INTERCONNECTION WITH WINDHAM WATER WORKS .....	29
5.2.1 DESCRIPTION.....	29
5.2.2 ADVANTAGES AND DISADVANTAGES.....	30
6.0 COSTS.....	31
7.0 CONCLUSIONS AND RECOMMENDATIONS.....	32
REFERENCES .....	35

**LIST OF TABLES**

TABLE 1 ..... EVALUATION OF CEDAR SWAMP AREA FOR GROUNDWATER SUPPLY  
TABLE 2 ..... EVALUATION OF WILLIMANTIC RIVER - MANSFIELD DEPOT AREA FOR GROUNDWATER SUPPLY  
TABLE 3 ..... EVALUATION OF WILLIMANTIC RIVER-EAGLEVILLE LAKE AREA FOR GROUNDWATER SUPPLY  
TABLE 4 ..... EVALUATION OF MANSFIELD HOLLOW AREA FOR GROUNDWATER SUPPLY  
TABLE 5 ..... EVALUATION OF CONNECTICUT WATER COMPANY INTERCONNECTION  
TABLE 6 ..... EVALUATION OF WINDHAM WATER WORKS INTERCONNECTION  
TABLE 7 ..... OPINION OF PROBABLE COST FOR WATER SUPPLY ALTERNATIVES

**LIST OF FIGURES**

FIGURE 1 ..... WATER SUPPLY ALTERNATIVES  
FIGURE 2 ..... CEDAR SWAMP POTENTIAL WELL SITES  
FIGURE 3 ..... MANSFIELD DEPOT POTENTIAL WELL SITES  
FIGURE 4 ..... EAGLEVILLE LAKE POTENTIAL WELL SITES  
FIGURE 5A ..... MANSFIELD HOLLOW POTENTIAL WELL SITES  
FIGURE 5B ..... MANSFIELD HOLLOW POTENTIAL WELL SITES  
FIGURE 6 ..... PROPOSED CONNECTICUT WATER INTERCONNECTION  
FIGURE 7 ..... WINDHAM WATER WORKS PROPOSED INTERCONNECTION

## **1.0 INTRODUCTION**

### **1.1 PURPOSE**

The Town of Mansfield is seeking to develop a water source/system for its 500 acre Four Corners commercial and residential area in Northern Mansfield. The Town is considering the following sources of supply for the proposed new water system:

- Groundwater in the Cedar Swamp area adjacent the Four Corners area
- Groundwater along the Willimantic River downstream of the current UConn wellfield
- Groundwater in the area of Mansfield Hollow
- An interconnection with Connecticut Water Company (CT Water)
- An interconnection with Windham Water Works (WWW)

The purpose of this initial phase of the project is to identify the most advantageous alternative for supplying the Four Corners area. This involved performing a comprehensive evaluation of the water supply alternatives considering a variety of factors, including:

- Department of Environmental Protection permits
- Department of Public Health requirements, permits, and approvals
- Department of Public Utility Control approvals
- Local permitting agency approvals
- Water quantity
- Reliability and redundancy
- Capital Cost
- Operating Cost

### **1.2 SCOPE OF WORK**

The scope of work for this phase of the project is based on Environmental Partners' agreement with the Town of Mansfield dated November 10, 2010. A summary of the scope of work is outlined below:

- a. Confirm/refine domestic and fire flow system demand estimates.

- b. Perform an evaluation of the groundwater alternatives, considering parcel mapping, land ownership, groundwater classifications, surficial geology, wetlands, flood plain, pollution sources, endangered and threatened species, and estimated yield of new well. The evaluation will include a desktop evaluation and site reconnaissance.
- c. Correspond with officials from CT Water, Windham Water Works, and UConn to discuss the interconnection alternatives.
- d. Correspond with DEP, DPH, and local regulatory agencies to introduce the project and the water supply alternatives, as well as seek their initial feedback on the alternatives and their information needs.
- e. Evaluate each option, and summarize the evaluation of the alternatives, most likely in a matrix format. Circulate this study/report as a draft.
- f. Meet with the project review team to review/revise the preliminary evaluation phase report - assist in selecting a preferred water supply alternative for further study, analysis and permitting.

## **2.0 PROPOSED WATER SYSTEM DEMANDS**

The Four Corners planning area covers an area spanning 500 acres near the intersection of Routes 44 and 195. There are 60 properties in the planning area, with a mix of residential, commercial, and mixed-residential use. Prior estimates of water demand for these 60 properties indicates that the initial water demand will be approximately 59,000 gallons per day (gpd), increasing to 170,000 gpd over a 20-year planning horizon. As part of the final version of this report, we will confirm these demand estimates.

Along with the water demands in the Four Corners planning area, the Town has given consideration to the demand for water from other potential real estate developments in Town. It is prudent to identify these potential developments and their water demand so that the selection and development of a new source of water supply is adequate to cover the projected demands of these potential developments. As part of the aforementioned effort to confirm the Four Corners area water demands, we will work with the Town to estimate the water demand of these potential developments.

## **3.0 WATER SUPPLY ALTERNATIVES AND EVALUATION FACTORS**

### **3.1 WATER SUPPLY ALTERNATIVES**

Five alternatives for water supply were evaluated for the Four Corners Area. Each of these alternatives is shown in **Figure 1**, and described below.

- Groundwater Supply in Cedar Swamp Area – Located adjacent to the proposed Four Corners service area is the Cedar Swamp and Cedar Swamp Brook. A brief analysis performed by Charter Oak Consulting dated March 9, 2009 suggests that the Cedar Swamp area might be a suitable site for a new groundwater supply.
- Groundwater Supply near the Willimantic River - There are known to be significant depths of good aquifer material adjacent to the Willimantic River. One of UConn's two wellfields is located along the river. This report considers potential well sites downstream of the UConn wellfield.
- Groundwater Supply near Mansfield Hollow Reservoir – Mansfield Hollow Reservoir and the downstream Willimantic Reservoir (located in the southeastern corner of Mansfield) are an abundant source of water. Both DEP and DPH have suggested that the Town investigate this area of Town for a new water supply.
- Connecticut Water Interconnection – For many years, CT Water has proposed to install a water main to extend their water system to UConn to supplement UConn's water supply. The Town of Mansfield could then connect to the CT Water pipeline to provide water to the Four Corners Area.
- An interconnection with Windham Water Works (WWW) – WWW owns and operates a water treatment plant on the southern edge of the Willimantic Reservoir in the southeastern corner of Mansfield. The facility provides water to Windham and a small portion of southern Mansfield. The proposed alternative would include a pipeline

extension from WWW's water treatment plant to the UConn system, where water would then be "wheeled" to the Four Corners Area.

## **3.2 EVALUATION FACTORS**

Each of the water supply alternatives was evaluated based on the following factors:

### **3.2.1 Water Quantity**

Each alternative was assessed for its ability to provide the estimated amount of water required in the Four Corners Area.

### **3.2.2 Water Quality**

The alternatives were assessed in terms of the expected water quality. For the interconnection options, available information to make this assessment consisted of Consumer Confidence Reports. For groundwater options, field testing will be needed.

### **3.2.3 DEP Diversion Permitting**

A diversion permit is required for the withdrawal of groundwater from one or more wells joined in one system whose combined maximum withdrawal exceeds 50,000 gallons per day (gpd). A diversion permit is also required to transfer water from one water supply distribution system to another where the combined maximum withdrawal from any source supplying the system or interconnected systems exceeds 50,000 gpd.

For groundwater withdrawals, the ability to obtain a diversion permit is highly dependent on the comparison of the desired withdrawal rate and the 7Q10 flow (smallest values of mean discharge computed over any 7-consecutive days during the annual period) of impacted streams or rivers. The ability to obtain a diversion permit for a groundwater withdrawal is also dependent on the environmental impacts within the proposed well(s) zone of influence. In particular, the impact on wetland soils within the proposed well(s) zone of influence. In addition to the impact on wetland soils, other environmental issues of interest to DEP include endangered or threatened

species, impact on floodplains (along with a mitigation plan if the proposed project includes fill or structures in the floodplain), and stream channel encroachment issues.

### **3.3.4 DPH Requirements for New Well**

The Connecticut Department of Public Health (DPH) requirements for a new well include:

- The ground immediately surrounding the well must be located above the 100 year flood level.
- The well must be located at least 50 feet from the annual high water mark.
- For well's with yields greater than 50 gpm, the well must be located at least 200 feet from any sewage disposal system or other source of pollution, with the Town maintaining sanitary conditions by ownership or easement.

### **3.3.5 DPH Requirements for System Capacity and Redundancy**

The DPH will require estimates of the projected water demands, and will require that the production/purchase capacity provide at least a 15% Margin-of-Safety (i.e. 15% more supply than demand) over the average day, maximum month, and maximum day demands.

The DPH requires that water systems maintain the 15% Margin of Safety with the largest source of supply off-line; as such, for a groundwater supply, the DPH will require that the Town provide a fully equipped backup well or a backup interconnection.

### **3.3.6 DPH Interconnection Requirements**

For an interconnection with another water system, the Town will need to seek a Sale of Excess Water Permit from the DPH. This permit allows a public water system to sell water reserves in excess of those required to maintain an abundant supply of water (i.e. adequate Margin of Safety) to customers in its service area. The applicant must provide the department with sufficient information to verify that the water proposed for sale is in excess of that required to meet their system needs.

### **3.3.7 Water Storage and Fire Flow**

The Connecticut Department of Public Utility Control (DPUC) regulations indicate that small systems shall provide atmospheric storage tank capacity of at least 200 gallons per residential customer or equal to the average daily demand of the system, whichever is the greater number. If commercial or industrial customers are included, additional storage shall be provided based on reasonable average day estimated water usage.

For the options that include an interconnection to a neighboring water system, it is likely that the storage capacity of the neighboring system can satisfy this requirement. Water supply options that do not include an interconnection with a neighboring system would require the construction of a storage tank – either elevated storage (i.e. a standpipe or elevated tank) or ground storage with a booster pump station.

Fire flow requirements are typically based on the ISO's guidance. Assuming a minimum fire flow need of 1,000 gpm for 2 hours, the Town will have to provide 120,000 gallons of storage for fire flows. This storage should be in addition to the DPUC storage requirement discussed above. This fire flow storage can be provided in several ways. If a water supply alternative is selected that includes an interconnection with a neighboring water system (either for regular use or only emergency/fire use), the Town can rely on the storage capacity of the water system that is providing the water.

### **3.3.8 Certificate of Public Convenience and Necessity**

Unless the Four Corners area is considered an extension of another public water system (e.g. UConn's or CT Water's system), the system will be considered a new Community Public Water System. The Town will thus be required to obtain a Certificate of Public Convenience and Necessity (CPCN) from Department of Public Health (DPH) and the Department of Public Utility Control (DPUC). As part of this process the DPH and DPUC will determine if the proposed water system will have adequate Technical, Managerial, and Financial capacity to maintain compliance with regulations after the system is put into operation. The application process requires the applicant to provide information showing that there is no feasible interconnection alternative. DPH senior staff have expressed the desire, whenever feasible, for

proposed new and existing small systems to become part of larger established water systems to minimize the number of small water systems in the state.

### **3.3.9 Property Purchases**

Some of the groundwater alternatives will require purchase or lease of land from a private party. This will impact the cost and schedule for these alternatives.

### **3.3.10 Other Entities**

Some of the alternatives involve other entities, such as UConn, CT Water, Windham Water Works, and the Town of Tolland. Each entity has its own goals, needs, agenda, and schedule, which may or may not coincide with Mansfield's goals, needs, agenda, and schedule. In addition, the entities must agree upon cost sharing arrangements for both capital and operating costs. The more entities involved in an alternative, the more complex the alternative.

### **3.3.11 Costs**

Capital, operating, and maintenance cost should all be considered when evaluating supply alternatives. All capital costs should be considered, including the cost for any upgrades to enable other systems to supply water to the Four Corners area. All operating costs should be considering, including the cost for a contract operator to operate and maintain the system and the cost to purchase water from one of the neighboring systems.

## **4.0 GROUNDWATER ALTERNATIVES**

### **4.1 Introduction**

A preliminary investigation of potential public water supply well sites was conducted in the Town of Mansfield in order to identify potential water sources for the Four Corners Area. The investigation relied on available data and reports including studies conducted by the UConn, studies previously conducted for the Town of Mansfield, USGS maps and reports and data from the University of Connecticut's Map and Geographic Information Center (MAGIC). A list of references is included at the end of this report.

