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Draft Final

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List of Acronyms

AOP	Advanced Oxidation Process
ADD	Average Daily Demand
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CEPA	Connecticut Environmental Policy Act
CGS	Connecticut General Statutes
COCs	Contaminants of Concern
CONN DOT	Connecticut Department of Transportation
CT DEEP	Connecticut Department of Energy and Environmental Protection
CT DPH	Connecticut Department of Public Health
CVOCs	Chlorinated Volatile Organic Compounds
CWC	Connecticut Water Company
DCE	1,1-Dichloroethene
DWAL	Drinking Water Action Level
DWSRF	Drinking Water State Revolving Fund
ECD	Environmental Classification Document
EIE	Environmental Impact Evaluation
ESA	Environmental Site Assessment
ESP	Exclusive Service Provider
ft	Feet
GAC	Granular Activated Carbon
GIS	Geographic Information System
GPCD	Gallons Per Capita Per Day
GPD	Gallons Per Day
GPM	Gallons Per Minute
GWPC	Groundwater Protection Criteria
in	Inches

ISO	Insurance Services Office
MCL	USEPA Drinking Water Maximum Contaminant Level
MCLG	USEPA Drinking Water Maximum Contaminant Level Goal
MDF	Maximum Daily Flow
MOS	Margin of Safety
msl	Mean Sea Level
MTBE	Methyl Tert-Butyl Ether
NDDB	National Diversity Database
O&M	Operation and Maintenance
PCE	Tetrachloroethene
PHD	Peak Hour Demand
POCD	Plan of Conservation and Development
PPC™	Public Protection Classification Program
RCSA	Regulations of Connecticut State Agencies
RSR	Remediation Standard Regulations
STEAP	Small Town Economic Assistance Program
SWPC	Surface Water Protection Criteria
TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbons
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VOCs	Volatile Organic Compounds

Executive Summary

Groundwater is the primary drinking water supply to residences and commercial properties in the Tylerville section of Haddam, Connecticut. Groundwater in Tylerville has been impacted by historic releases of chlorinated solvents, 1,4-dioxane (a solvent stabilizer), gasoline constituents (including Methyl Tert Butyl Ether, or MTBE), and sodium chloride. The Tylerville Center Study Area consists of 95 parcels zoned for residential, commercial, and industrial uses throughout the area where groundwater impacts have been detected. No public water utility exists for the impacted area; hence parcels impacted with contaminants above applicable state and federal criteria currently utilize individual filter systems and/or receive bottled water for consumptive use. The Study Area includes approximately 240 acres and is bordered by Camp Bethel to the North, the Connecticut River to the East, a new Connecticut Department of Transportation facility to the South, and Route 154 to the West.

Several contaminants of concern have been identified and linked to historic and on-going releases. Generally, chlorinated solvents and gasoline constituents, including MTBE, have impacted the overburden and bedrock aquifers, impacting numerous potable wells. This project includes the evaluation of potential water supply alternatives to provide a reliable source of potable water to the affected properties. These alternatives include the following:

- Extension of the existing Connecticut Water Company water distribution system which currently terminates in the Town of Chester,
- Development of a local groundwater supply and distribution system,
- Development of new individual wells, and
- The continued use of individual water treatment in the Proposed Water Supply Area.

These alternatives were evaluated based on effectiveness in protecting human health, reliability, typical cost, and implementation. Based on review of the evaluation criteria, the extension of the Connecticut Water Company distribution system is the recommended alternative.

1.0 Introduction

The Tylerville Center Impacted Groundwater Study Area (Study Area) is located in the Tylerville section of Haddam, Middlesex County, Connecticut (**Figure 1-A and Figure 1-B**). This Study Area includes properties that have exhibited concentrations of contaminants in groundwater exceeding the Connecticut Department of Public Health (CT DPH) Drinking Water Action Levels (DWALs) and/or the United States Environmental Protection Agency (US EPA) Maximum Contaminant Levels (MCLs) for one or more constituents and surrounding properties. AECOM has contracted with the Connecticut Department of Energy and Environmental Protection (CT DEEP) to evaluate water supply alternatives for the Proposed Water Supply Area and recommend a preferred alternative in accordance with Connecticut General Statute (CGS) Section 22a-471 and the Regulations of Connecticut State Agencies (RCSA) Section 22a-471-1. All observations, findings, and conclusions presented herein are subject to the Statement of Limitations presented in **Appendix A**.

1.1 Study Area Description

The Study Area is centered along Bridge Road (Route 82) and bordered by Camp Bethel to the North, the Connecticut River to the East, the new Connecticut Department of Transportation facility to the South, and Saybrook Road (Route 154) to the West. Several properties where releases of volatile organic compounds (VOCs) have occurred and have impacted groundwater in the area have reportedly been identified through sampling conducted by CT DEEP, the Chatham Health District, the Town of Haddam prior to joining the Chatham Health District, and various responsible parties. In addition to VOCs, MTBE and gasoline constituents have been identified in groundwater in the vicinity of Bridge Road and Saybrook Road. Documented release areas potentially contributing to groundwater impacts in Tylerville are listed below.

Documented release areas include:

- 95 Bridge Road: The Former Sibley Company
- 105 Bridge Road: Former ConnDOT Facility
- 79-81 Bridge Road: Botelle Property
- 1598 Saybrook Road (Rt. 154): Tylerville Mobil Gas Station
- 1618 Saybrook Road (Rt. 154): LukOil Gas Station
- Little Meadow Road: Former Camelot Cruises

While limited remedial activities have been conducted at the above referenced properties, additional investigation/remediation work may still be necessary.