### **4.2 Investigation Approach**

The investigation into potential water supply well sites in Mansfield focused on four areas (refer to **Figure 1**):

- Cedar Swamp
- Willimantic River near Mansfield Depot
- Willimantic River near Eagleville Lake
- Mansfield Hollow

The first step in the evaluation was to use available geologic mapping to identify areas of potential sand and gravel aquifers. These areas were then overlaid with parcel maps for the Town of Mansfield. Parcels that were large enough to site a well with the required 200-foot radius within areas of sand and gravel were identified.

Each potential site that met the criteria was then examined for potential disqualifying attributes including presence of water quality hazards, lack of access, steep slopes, serious wetland concerns and incompatible land uses.

Once the sites were identified on the basis of mapping, field checks were conducted at each site to confirm the mapping and take note of any special conditions that were not apparent from the mapping.

Below is a discussion of the potential sites identified in each of the four primary areas of investigation. The potential of these sites is based solely on geologic mapping, field visits, and existing published data. Test well drilling would need to be conducted to establish the quantity and quality of available water resources.

### **4.3 Cedar Swamp**

#### **4.3.1 Water Supply Potential**

There is a relatively small aquifer adjacent to and beneath Cedar Swamp, near the northern border of Mansfield (see **Figure 2**). Most of the aquifer and swamp extends into Willington. The area of aquifer materials (sand and gravel) is shown in **Figure 2**. As far as we have been able to determine, there has been no subsurface drilling conducted anywhere in the aquifer so there is no data on aquifer thickness or the types of materials that might be present at depth.

We have concluded that the amount of water available in the Cedar Swamp area is significantly less than was previously estimated by Charter Oaks in their memorandum of March 9, 2010, and the potential for ecological impacts are significantly greater. Charter Oaks based their preliminary conclusions on a very rough water balance for the aquifer that does not take into account the limited capture zone of a potential well at this location or seasonal fluctuations in available water. Potential local wetland impacts would have to be evaluated closely in the course of the permitting process.

The flow of Cedar Swamp Brook would be decreased essentially by the amount of water pumped from the well. Based on information from USDA, the estimated low stream flow for Cedar Swamp Brook is 250 gpm. If a well were to be developed to meet the 20 year demand of 170,000 gallons per day (or 118 gpm), the well production would equate to approximately 47% of the low stream flow. Since this is a relatively high percentage of the low stream flow, it is likely that the Diversion Permitting process would be complex.

#### **4.3.2 Potential Well Sites**

There are only two lots within this potential aquifer area that are large enough to site a public water supply well - a minimum 200-foot radius is required for protective purposes. Those lots

and four potential well sites within them are shown in **Figure 2** along with the 200-foot radius for each potential site.

Three of the potential well sites are located on lot 2-5-39 (C-1, C-2 and C-3); the owner is identified in Town Assessor records as Diane Becker. There is access to the lot from Cedar Swamp Road; however, it will be necessary to cross an area mapped as wetland area to get to the sites. Three potential test well exploration sites have been identified. These sites are not within currently mapped wetland areas, but this assumption would need to be confirmed with more detailed mapping.

A fourth site (C-4) is located on lot 2-5-22. The owner is identified as the Taylor Family Trust. Access to the lot is from Storrs Road. One potential test well exploration site has been identified. This site is not within a currently mapped wetland area, but this would need to be confirmed with more detailed on-site mapping.

There is some potential for a water supply well in the portion of Cedar Swamp located south of Route 195. However, none of the properties in this area are sufficient to provide a 200-foot radius. A suitable wellhead protection area would be possible if two or more of the properties were combined. In addition, because of the smaller quantity of sand and gravel deposits in this area, the potential yield of a well here would be lower than at the sites described above.

### **4.3.3 Infrastructure**

If the Town were to proceed with developing a groundwater supply at Cedar Swamp, there are two key infrastructure issues to consider. First, the Town will need to provide a backup source of supply pursuant to Department of Public Health standards. This could be an interconnection with UConn or a fully equipped backup well. Second, the Town will need to provide water storage. If the Four Corners distribution system is interconnected with the UConn system, the UConn water storage tanks could serve as the water storage for the Four Corners Area. If there is no interconnection with the UConn system, the Town will have to provide elevated storage or ground level storage with a booster pump station.

It should be noted that the two potential well sites are located within the 100-year flood plain. The wellhead, land around the wellhead, and the wellhouse all have to be located above the 100-year flood level in accordance with DPH requirements.

#### **4.3.4 Operations**

With this alternative, the Town would be creating a new community water supply system. Thus, the Town would need to obtain a Certificate of Public Convenience and Necessity (CPCN) from the Department of Public Health (DPH) and the Department of Public Utility Control (DPUC). The Town plans to retain a contract operator to operate and maintain the system to ensure compliance with DPH, DEP, and DPUC standards and regulations.

#### **4.3.5 Advantages and Disadvantages**

The primary advantage of a groundwater supply at Cedar Swamp is its close proximity to the proposed Four Corners area, which will limit the amount of required pipeline and associated cost. Another critical advantage is that this alternative would involve only one other entity, UConn, if the Town opts to interconnect with the UConn system. This means that the Town has significant control over the project schedule.

The primary disadvantage of a groundwater supply at Cedar Swamp is the limited drainage area and yield, and the resulting potential environmental impacts of withdrawing water from this aquifer. These factors will make it difficult to obtain a diversion permit from DEP.

Additional advantages and disadvantages of this alternative are summarized in **Table 1**.

### **4.4 Willimantic Sites Near Mansfield Depot**

#### **4.4.1 Water Supply Potential**

There are known to be significant depths of good aquifer material adjacent to the Willimantic River; however, the extent of these deposits perpendicular to the river varies.

#### **4.4.2 Potential Well Sites**

In the Mansfield Depot Area, we have identified three lots within the potential aquifer area that are large enough to site a public water supply well with the minimum 200-foot radius and that have compatible land uses. Those lots and two potential well sites are shown in **Figure 3** along with the 200-foot radius for each well site.

One potential well site (MD-1) is located on lot 13-16-1. A test well was drilled on this site in 1963 (Milone & MacBroom, 2002). Good sandy material was reported to a depth of approximately 34 feet below ground. The water table was approximately five feet below ground. If the aquifer material is highly transmissive, this could provide sufficient water for a public water supply well. The owner of this lot is identified in Town records as Chester and Leon Heckler. There is access to the lot from Route 44. The proposed site is within mapped a wetland areas but it is also farmland. It is unlikely that this property would be considered a wetland from a regulatory standpoint. However, it will be necessary to resolve that issue. The use of agricultural chemicals and fertilizers on the property would need to be investigated and might impact water quality.

The second potential well site in this area (MD-2) is located on lot 13-16-11. The owner is identified as Timothy Quinn. Access to the lot would be from Depot Road. The property consists of a highland above the Willimantic River, a steep slope down to the river and then wetlands adjacent to the river. The highland areas are likely to have high depths to groundwater (as much as 40 feet); so site MD-2 was selected because it is near the toe of the slope but outside of the wetlands.

The third potential well site in this area (MD-3) is located on lot 13-16-12. One significant advantage of this parcel is that it is town-owned. A disadvantage of this parcel is that it is the site of a former wastewater discharge area. The site is currently a park (River Park). The lot appears to have favorable sand and gravel deposits, but there is some question about the water quality and other potential restrictions associated with the former use for wastewater discharge. It may be possible to find a location that would not be impacted by the former wastewater facility.

Note that there is also an abandoned landfill between UConn's Willimantic River wells and Mansfield Depot. The potential impact of this dump is presently unknown, but should be investigated if one of the Mansfield Depot potential well sites is pursued, particularly site MD-1.

#### **4.4.3 Infrastructure**

If the Town were to proceed with developing a groundwater supply in the Mansfield Depot Area, the critical infrastructure issue would be an agreement with UConn to interconnect with the UConn water system, and “wheel” water through the UConn water system to the Four Corners Area. The infrastructure required would include:

- a well
- a wellhouse to house chemical feed and storage systems, electrical equipment, and instrumentation and controls
- a transmission main to connect the well to the UConn system (see **Figure 3**)
- a transmission main to connect the UConn system to the proposed Four Corners water system (i.e. a transmission main on Hunting Lodge Road from UConn's 16-inch main to Route 44, and on Route 44 from Hunting Lodge Road to the proposed terminus of the Four Corners water system).

Note that the water from the proposed well would be pumped directly into UConn's 5.4 million gallon storage tank via the proposed new water main and then UConn's existing 16-inch water main that connects their Willimantic Wellfield to the UConn water system.

Under this arrangement with UConn, the proposed Four Corners water system would be considered an extension of the UConn system. The DPH and DPUC requirements for reliability, redundancy, and storage would be satisfied by the fact that the UConn system has multiple water supply sources and adequate water storage.

It should be noted that the potential well sites are located within the 100-year flood plain. The wellhead, land around the wellhead, and the wellhouse all have to be located above the 100-year flood level in accordance with DPH requirements.

#### **4.4.4 Operations**

With this alternative, the Town would own and operate the new well. The Town could retain a contract operations firm to operate the well, similar to what UConn has done by hiring the CT Water subsidiary to operate and maintain their wellfields. The Town could also choose to retain the same contract operations firm to operate and maintain the Four Corners distribution system, including flushing the system and repairing main breaks.

One issue to be discussed with UConn is the cost, if any, associated with “wheeling” water through the UConn system to the Four Corners area.

#### **4.4.5 Advantages and Disadvantages**

A primary advantage of a groundwater supply in the Mansfield Depot area is that the area has a significant depth of good aquifer material, and thus a good potential yield. The area is also relatively close to the UConn distribution system, which means that a relatively short length of pipeline would need to be installed to connect a new well to the UConn system.

A primary disadvantage of this alternative is that diversion permitting could be complex because of concerns that additional groundwater withdrawals near the Willimantic River, near the existing UConn wellfield, could impact streamflow and thus fisheries.

Additional advantages and disadvantages of this alternative are summarized in **Table 2**.

### **4.5 Willimantic Sites Near Eagleville Lake**

#### **4.5.1 Water Supply Potential**

There are known to be significant depths of good aquifer material adjacent to the Willimantic River; however, the extent of these deposits perpendicular to the river varies.

#### **4.5.2 Potential Well Sites**

There are several potential well sites along the Willimantic River near Eagleville Lake (see **Figure 4**). One primary advantage of locating a well along this stretch of the Willimantic River

is that the greater width of the river in this region reduces the potential impacts of groundwater withdrawals on fish habitat.

There are four lots within this potential aquifer area that are large enough to site a public water supply well with the minimum 200-foot radius. Those lots and five potential well sites are shown in **Figure 4** along with the 200-foot radius for each well site.

Two of the potential well sites are located on lot 14-26-7 (EP-1 and EP-2). The owner is identified in Town records as Karen Green. There is access to the lot from Stafford Road. The proposed site is currently farmed. The use of agricultural chemicals and fertilizers on the property would need to be investigated and might impact water quality. Of the two potential sites, EP-1 has the greatest potential because it is further from the till boundary and closer to the river. Potential impacts from the former wastewater disposal on the adjacent town-owned property would need to be investigated. The 200-foot radius for EP-2 is very close to the property boundary. It may be necessary to survey the site in order to ensure that the 200-foot radius is available.

A third site (EP-3) is located south of Eagleville Lake on lot 20-66-1. The owner is identified as Ethan Stearns. Access to the lot is from Stafford Road. It is adjacent to a gravel mining operation which is a potential source of contamination.

The fourth site in this area (EP-4) is also located south of Eagleville Lake on lot 29-54-18. This is property owned by the State of Connecticut, and is part of the Eagleville Preserve Trail. Access to the lot is from Stonehouse Road. Much of the property is mapped as wetlands.

The fifth site in this area (EP-5) is also located south of Eagleville Lake on lot 29-54-20. The primary advantage of this site is that it is town-owned open space. Access to the lot is from Stafford Road. This property also has a significant amount of mapped wetlands, but there is an upland area that is out of the wetlands.

### **4.5.3 Infrastructure**

If the Town were to proceed with developing a groundwater supply in the Eagleville Lake Area, the critical infrastructure issue would be an agreement with UConn to interconnect with the

UConn water system, and “wheel” water through the UConn water system to the Four Corners Area. The infrastructure required would include:

- a well
- a wellhouse to house chemical feed and storage systems, electrical equipment, and instrumentation and controls
- a transmission main to connect the well to the UConn system (see **Figure 4**). Note that Figure 4 shows a pipeline route on Route 32. The alternative is to install the water main on South Eagleville Road. UConn currently has water main on South Eagleville Road, extending about 5,000 feet west from the intersection with Route 195. However, this main is 6 inch diameter, and will not have adequate hydraulic capacity for the intended well production. Thus, if the South Eagleville Road route is selected, the interconnection point with the UConn system would have to be at the intersection of South Eagleville Road and Route 195. A pipeline along this route would be of similar length and cost to the proposed pipeline on Route 32.
- a transmission main to connect the UConn system to the proposed Four Corners water system (i.e. a transmission main on Hunting Lodge Road from UConn’s 16-inch main to Route 44, and on Route 44 from Hunting Lodge Road to the proposed terminus of the Four Corners water system).

Note that the water from the proposed well would be pumped directly into UConn’s 5.4 million gallon storage tank via the proposed new water main and then UConn’s existing 16-inch water main that connects their Willimantic Wellfield to the UConn water system.

Under this arrangement with UConn, the proposed Four Corners water system would be considered an extension of the UConn system. The DPH and DPUC requirements for reliability, redundancy, and storage would be satisfied by the fact that the UConn system has multiple water supply sources and adequate water storage.

It should be noted that the two potential well sites are located within the 100-year flood plain. The wellhead, land around the wellhead, and the wellhouse all have to be located above the 100-year flood level in accordance with DPH requirements.

#### **4.5.4 Operations**

With this alternative, the Town would own and operate the new well. The Town could retain a contract operations firm to operate the well, similar to what UConn has done by hiring the CT Water subsidiary to operate and maintain their wellfields. The Town could also choose to retain the same contract operations firm to operate and maintain the Four Corners distribution system, including flushing the system and repairing main breaks.

One issue to be discussed with UConn is the cost, if any, associated with “wheeling” water through the UConn system to the Four Corners area.

#### **4.5.5 Advantages and Disadvantages**

A primary advantage of a groundwater supply in the Eagleville Lake area is that the greater width of the Willimantic River in this area reduces the potential impacts of groundwater withdrawals on fish habitat. This could result in an easier diversion permitting process than if a well is sited further upstream near the existing UConn wellfield.

A primary disadvantage of this alternative compared to the Mansfield Depot alternative is the length of pipeline and associated cost to connect a new well to the UConn system.

Additional advantages and disadvantages of this alternative are summarized in **Table 3**.

### **4.6 Mansfield Hollow**

#### **4.6.1 Water Supply Potential**

The fourth area to be investigated for a new groundwater supply was the Mansfield Hollow area in the southeastern corner of Mansfield. Two large water bodies, Mansfield Hollow Reservoir and Willimantic Reservoir, are located in this area of Town. In addition, this region of Town has significant deposits of sand and gravel.

Both DEP and DPH have suggested that this area of Town is the best place to site a new water supply because of the abundance of water.

#### **4.6.2 Potential Well Sites**

In the Mansfield Hollow Area, we have identified three town-owned sites with good water supply potential that are sufficiently large to site a well (see **Figures 5A and 5B**).

One of the potential well sites (MH-1) is located on lot 34-110-2. This is town-owned open space land that is located adjacent to the Town of Windham Water Department. Access to the lot is from Storrs Road. The lot is relatively small, but it may be possible to locate a well on the property with the necessary 200-foot protective radius. Much of the site is open and flat. There are some unmapped wetlands on the property which will need to be taken into account.

The second site (MH-2) is located on Bassetts Bridge Road, a little over a mile north of the previous site, on lots 29-113-17 and 29-113-17 2. The property is town-owned open space. Prior to the purchase of the property by the Town, this property was considered for a potential development in the late 1980s (Legette, Brashears & Graham, 1989). At that time, issues were raised about the potential impacts from an abandoned landfill located just northeast of the property. Although there was no evidence of groundwater contamination based on the testing of private bedrock wells in the area, there was almost no data available on the quality of shallow groundwater. The developer did not conduct a thorough impact analysis. No groundwater quality data from the landfill area is available. Significant additional testing and analysis would be necessary to address this issue before developing a public water supply well on the property.

A third site (MH-3) is located on the property of the Southeast School on Warrenville Road. This property is located adjacent to Mansfield Hollow Reservoir. Most of the property is occupied by the school building and ball fields. However, there is a wooded portion of the property that is large enough to provide the 200-foot protective radius. Note that the recently closed town landfill lies north of this proposed well site, on the opposite side of the Fenton River. It is our understanding that a recent study of the landfill showed that the area of influence of the landfill on the groundwater extended only to the Fenton River; as such, we would not expect the landfill to be a risk to water quality at the proposed MH-3 site.

### **4.6.3 Infrastructure**

If the Town were to proceed with developing a groundwater supply in the Mansfield Hollow Area, the critical infrastructure issue would be an agreement with UConn to interconnect with the UConn water system, and “wheel” water through the UConn water system to the Four Corners Area. The infrastructure required would include:

- a well
- a wellhouse to house chemical feed and storage systems, electrical equipment, and instrumentation and controls
- a transmission main to connect the well to the UConn system (see **Figure 5B**)
- a transmission main to connect the UConn system to the proposed Four Corners water system (i.e. a transmission main on Hunting Lodge Road from UConn’s 16-inch main to Route 44, and on Route 44 from Hunting Lodge Road to the proposed terminus of the Four Corners water system).

Note that water from the proposed well would be pumped to the chlorination basin at UConn’s Fenton River wellfield, where it would then be pumped using the existing UConn booster pumps, into the UConn distribution system.

Under this arrangement with UConn, the proposed Four Corners water system would be considered an extension of the UConn system. The DPH and DPUC requirements for reliability, redundancy, and storage would be satisfied by the fact that the UConn system has multiple water supply sources and adequate water storage.

### **4.6.4 Operations**

With this alternative, the Town would own and operate the new well. The Town could retain a contract operations firm to operate the well, similar to what UConn has done by hiring the CT Water subsidiary to operate and maintain their wellfields. The Town could also choose to retain the same contract operations firm to operate and maintain the Four Corners distribution system, including flushing the system and repairing main breaks.

One issue to be discussed with UConn is the cost associated with “wheeling” water through the UConn system to the Four Corners area; in particular, the cost to pump the water into the UConn distribution system.

#### **4.6.5 Advantages and Disadvantages**

A primary advantage of a groundwater supply in the Mansfield Hollow area is the abundant water supply in the area, and the fact that both DPH and DEP support the idea of developing a source of supply in this area of Town.

Another significant advantage of this alternative is that the three potential well sites are all owned by the Town of Mansfield. This means the Town will not have to spend the money and time to purchase a property for a well.

The primary disadvantage of this alternative is the length of water main required to connect the potential well sites to the UConn system.

Additional advantages and disadvantages of this alternative are summarized in **Table 4**.

#### **4.7 Other Town-Owned Properties**

In addition to the sites identified above, a review was conducted of all town-owned properties underlain by mapped aquifers in the Town of Mansfield. Most of the productive aquifers in the Town of Mansfield are associated with glacial deposits along the major river valleys - the Willimantic, Fenton, Mount Hope and Natchaug Rivers. The primary exception to this is the Cedar Swamp Aquifer. The potential of these aquifers with respect to Town-owned properties is as follows:

- There are no town-owned properties in the Cedar Swamp aquifer.
- The potentially viable town-owned properties along the Willimantic and Natchaug Rivers (Mansfield Hollow) have been identified in this report.
- Developing a public water supply site within the Fenton River would be difficult considering the existing impacts of UConn’s wells on the low flows of that river.

Nevertheless, town-owned properties within that river basin include lots 24-68-17 (Mansfield Lions Memorial Park) and 10-43-35 1 on Gurleyville Road.

- In the Mount Hope River Basin, the only town-owned property that is underlain by a potentially viable aquifer is lot 19-73-33 on Warrenville Road.

#### **4.8 Diversion Permitting**

Each of the potential well sites that we have identified has potential advantages and disadvantages with respect to the permitting process, particularly the Diversion Permit. One of the primary concerns of DEP is the potential impact of proposed water supply wells on stream flows. This has been an on-going concern for the UConn wells located on the Willimantic and Fenton Rivers. With respect to the potential well sites considered in this report, the most advantageous from a Diversion Permitting standpoint are the sites located near Eagleville Lake and Mansfield Hollow.

As mentioned earlier, the stretch of the Willimantic River dominated by Eagleville Lake will be less prone to potential well impacts than other stretches of the river for several reasons including that the lake provides a substantial amount of water in storage, it is not an ideal habitat for the more ecological sensitive fluvial fish, and the dam provides some control on water levels.

The Mansfield Hollow sites are advantageous for similar reasons; in particular, the Mansfield Hollow Reservoir stores an enormous amount of water. The nearby Willimantic Reservoir is utilized by the Town of Windham as a water supply and that reservoir is reported to have more in available safe yield than the Town currently uses. In our discussions with DEP, they indicated a distinct preference for obtaining water where there is known to be a surplus, and the Willimantic Reservoir was specifically mentioned as a preferred source for the Town of Mansfield.

Every potential site has to be thoroughly evaluated in order to determine potential yields and environmental impact. Nevertheless, it appears that DEP has concerns about potential impacts to the Willimantic River, and any potential well near the Willimantic River will be carefully scrutinized through the Diversion Permitting process. The Cedar Swamp sites will also be reviewed carefully by DEP because the required yield of the wells will be relatively large with respect to the low flows of Cedar Swamp Brook. The Mansfield Hollow sites, on the other

hand, are located within a basin with relatively lower sensitivity to impacts on stream flows. Therefore, it is likely that the Diversion Permit process for these sites will be less complicated.

## **5.0 INTERCONNECTION ALTERNATIVES**

### **5.1 Interconnection with Connecticut Water Company**

#### **5.1.1 Description**

Connecticut Water Company (CT Water) and UConn are considering an interconnection from CT Water's Northern Region-Western System to the UConn campus. The pipeline route is shown in **Figure 6**, and would include nearly 5 miles of water main. CT Water has indicated that their most recent proposed contract with UConn stipulates that CT Water would pay all of the capital costs for the interconnection, in return for guaranteed revenue from UConn.

As shown in **Figure 6**, the proposed interconnection would extend to Jensen's Mobile Home Park on Route 44. Thus, a limited amount of additional piping would be needed to extend the CT Water system into the Four Corners Area. CT Water is interested in supplying water to the Four Corners Area. Under CT Water's standard water main extension contract, the Town would pay CT Water to furnish and install the water mains in the proposed Four Corners Area. The Four Corners Area would become an extension of CT Water's system; as such, CT Water would operate and maintain this system, and all customers in the Four Corners Area would be customers of CT Water.

Typically, the water mains in the Four Corners Area would be owned by CT Water immediately upon installation; however, if the Town sells bonds to fund the cost of the water mains, CT Water has indicated that they can adjust their standard extension contract so that the water main is owned by the Town until the bonds mature, at which time CT Water would then become the owner of the water mains.

Note that the proposed CT Water Interconnection passes through Tolland, and CT Water's current plan is to wheel water through the Tolland Water System. It is our understanding that the wheeling agreement is still under consideration by the Town of Tolland.

CT Water has indicated that the interconnection will have a capacity of 1 million gallons per day (MGD), with 0.5 MGD guaranteed to UConn and the remaining 0.5 MGD available to serve the needs of other users in Mansfield. CT Water would need to apply for a Sale of Excess Water

Permit from the Department of Public Health (DPH) in order to transfer this water to UConn and Mansfield. As part of this effort, CT Water would need to show the DPH that they had adequate excess water supply.

### **5.1.2 Advantages and Disadvantages**

The primary advantage of an interconnection with CT Water is that CT Water is willing to pay the cost of extending the water main to the UConn campus. This means that the Town's capital cost would be limited to paying for the water mains in the proposed Four Corners distribution system.

Another advantage of this alternative is that the CT Water and UConn systems would provide the source redundancy, water storage, and fire protection needs of the Four Corners Area. In other words, the Town would benefit from the multiple sources and water storage that exists in these two systems.

A primary disadvantage of this alternative is the number of parties involved in the project. CT Water and UConn need to agree to a contract, which would then have to be approved by the Department of Public Utility Control. CT Water and Tolland would have to agree to a contract to wheel water through the Tolland water system. Each party has its own goals, needs, agenda, and schedule. The result can be long periods of negotiation, which could delay the project.

Two other critical disadvantages are (1) that the interconnection would involve an interbasin transfer, which could complicate the diversion permitting process, and (2) that the extension of a water main along Route 195 could spur secondary real estate development.

Additional advantages and disadvantages of the CT Water Interconnection alternative are summarized in **Table 5**.

## **5.2 Interconnection with Windham Water Works**

### **5.2.1 Description**

Windham Water Works (WWW) supplies water to the Town of Willimantic and a small area of southeastern Mansfield. Their source of supply is water treatment plant that treats water from the Willimantic Reservoir in southeastern Mansfield (see **Figure 7**).

With this alternative, the Town of Mansfield would purchase water from WWW. The water would be delivered to the Four Corners Area via a new pipeline on Route 195 from WWW to the UConn system, where the water would then be “wheeled” through the UConn system and delivered to the Four Corners Area via an interconnection between UConn and the Four Corners Area (i.e. a pipeline on Hunting Lodge Road from UConn’s 16-inch main to Route 44, and on Route 44 from Hunting Lodge Road to the proposed terminus of the Four Corners water system).

A pump station would be required at WWW to pump the water to the UConn campus. Note that there is a large elevation difference between the WWW site and the UConn tanks. If the Town were to build a single pump station at WWW, the water pressure at that station would be at least 230 pounds per square inch (psi). Typically, water system pressures do not exceed 125 psi; however, there are pump stations that operate with pressures of 230 psi and above. The other alternative is to build two pump stations – a “series” arrangement with one pump station at WWW water treatment plant and the other located between WWW and UConn. The goal would be to locate the second pump station such that neither pump station experience pressures higher than say 150 psi. Note that one disadvantage of the single pump station approach is that a portion of the pipeline from WWW water treatment plant to UConn would have too high a pressure for customers to connect safely, even with a pressure relief valve located on their property.

The WWW has an abundant supply of water in its reservoir; in particular, the safe yield of the reservoir is 7.9 MGD compared to the maximum day demand of 3.9 MGD in 2006. However, the capacity of the WWW water treatment plant and the diversion permit limit are 4.1 MGD. Thus, the treatment capacity and permit limit are only 5% greater than the maximum day demand (i.e. a 5% Margin of Safety). Since the DPH standard is a 15% Margin of Safety, to provide

water to the Town of Mansfield, the WWW treatment plant would need to be expanded and the diversion permit limit would need to be increased.

The Town of Windham Water Commission Chairperson, Mike Callahan, has indicated that the Commission is open to discussions about the planning and development of this alternative. Mr. Callahan noted that at this time, the Town is not in the position to undertake a major program of this nature, and the money to fund this alternative would have to come from the Town of Mansfield or UConn.

### **5.2.2 Advantages and Disadvantages**

The primary advantage of an interconnection with WWW is that there is an abundant supply of water in WWW's reservoir. This means that diversion permitting will be relatively straightforward compared to other alternatives (i.e. wells along the Willimantic River or in the Cedar Swamp area).

The primary disadvantage of this alternative is that it will require increasing the capacity of WWW's water treatment plant. It is our understanding that it has been estimated that this upgrade would cost \$8 million to \$10 million; this estimate can be refined with a further evaluation of the water treatment plant and discussions with WWW. In addition to the cost associated with this upgrade, there are other issues that need to be considered including the concept of the Town of Mansfield paying for additional infrastructure at the water treatment plant that would be owned, operated, and maintained by the WWW. The legal and financial aspects of this approach would be complex, and would have to be defined in an inter-municipal agreement.

Another disadvantage of this alternative is the cost of the water main to connect WWW to the UConn system.

Additional advantages and disadvantages of the CT Water Interconnection alternative are summarized in **Table 6**.

## 6.0 COSTS

Opinions of Probable Cost for the water supply alternatives are shown in **Table 7**.

The least expensive alternative for the Town in terms of capital cost would be an interconnection with CT Water because CT Water is proposing to pay for the interconnection piping as part of their proposed agreement with UConn.

The cost of the wellfield alternatives is differentiated by two factors: the length of pipeline needed to connect the potential well site to the Four Corners Area, and whether a land purchase or lease is needed. Without giving consideration to the cost of purchasing or leasing land, the Cedar Swamp alternatives are the least expensive groundwater alternatives, followed by the Mansfield Depot alternatives. Considering all costs, including the purchase or lease of land, the least expensive groundwater alternative is likely to be a well located in Mansfield Depot on the Town property where the former wastewater facility was located. This alternative would not require the purchase of land, and requires less transmission main than other groundwater alternatives.

The most expensive alternatives are those located in the Mansfield Hollow area of Town because of the more than 5 miles of water main that will have to be installed to connect these sources to the UConn system.

## **7.0 CONCLUSIONS AND RECOMMENDATIONS**

This report summarizes an evaluation of various water supply alternatives for the Four Corners Area of Mansfield, CT. The general summary for each alternative is as follows:

- Groundwater in the Cedar Swamp Area – This alternative is estimated to be the least costly groundwater alternative, not considering the cost of purchasing or leasing land. However, Cedar Swamp aquifer has a limited drainage area, and thus will likely yield a limited water supply. In addition, the limited yield and potential environmental impacts will likely result in a complex diversion permitting process.
- Groundwater along the Willimantic River downstream of the current UConn wellfield – Two areas downstream of the existing UConn wellfield were considered: Mansfield Depot area and Eagleville Lake area. Potential well sites in the Mansfield Depot area have the advantage of being relatively close to the proposed interconnection location with UConn, which means less piping and associated cost compared to other alternatives. Furthermore, one of the potential well sites in the Mansfield Depot area is owned by the Town, which means the Town could avoid the cost of a land purchase or lease. This particular site was once used for treatment and disposal of wastewater, so further investigation will be needed to determine if this site could be used for a groundwater supply. Potential wells sites in the Eagleville Lake area have the advantage of being located close to the Lake, which will act as a buffer for the impact of groundwater withdrawals. This factor will be a benefit for the diversion permitting process. One of the potential well sites in the Eagleville Lake area is located on Town property, which means the Town could avoid the cost of a land purchase or lease. The primary disadvantage of the Eagleville Lake alternatives is the relatively long pipelines that would be needed to connect these potential well sites to the proposed interconnection with UConn.
- Groundwater in the area of Mansfield Hollow – The primary advantage of potential well sites in the Mansfield Hollow area is the abundance of water in this area of Town; in particular, in the Mansfield Hollow Reservoir and Willimantic Reservoir. The DEP and

DPH have encouraged the search for a new water supply in this area of Town, and their support would facilitate the permitting process. Another advantage of the potential well sites in the Mansfield Hollow area is that the potential well sites are all owned by the Town, which means that Town can avoid the cost of purchasing or leasing land. The primary disadvantage of this alternative is the relatively long lengths of water main that would be required to connect the potential well sites to the UConn system.

- An interconnection with Connecticut Water Company (CT Water) – The primary advantage of this alternative is that CT Water is proposing to pay the full cost to install the more than 5 miles of water main required for the interconnection. One disadvantage of this alternative is the number of entities that need to “buy-in” to the alternative, including UConn, CT Water, and the Town of Tolland; this could delay the implementation of this alternative.
- An interconnection with Windham Water Works (WWW) – The primary advantage of an interconnection with WWW is that they have an abundance of water in their Willimantic Reservoir. The DEP and DPH have encouraged the search for a new water supply in this area of Town, and their support would facilitate the permitting process. The primary disadvantage of this option is the cost, including the cost to increase the capacity of the WWW water treatment plant and to install more than 5 miles of water main to connect to the UConn system.

Based on our evaluation, we believe the best course of action is to pursue groundwater alternatives in the Mansfield Depot area and Eagleville Lake area. In particular, we believe the Town-owned properties in these two areas should be investigated further.

These two potential well sites have the advantage of being Town-owned properties; thus avoiding the cost and potential delays associated with purchasing or leasing property. These alternatives have the advantage of being less complex than the interconnection options because there are less entities involved (e.g. CT Water, Windham Water Works). The Mansfield Depot property has the advantage of being relatively close to the proposed interconnection with UConn, which will reduce the cost of interconnection piping. The Eagleville Lake property has the

advantage of being located near the Eagleville Lake, which will mitigate potential impacts of a groundwater withdrawal on the river, thus possibly reducing the complexity of diversion permitting.

These two alternatives involve withdrawing groundwater adjacent to the Willimantic River, and thus will be closely evaluated for potential impacts on the river. However, it should be noted that development of a high producing well on one of these two Town-owned sites could allow UConn to reduce their withdrawals at their existing Willimantic Wellfield. This would be a benefit because UConn's Willimantic Wellfield is located along a stretch of the river with lower flows than the downstream areas near Mansfield Depot and Eagleville Lake.

The next step would be an environmental assessment of each of these Town-owned properties to identify environmental risks; in particular, risks related to the Mansfield Depot site that was formerly used for wastewater discharge. We also recommend meeting with both DEP and DPH to discuss permitting for both of the Town-owned sites. Based on the results of this work, we would recommend test borings and observations wells to evaluate water quality and potential yield at one or both of these Town-owned sites.

## REFERENCES

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**TABLE 1**  
**EVALUATION OF CEDAR SWAMP AREA FOR GROUNDWATER SUPPLY**

Factor	Advantages	Disadvantages
Water Quantity		<ul style="list-style-type: none"> <li>• Limited drainage area/yield.</li> <li>• Potential adverse impact on Cedar Swamp Brook.</li> <li>• Potential adverse impact on wetlands.</li> </ul>
Water Quality		<ul style="list-style-type: none"> <li>• Uncertain – wells near wetlands tend to have water quality concerns such as high iron and manganese.</li> </ul>
DEP Diversion Permitting		<ul style="list-style-type: none"> <li>• Diversion permitting could be complex because of potential impact on wetlands, brook, and endangered species.</li> </ul>
DPH Requirements/ Permits/Approvals		<ul style="list-style-type: none"> <li>• Will need a backup supply (either a 2<sup>nd</sup> well or interconnection).</li> <li>• Will likely be considered a new water system, so will need to obtain a Certificate of Public Convenience and Necessity.</li> <li>• Potential well sites are located within the 100-year flood zone.</li> </ul>
Reliability / Redundancy		<ul style="list-style-type: none"> <li>• Will need a backup supply (e.g. 2<sup>nd</sup> well or interconnection).</li> </ul>
Water Storage and Fire Flow		<ul style="list-style-type: none"> <li>• Will need either a new, local storage tank (i.e. an elevated tank or a ground level tank with booster pumps and a fire pump), or use of UConn's tanks via an interconnection.</li> </ul>
Local Permitting		<ul style="list-style-type: none"> <li>• Potential wetlands crossing for several of the potential well sites.</li> <li>• Willington regulatory commissions may have jurisdiction.</li> </ul>
Property Purchases		<ul style="list-style-type: none"> <li>• Will require purchase of property for the well.</li> </ul>
Other Parties	<ul style="list-style-type: none"> <li>• UConn, if an interconnection is selected.</li> </ul>	

**TABLE 2**  
**EVALUATION OF WILLIMANTIC RIVER – MANSFIELD DEPOT AREA FOR GROUNDWATER SUPPLY**

Factor	Advantages	Disadvantages
Water Quantity	<ul style="list-style-type: none"> <li>Significant depth of good aquifer material; thus good potential yield.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing concerns about the impact of UConn’s existing wells along the Willimantic River could impact the allowable withdrawal.</li> </ul>
Water Quality		<ul style="list-style-type: none"> <li>For Site MD-1, the nearby abandoned landfill, as well as the use of agricultural chemicals could impact water quality. Site MD-2 is further from these potential sources of contamination, and thus less at less risk of water quality impacts.</li> <li>MD-3 is located on a town property that was formerly used for wastewater disposal; this requires further evaluation to determine possible impact on the site’s use for a groundwater supply.</li> </ul>
DEP Diversion Permitting		<ul style="list-style-type: none"> <li>Diversion permitting could be complex because of concerns that additional groundwater withdrawals near the Willimantic River could impact streamflow and thus fisheries.</li> </ul>
DPH Requirements/ Permits/Approvals	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the UConn system; a Certificate of Public Convenience and Necessity is not needed.</li> </ul>	<ul style="list-style-type: none"> <li>The potential well sites are located within the 100-year flood zone.</li> </ul>
Reliability / Redundancy	<ul style="list-style-type: none"> <li>The Four Corners water system would be an extension of the UConn system, and would thus benefit from the reliability/redundancy (in terms of supply and storage) in the UConn system.</li> </ul>	
Water Storage and Fire Protection	<ul style="list-style-type: none"> <li>The Four Corners water system would be an extension of the UConn system, and would thus benefit from the storage in the UConn system.</li> </ul>	
Local Permitting		
Infrastructure	<ul style="list-style-type: none"> <li>Relatively close to the UConn distribution system, so less pipeline needed compared to other alternatives.</li> </ul>	
Property Purchases		<ul style="list-style-type: none"> <li>Both potential well sites are located on private land, so this alternative would require purchase of property for the well.</li> </ul>
Other Parties	<ul style="list-style-type: none"> <li>UConn, for a “wheeling” agreement and interconnection.</li> </ul>	

**TABLE 3  
EVALUATION OF WILLIMANTIC RIVER – EAGLEVILLE LAKE AREA FOR GROUNDWATER SUPPLY**

Factor	Advantages	Disadvantages
Water Quantity		<ul style="list-style-type: none"> <li>Ongoing concerns about the impact of UConn’s existing wells along the Willimantic River could impact the allowable withdrawal from a well; however, Eagleville Pond reduces the potential impacts on fish habitat.</li> </ul>
Water Quality		<ul style="list-style-type: none"> <li>For Site EP-1 and EP-2, there is a need to investigate the possible impact on water quality of the use of agricultural chemicals and the former wastewater disposal on the adjacent property.</li> <li>For Site EP-3, there is a need to investigate the possible impact on water quality of gravel pit on the adjacent property.</li> </ul>
DEP Diversion Permitting		<ul style="list-style-type: none"> <li>Diversion permitting could be complex because of concerns that additional groundwater withdrawals would impact streamflow and thus fisheries; although a well near Eagleville Pond is expected to require less permitting effort than a new well upstream.</li> </ul>
DPH Requirements/ Permits/Approvals	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the UConn system; a Certificate of Public Convenience and Necessity is not needed.</li> </ul>	<ul style="list-style-type: none"> <li>Potential well sites are located within the 100-year flood zone.</li> </ul>
Reliability / Redundancy	<ul style="list-style-type: none"> <li>The Four Corners water system would be an extension of the UConn system, and would thus benefit from the reliability/redundancy (in terms of supply and storage) in the UConn system.</li> </ul>	
Water Storage and Fire Protection	<ul style="list-style-type: none"> <li>The Four Corners water system would be an extension of the UConn system, and would thus benefit from the storage in the UConn system.</li> </ul>	
Local Permitting		<ul style="list-style-type: none"> <li>Much of the property for EP-4 is mapped as wetlands.</li> </ul>
Infrastructure		<ul style="list-style-type: none"> <li>Relatively long pipeline extensions would be needed for several of the Eagleville Pond Area alternatives.</li> </ul>
Property Purchases	<ul style="list-style-type: none"> <li>Potential well site EP-5 is on a Town-owned parcel.</li> <li>Potential well site EP-4 is on a State-owned parcel.</li> </ul>	<ul style="list-style-type: none"> <li>Potential well sites for EP-1, EP-2, and EP-3 are on private property, and would thus require purchase of property.</li> </ul>
Other Parties	<ul style="list-style-type: none"> <li>UConn, for a “wheeling” agreement and interconnection.</li> </ul>	

**TABLE 4**  
**EVALUATION OF MANSFIELD HOLLOW AREA FOR GROUNDWATER SUPPLY**

Factor	Advantages	Disadvantages
Water Quantity	<ul style="list-style-type: none"> <li>• Area has significant deposits of sand and gravel.</li> </ul>	
Water Quality		<ul style="list-style-type: none"> <li>• For potential well site MH-2, there is a water quality risk associated with the nearby abandoned landfill. Significant additional water quality testing would be needed.</li> </ul>
DEP Diversion Permit	<ul style="list-style-type: none"> <li>• DEP prefers the Mansfield Hollow Area over the Willimantic River Area for a new water supply because of the available water in Mansfield Hollow.</li> </ul>	
DPH Requirement/Permits/Approvals	<ul style="list-style-type: none"> <li>• Potential well sites are not located within the 100-year flood plain.</li> <li>• The Four Corners distribution system would be an extension of the UConn system; a Certificate of Public Convenience and Necessity is not needed.</li> </ul>	
Reliability / Redundancy	<ul style="list-style-type: none"> <li>• The Four Corners distribution system would be an extension of the UConn system, and would thus benefit from the reliability/redundancy (in terms of supply and storage) in the UConn system.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>
Water Storage and Fire Protection	<ul style="list-style-type: none"> <li>• The Four Corners distribution system would be an extension of the UConn system, and would thus benefit from the storage in the UConn system.</li> </ul>	
Local Permitting		<ul style="list-style-type: none"> <li>• The site for MH-1 has unmapped wetlands that will have to be investigated.</li> </ul>
Infrastructure		<ul style="list-style-type: none"> <li>• Long pipeline extensions would be needed compared to other alternatives.</li> </ul>
Property Purchases	<ul style="list-style-type: none"> <li>• Three Town-owned sites with good water supply potential have been identified.</li> </ul>	
Other Parties	<ul style="list-style-type: none"> <li>• UConn, for a “wheeling” agreement and interconnection.</li> </ul>	

**TABLE 5**  
**EVALUATION OF CONNECTICUT WATER COMPANY INTERCONNECTION**

Factor	Advantages	Disadvantages
Quantity of Water	<ul style="list-style-type: none"> <li>CT Water has indicated that they have available water to provide to UConn (0.5 MGD) and the Town (0.5 MGD).</li> </ul>	
Quality of Water	<ul style="list-style-type: none"> <li>CT Water's 2009 Water Quality Report for its Northern Region-Western System indicated that the system met all MCLs in 2009.</li> </ul>	
DEP Diversion Permit		<ul style="list-style-type: none"> <li>CT Water interconnection would involve an interbasin transfer, which could complicate the Diversion permitting process.</li> </ul>
DPH Regulations/Permits/Approvals	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the CT Water system; a Certificate of Public Convenience and Necessity is not needed.</li> </ul>	<ul style="list-style-type: none"> <li>To obtain a Sale of Excess Water Permit, CT Water needs to provide DPH with information showing that they have adequate water supply.</li> </ul>
Reliability / Redundancy	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the CT Water system, and would be interconnected with the UConn system, and would thus benefit from the reliability/redundancy in the CT Water and UConn systems.</li> </ul>	
Water Storage and Fire Protection	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the CT Water system, and interconnected with the UConn system, and would thus benefit from the storage in both of those systems.</li> </ul>	
Local Permitting		<ul style="list-style-type: none"> <li>There is public concern that a CT Water pipeline extension along Rt 195 will spur unwanted development.</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>Although the alternative would include more than 5 miles of pipeline, CT Water has proposed to UConn that they pay for this pipeline.</li> </ul>	
Property Purchases	<ul style="list-style-type: none"> <li>No property purchases required.</li> </ul>	
Other Parties		<ul style="list-style-type: none"> <li>Numerous entities are involved: CT Water, UConn, and Tolland.</li> </ul>

**TABLE 6  
EVALUATION OF WINDHAM WATER WORKS INTERCONNECTION**

Factor	Advantages	Disadvantages
Quantity of Water	<ul style="list-style-type: none"> <li>There is substantial additional safe yield available in the WWW's Willimantic Reservoir; specifically, the safe yield is 7.9 MGD compared to the 2006 Maximum Day Demand of 3.91 MGD.</li> </ul>	<ul style="list-style-type: none"> <li>WWW's water treatment plant (WTP) capacity and diversion permit limit are 4.1 MGD, which is only 5% greater than the 2006 Maximum Day Demand of 3.91 MGD; as such, the WTP would have to be expanded, and the diversion permit limit raised.</li> </ul>
Quality of Water		
DEP Diversion Permit	<ul style="list-style-type: none"> <li>DEP prefers the Mansfield Hollow Area over other potential sources of supply in the Mansfield Area because there is abundant safe yield, and no interbasin transfer; as such, permitting might be relatively straightforward.</li> </ul>	
DPH Regulations/Permits/Approvals	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the UConn system; a Certificate of Public Convenience and Necessity is not needed.</li> </ul>	<ul style="list-style-type: none"> <li>DPH would need to approve a Sale of Excess Water Permit, which would require WWW to develop additional capacity (in terms of WTP capacity and diversion permit limit).</li> </ul>
Reliability / Redundancy	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the UConn system, and would thus benefit from the reliability/redundancy (in terms of supply and storage) in the UConn system.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>
Water Storage and Fire Protection	<ul style="list-style-type: none"> <li>The Four Corners distribution system would be an extension of the UConn system, and would thus benefit from the storage in the UConn system.</li> </ul>	
Local Permitting		
Infrastructure		<ul style="list-style-type: none"> <li>Long pipeline extensions would be needed compared to other alternatives.</li> <li>One or two pump stations would be needed to pump the water to the elevation of the UConn water tanks.</li> </ul>
Property Purchases	<ul style="list-style-type: none"> <li>No property purchases required.</li> </ul>	
Other Parties	<ul style="list-style-type: none"> <li>WWW is willing to participate.</li> <li>UConn, for a "wheeling" agreement and interconnection.</li> </ul>	<ul style="list-style-type: none"> <li>A relatively complex inter-municipal agreement would be needed between Windham and Mansfield.</li> </ul>

**TABLE 7**  
**OPINION OF PROBABLE COST FOR WATER SUPPLY ALTERNATIVES**  
**FOUR CORNERS AREA, MANSFIELD, CT**

Alternative	Well No.	Transmission Piping (ft)	Opinion of Probable Cost (a)				Total
			Transmission Piping (b)	Well & Wellhouse (c)	Property Purchase	Engineering, Hydrogeologic, and Permitting Services	
CT Water Interconnection	NA	-	\$0	NA	\$0	\$0	\$0
Windham Water Works Interconnection	NA	27,500	\$5,500,000	(d)	\$0	(d)	(d)
Mansfield Depot Wellsites	MD-1	9,900	\$1,900,000	\$900,000	(e)	\$700,000	\$3,500,000
	MD-2	11,200	\$2,100,000	\$900,000	(e)	\$800,000	\$3,800,000
	MD-3	11,400	\$2,100,000	\$900,000	\$0	\$800,000	\$3,800,000
Eagleville Lake Wellsites	EP-1	9,400	\$1,800,000	\$900,000	(e)	\$700,000	\$3,400,000
	EP-2	11,650	\$2,300,000	\$900,000	(e)	\$800,000	\$4,000,000
	EP-3	16,550	\$3,200,000	\$900,000	(e)	\$1,000,000	\$5,100,000
	EP-4	18,400	\$3,500,000	\$900,000	(e)	\$1,100,000	\$5,500,000
	EP-5	19,200	\$3,600,000	\$900,000	\$0	\$1,100,000	\$5,600,000
Cedar Swamp Wellsites	C-1	9,300	\$1,600,000	\$900,000	(e)	\$600,000	\$3,100,000
	C-2	9,300	\$1,600,000	\$900,000	(e)	\$600,000	\$3,100,000
	C-3	9,800	\$1,700,000	\$900,000	(e)	\$700,000	\$3,300,000
	C-4	6,200	\$1,100,000	\$900,000	(e)	\$500,000	\$2,500,000
Manfield Hollow Wellsites	MH-1	39,600	\$6,400,000	\$900,000	\$0	\$1,800,000	\$9,100,000
	MH-2	33,900	\$5,100,000	\$900,000	\$0	\$1,500,000	\$7,500,000
	MH-3	34,700	\$5,300,000	\$900,000	\$0	\$1,600,000	\$7,800,000

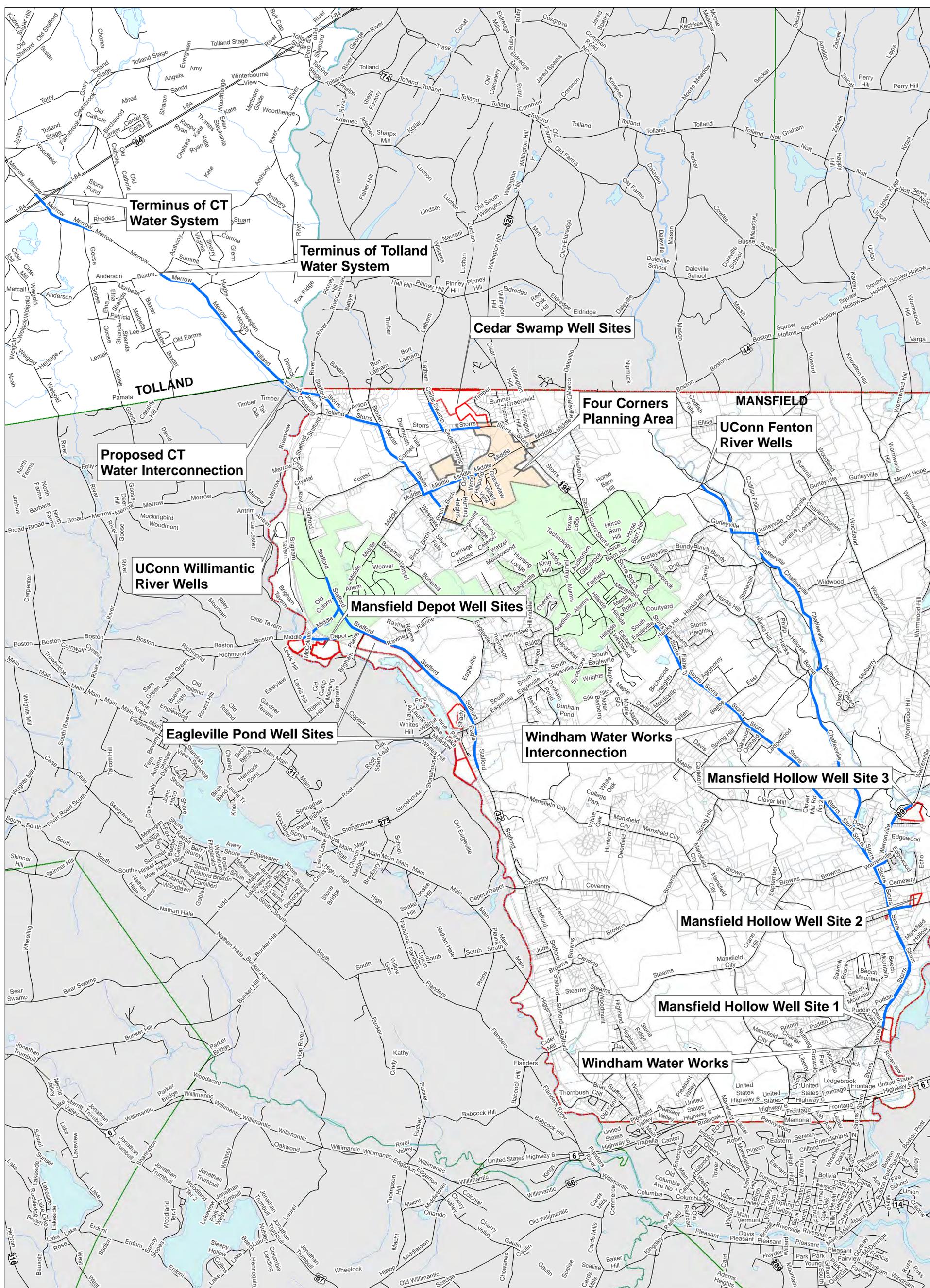
(a) The Opinions of Probable Cost are considered "Order of Magnitude" estimates, and have an expected accuracy range of -30% to +50%.

(b) "Transmission Piping" does include 5,000 feet of interconnection piping with UConn on Hunting Lodge Road and Route 44, but does not include the approximately 11,000 feet of distribution system piping in the Four Corners Area.

(c) It is assumed that the treatment will include chemical addition only for disinfection, pH control, and corrosion control.

(d) The Windham Water Works Interconnection option will require an increase in the WWW water treatment plant capacity; the cost of which can be estimated upon further evaluation of the WWW water treatment plant and discussions with WWW. The interconnection will also require one or two pump stations (see text for details) at a cost of approximately \$800,000 each.

(e) This well site alternative will require the purchase or lease of private property.



**Figure 1**  
**Water Supply Alternatives**  
**Mansfield, Connecticut**

January 2011



0 1,750 3,500 7,000 Feet

**Legend**

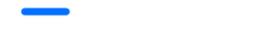
- Proposed Water Mains
- Four Corners Planning Area
- UCONN Water System
- Town Boundary
- Potential Well Sites



January 2011

### Legend

Proposed Water Mains



Roads



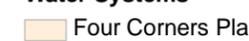
Proposed Well



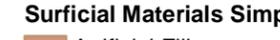
200 ft Buffer Zone



Town Boundary



Potential Well Sites



Parcels



Wetlands



Water Systems

Four Corners Planning Area

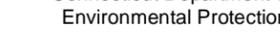


UCONN



Surficial Materials Simple Legend

Artificial Fill



Natural Postglacial



Fine



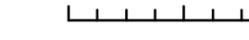
Coarse



Stacked Coarse



Coarse over Fine



Fine over Coarse



Till



Thick Till



End Moraine

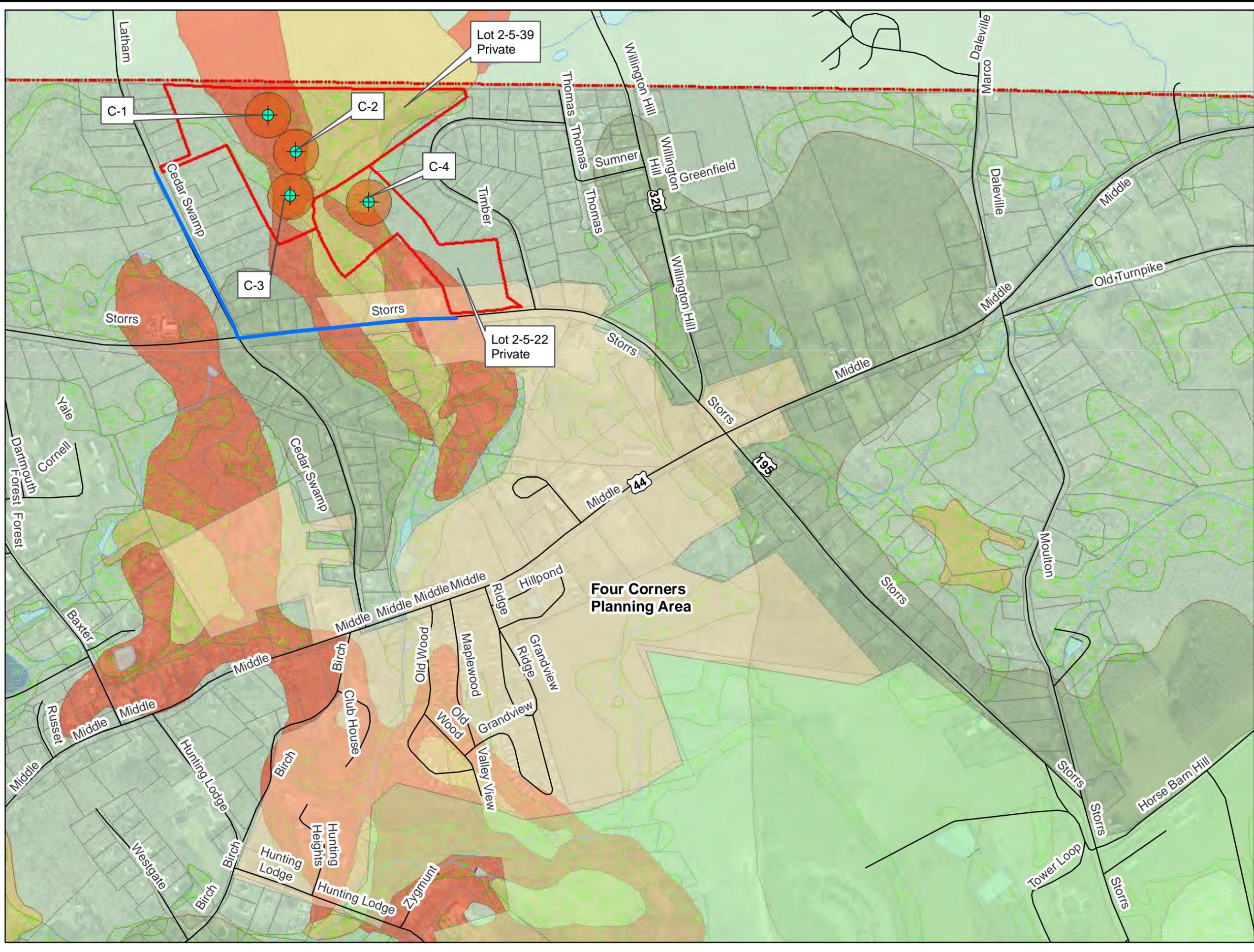


All Data Supplied by the State of Connecticut Department of Environmental Protection



0 250 500 1,000 Feet

**Figure 2**  
Cedar Swamp  
Potential Well Sites  
Mansfield, Connecticut





January 2011

### Legend

-  Proposed Water Mains
-  Roads
-  Proposed Well
-  200 ft Buffer Zone
-  Town Boundary
-  Potential Well Sites
-  Wetlands

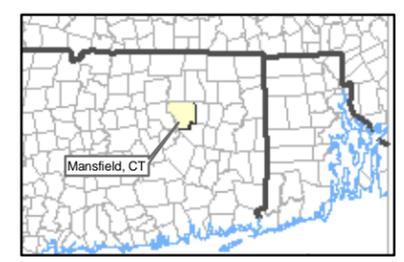
### Water Systems

-  Four Corners Planning Area
-  UCONN

### Surficial Materials Simple Legend

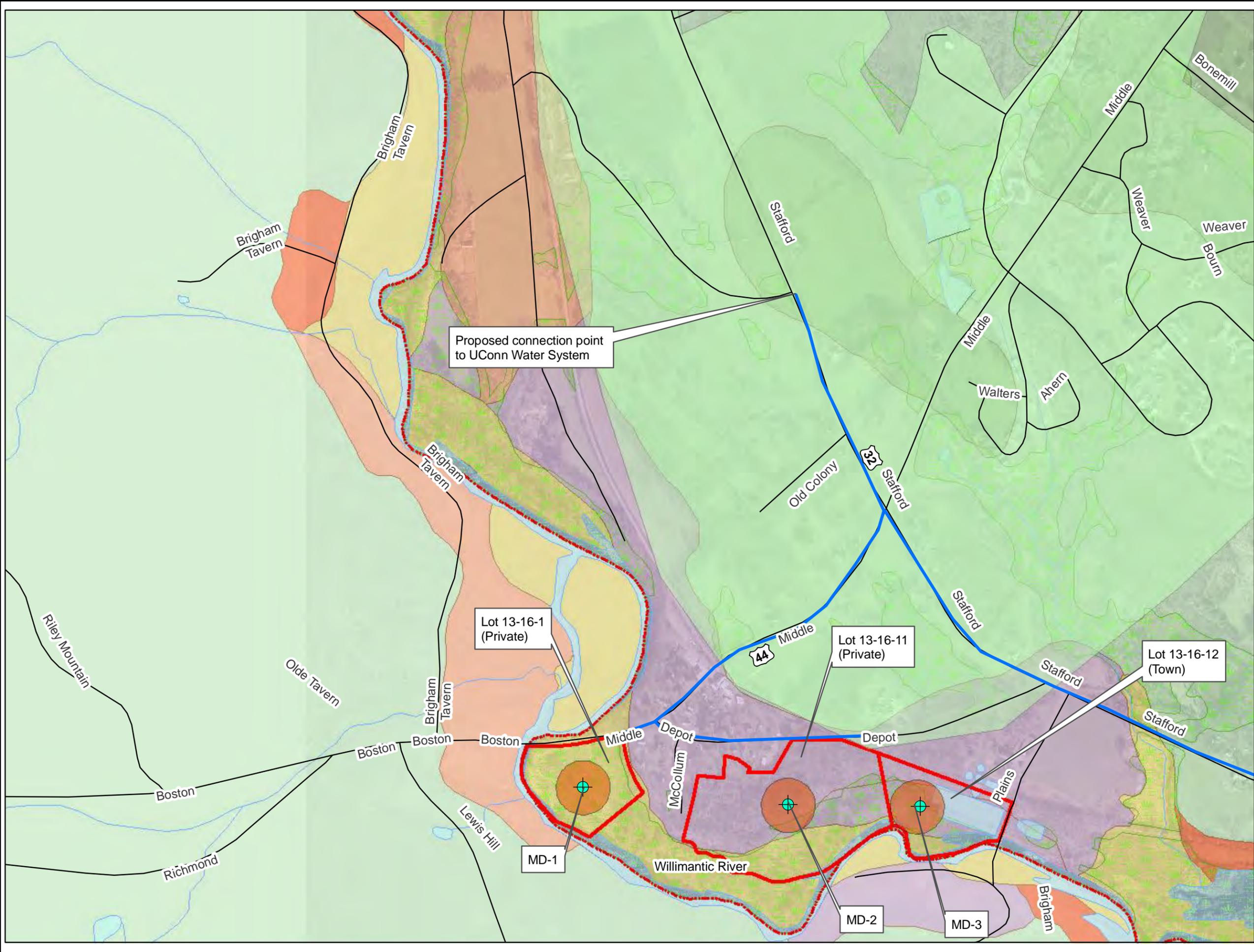
-  Artificial Fill
-  Natural Postglacial
-  Fine
-  Coarse
-  Stacked Coarse
-  Coarse over Fine
-  Fine over Coarse
-  Till
-  Thick Till
-  End Moraine

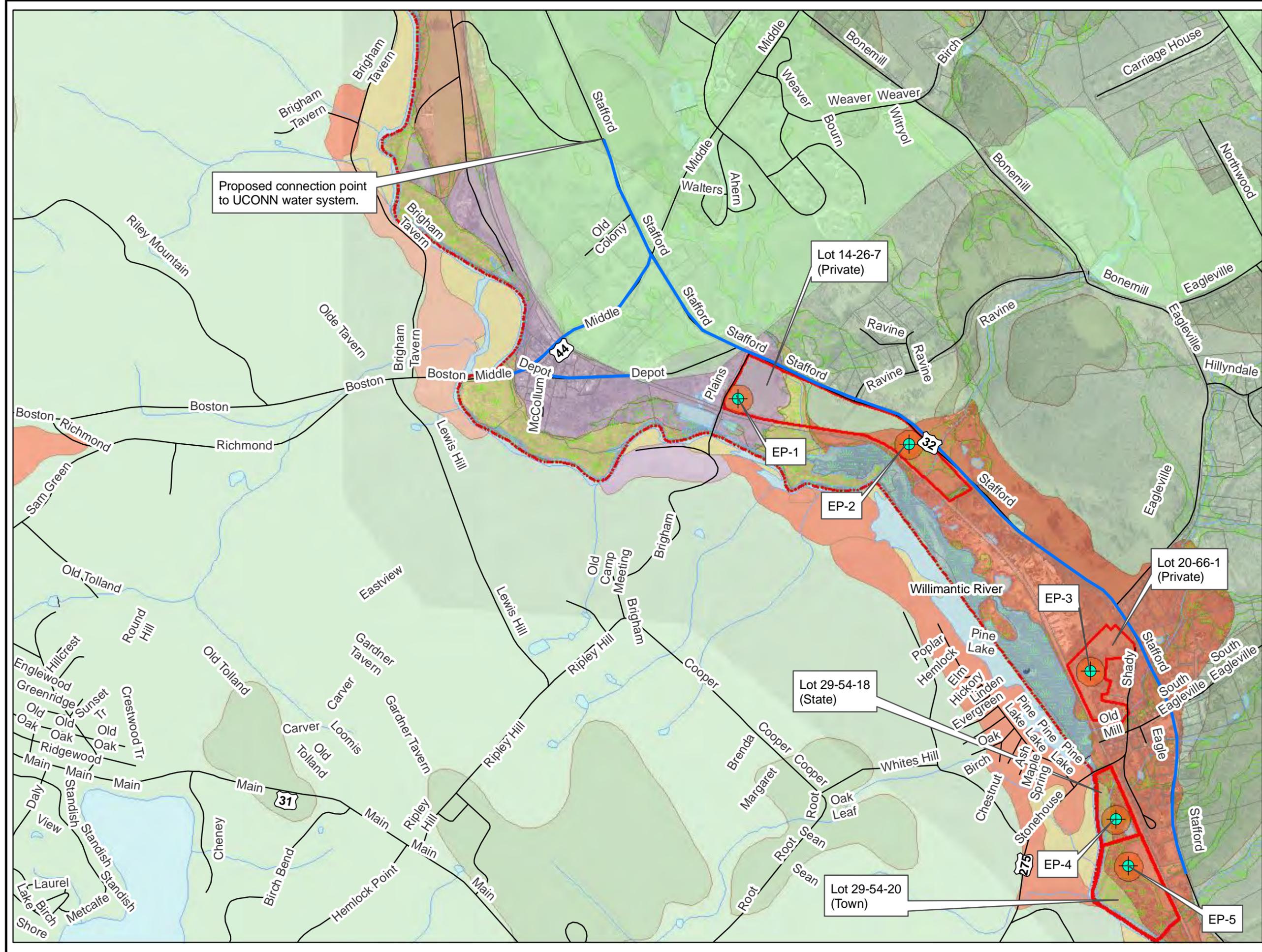
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0 250 500 1,000 Feet

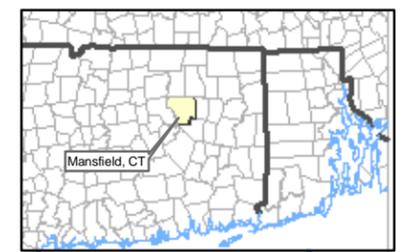
**Figure 3**  
Mansfield Depot  
Potential Well Sites  
Mansfield, Connecticut





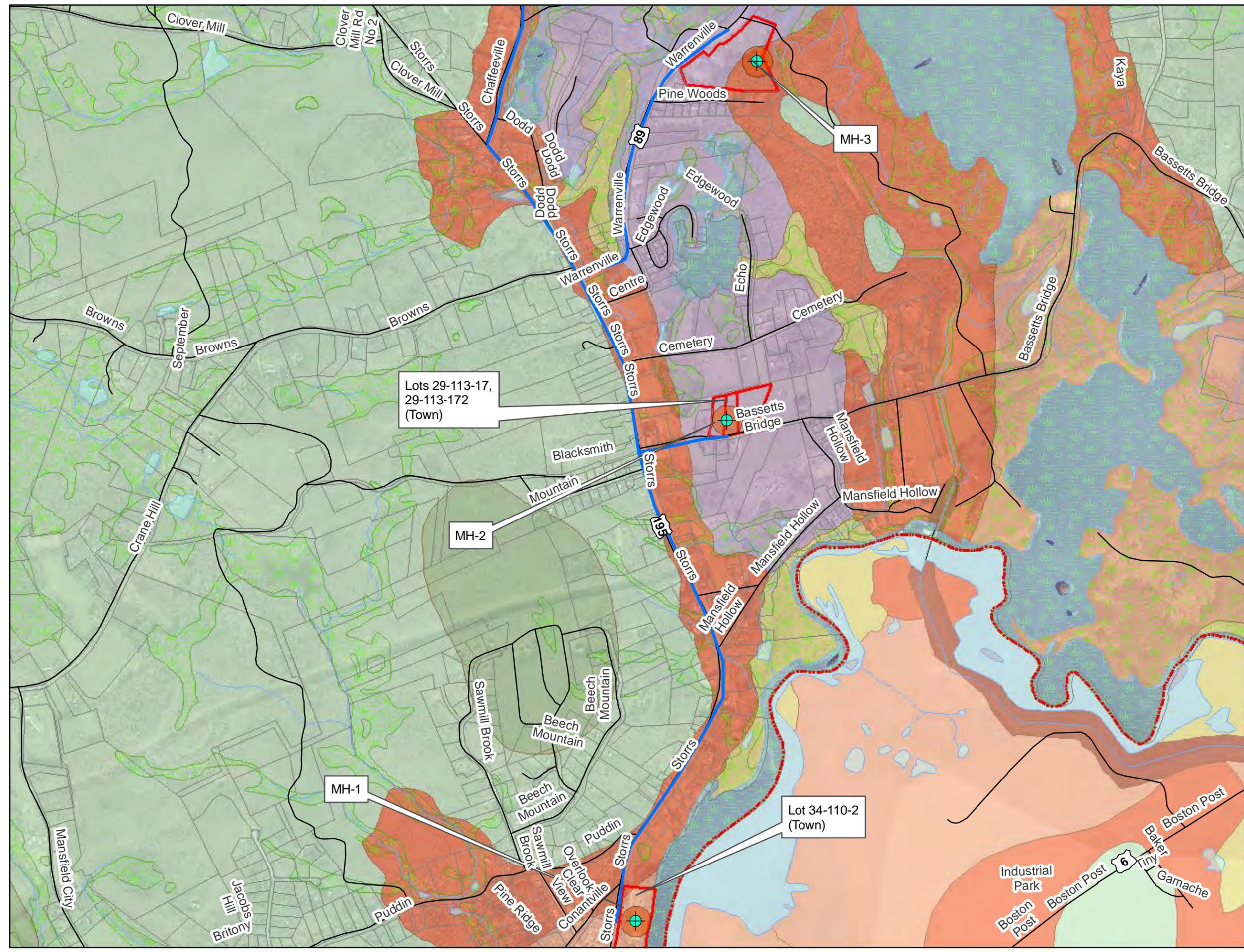
- Legend**
- Proposed Water Mains
  - Roads
  - ⊕ Proposed Well
  - 200 ft Buffer Zone
  - ⊞ Town Boundary
  - ⊞ Potential Well Sites
  - Wetlands
- Water Systems**
- Four Corners Planning Area
  - UCONN
- Surficial Materials Simple Legend**
- Artificial Fill
  - Natural Postglacial
  - Fine
  - Coarse
  - Stacked Coarse
  - Coarse over Fine
  - Fine over Coarse
  - Till
  - Thick Till
  - End Moraine

All Data Supplied by the State of Connecticut Department of Environmental Protection



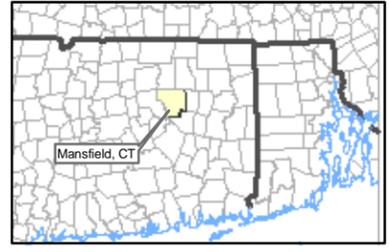
0 370 740 1,480 Feet

**Figure 4**  
Eagleville Lake  
Potential Well Sites  
Mansfield, Connecticut  
**Environmental Partners**  
A partnership for engineering solutions. GRCSUP  
Quincy, MA www.envpartners.com



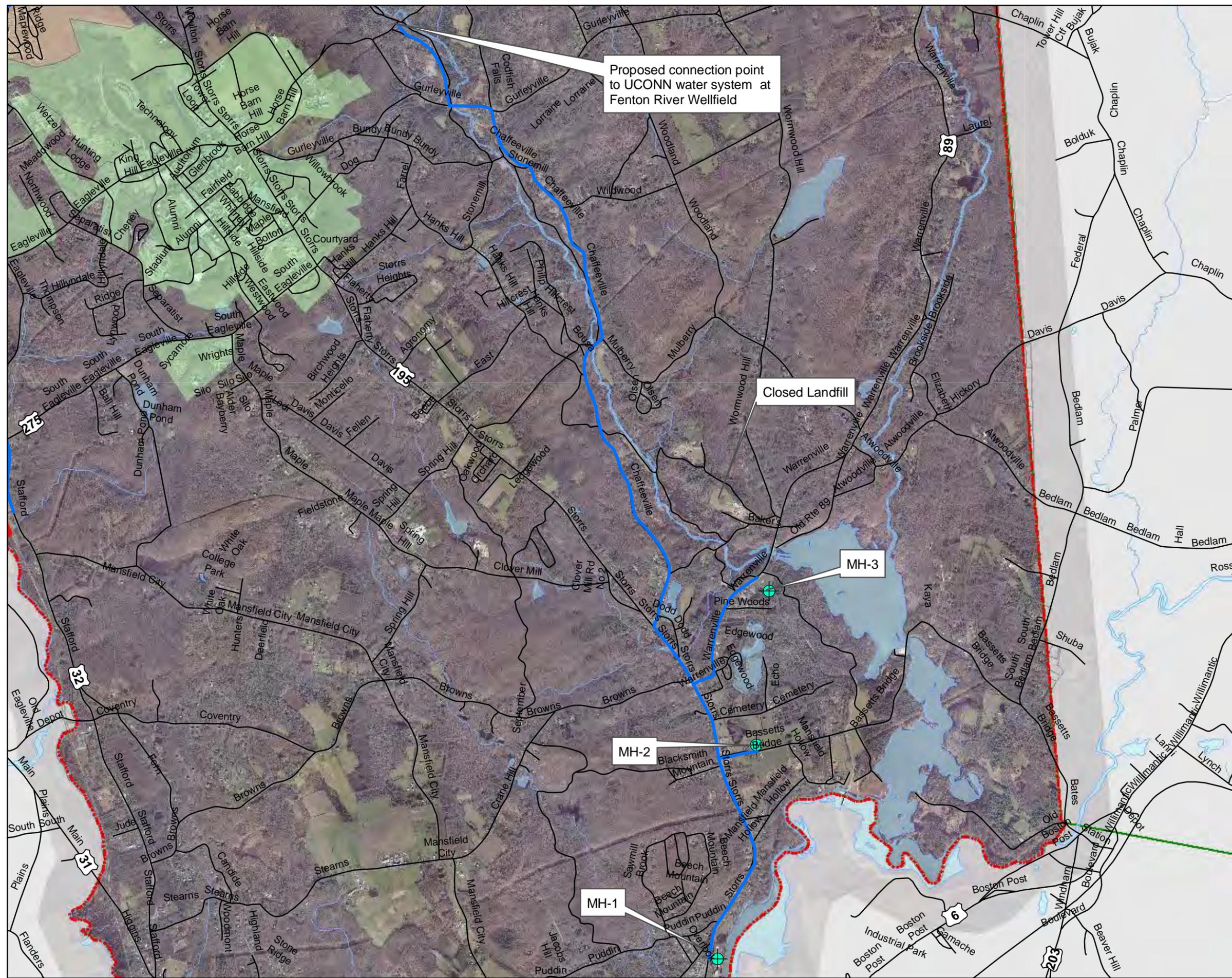
- Legend**
- Proposed Water Mains
  - Roads
  - ⊕ Proposed Well
  - 200 ft Buffer Zone
  - Town Boundary
  - Potential Well Sites
  - Wetlands
- Surficial Materials Simple Legend**
- Artificial Fill
  - Natural Postglacial
  - Fine
  - Coarse
  - Stacked Coarse
  - Coarse over Fine
  - Fine over Coarse
  - Till
  - Thick Till
  - End Moraine

All Data Supplied by the State of Connecticut Department of Environmental Protection



0 375 750 1,500 Feet

**Figure 5A**  
 Mansfield Hollow  
 Potential Well Sites  
 Mansfield, Connecticut  
**Environmental Partners**  
 A partnership for engineering solutions.  
 GRSU  
 Quincy, MA www.envpartners.com



Proposed connection point to UCONN water system at Fenton River Wellfield

Closed Landfill

MH-3

MH-2

MH-1

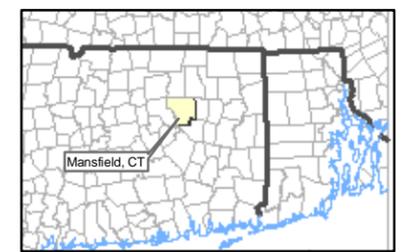


January 2011

**Legend**

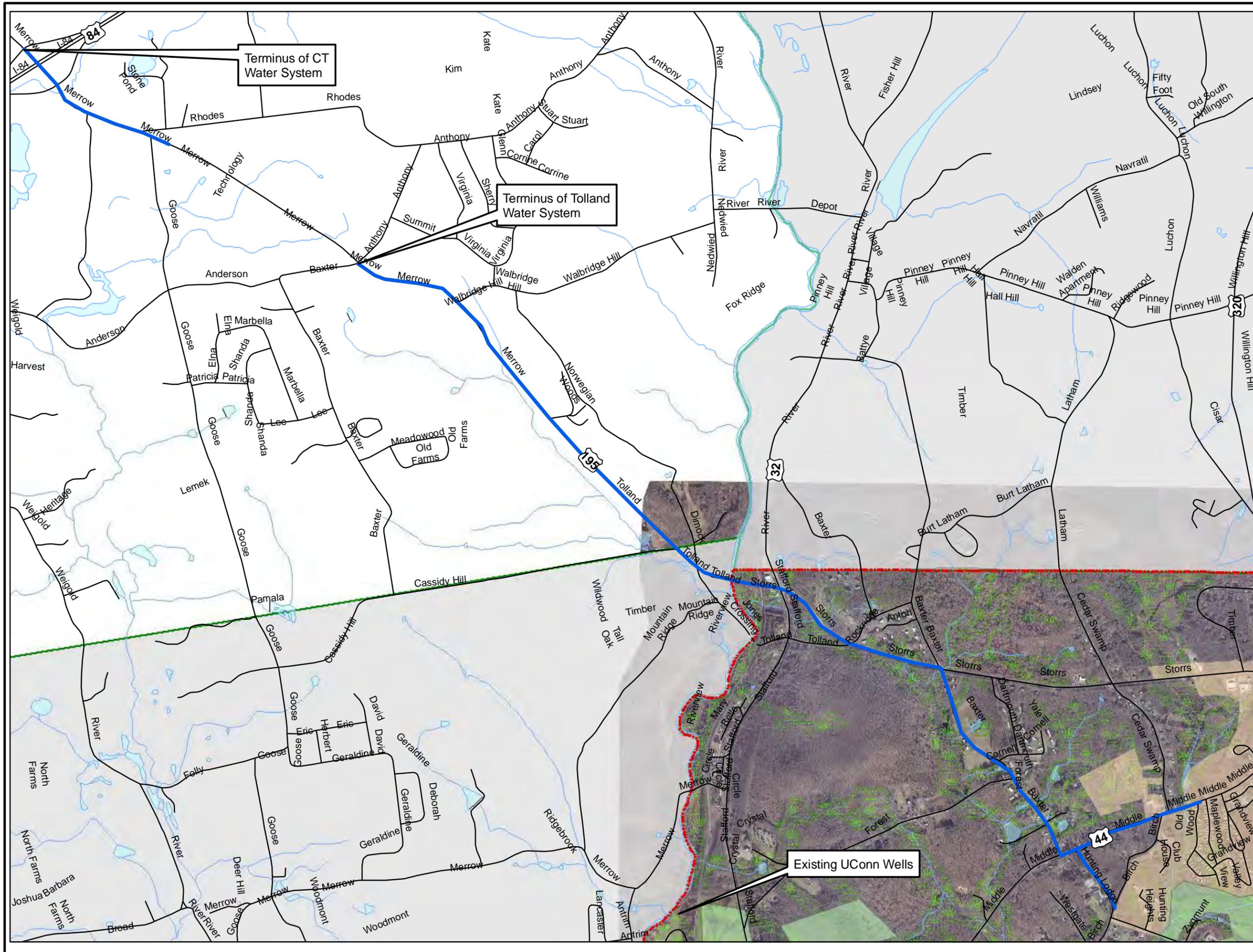
- Proposed Water Mains
- Roads
- Proposed Well
- Water Systems**
- Four Corners Planning Area
- UConn

All Data Supplied by the State of Connecticut Department of Environmental Protection



0 875 1,750 3,500 Feet

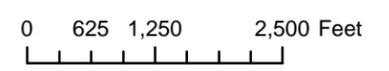
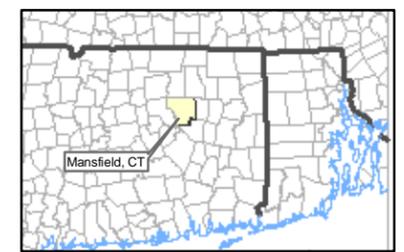
**Figure 5B**  
 Manfield Hollow  
 Potential Well Sites  
 Mansfield, Connecticut



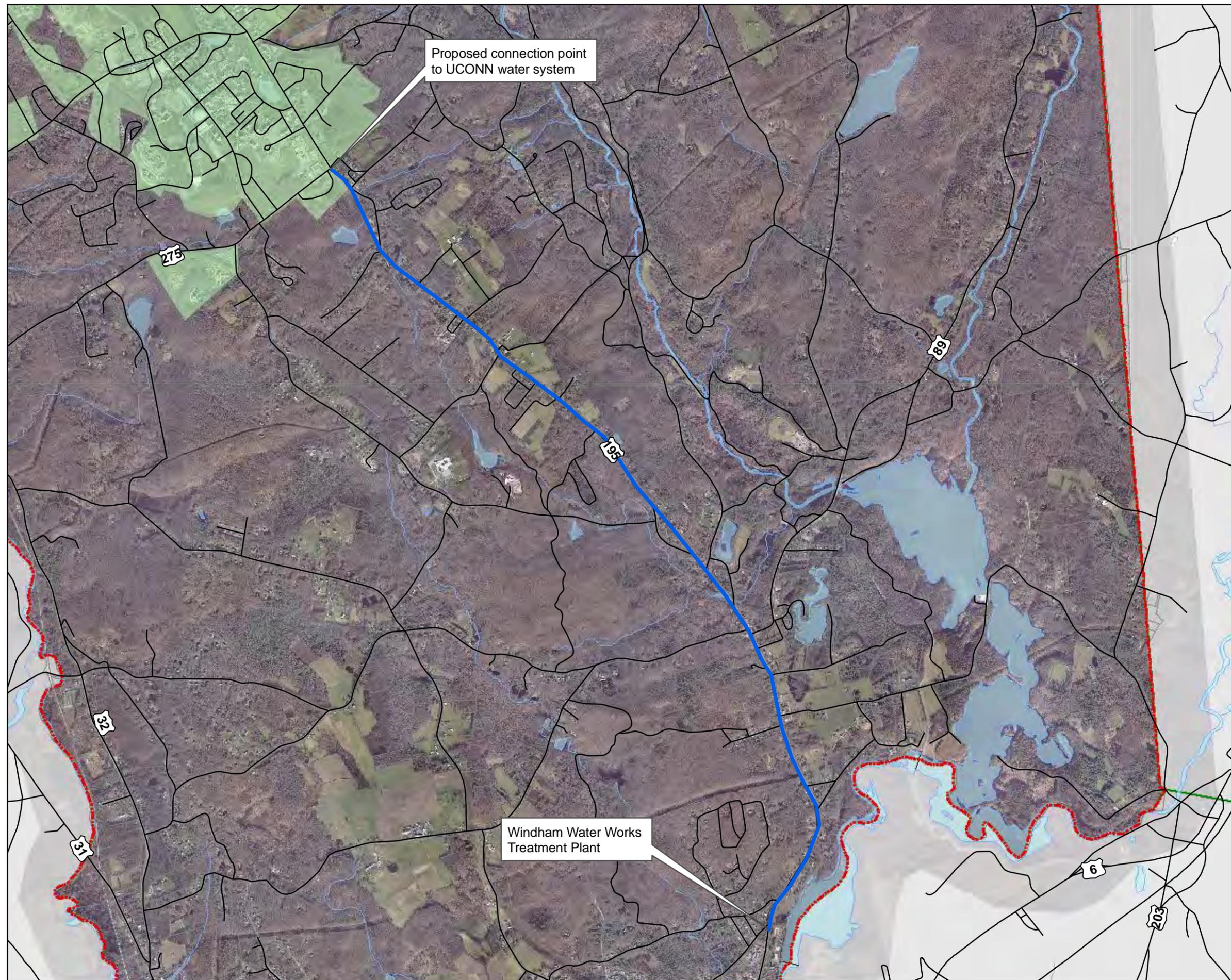
N  
January 2011

- Legend**
- UConn Interconnection
  - Roads
  - Town Boundary
  - Parcels
  - Wetlands
- Water Systems**
- Four Corners Planning Area
  - UCONN

All Data Supplied by the State of Connecticut Department of Environmental Protection



**Figure 6**  
Proposed  
UConn Interconnection  
Mansfield, Connecticut

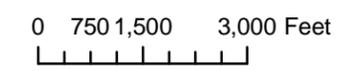
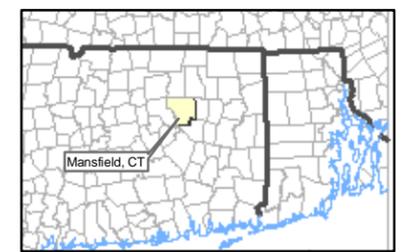


January 2011

**Legend**

- Proposed Pipeline
- Roads
- UConn Water System
- Town Boundary

All Data Supplied by the State of Connecticut Department of Environmental Protection



**Figure 7**  
 Windham Water Works  
 Proposed Interconnection  
 Mansfield, Connecticut

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