Based on records obtained from the Town of Haddam Assessor's office, an estimated 95 parcels are located within the Study Area. Of these 95 parcels, an estimated 71 have detected chemical constituents in groundwater. Of these 71 properties with known impacts, there are 23 individual treatment systems utilized to filter potable water (5 locations with treatment systems also receive bottled water). In addition, 3 properties receive bottled water for consumptive use. A summary of the properties within the Study Area is provided in **Section 2.5.1** and **Table 2**.

1.2 Project Objectives

The primary objectives of the project include:

- Identify the area of currently impacted properties – the Study Area.
- Identify a subset of properties requiring a potable water supply – the Proposed Water Supply Area.
- Screen potential water supply alternatives.
- Prepare water demand projections for the Proposed Water Supply Area.
- Prepare a detailed evaluation of alternatives that result from the initial screening process.

1.3 Report Organization

The findings of the project tasks are presented in the following sections:

- Section 1.0 presents an introduction, Study Area description and project objectives.
- Section 2.0 presents a summary of Study Area characteristics and identifies properties that have exceeded applicable regulatory criteria for groundwater. The Proposed Water Supply Area is defined.
- Section 3.0 presents a screening level evaluation of the potential water supply alternatives.
- Section 4.0 presents the calculated water demands for the Proposed Water Supply Area.
- Section 5.0 presents a detailed evaluation of the water supply alternatives that result from the screening level process.
- Section 6.0 presents a summary of the study findings and a recommended alternative.
- Section 7.0 includes references.

2.0 Study Area Characteristics and Impacted Groundwater Areas

Tylerville has a long history of mixed industrial/commercial and residential use. During the 1700s, Tylerville was a shipbuilding village and active seaport. In 1871, Connecticut Valley Railroad began transporting along the Connecticut River and the Goodspeed Station opened. Camp Bethel was established in the 1800s as a camp surrounding a central chapel. Today, the Study Area includes a mix of zoned industrial/commercial and residential properties. The commercial properties are concentrated along Bridge Road and Route 154 while the residential properties are generally located on Little Meadow Road, adjacent to the Connecticut River, and Camp Bethel Road. Open space consisting of Clark Creek Wildlife Management Area and Eagle Landing State Park are located along the eastern portion of the Site.

2.1 Anthropogenic Setting

2.1.1 Land Use and Demographics

The Study Area is referenced as Tylerville Center and is located within the Town of Haddam, Middlesex County, Connecticut. It includes a mix of commercial, industrial, and residential properties. The Study Area contains 95 total parcels zoned for residential, commercial, and industrial land uses. Population data within the Study Area was not available from the Town offices; however the Town population in 2008 was 7,768. The five year projected population growth rate is 0.8%, resulting in a projected population of 8,067 in 2013.

Based on the modified Phase I ESA conducted at the Study Area (AECOM, 2010), manufacturing operations have occurred on portions of the Study Area since the early 1900's. Aerial photos identified manufacturing, agricultural, and residential land uses since 1936. In 1965, aerial photographs identified development of the State of Connecticut Department of Transportation (CONN DOT) property located at 105 Bridge Road. Historic topographic maps identify increasing development in the Tylerville section of Haddam.

2.2 Physical Setting

2.2.1 Physical Geography

Haddam, Connecticut lies within the Connecticut Valley Lowland, a north-south trending basin in Central Connecticut that is also known as the Central Lowland or Hartford Basin. The study area topography ranges from approximately 10 feet to 80 feet above mean sea level (msl). Properties along Saybrook Road are at approximately 50 feet above msl, and properties along the western portion of Bridge Road range from approximately 50 feet to 80 feet above msl. The eastern section of Bridge Road drops off towards the Connecticut River to approximately 10 feet above msl or lower. The properties along Little Meadow Road are at approximately 10 feet to 20 feet above msl.

2.2.2 Geology

The Tylerville Center area is located on glacial meltwater deposits known as the Lower Connecticut River Tylerville-Portland Deposits (USGS, 2005). These deposits are predominantly derived from deposition within sediment dammed ponds as the ice sheet melted and retreated during the last glaciation. An ice contact margin was noted by USGS (2005) to run from northwest to southeast through Tylerville, where a localized lobe of ice

extended from the glacial margin. It is inferred that the depositional environment would be very complex based on the position of the ice contact margin and ponding caused by sediment dams. Deposits are up to 250 feet thick in this unit. Deltaic sediments within this depositional unit are primarily coarse grained materials with fine interbedded clays and silts. Alluvial floodplain materials were identified adjacent to the Connecticut River in this location.

Bedrock is identified as Hebron Gneiss, interlayered dark-gray to brownish gray quartz-biotite schist and greenish gray, fine to medium-grained calc-silicate gneiss. This is an early Paleozoic formation that comprises the Hebron Formation. The Hebron Formation comprises a large portion of bedrock in this section of the state (USGS, 2000). Investigations for the Sibley site (95 Bridge Road) have shown outcrops nearby dipping gently and moderately westward and that some areas are capable of producing adequate amounts of groundwater to supply drinking water domestic wells (Ebasco, 1987). Investigations in the shallow overburden have identified unconsolidated materials of varying thickness consisting of fine to medium sand, fine to coarse sand, and/or fine sand and silt (CEI, 2008).

2.2.3 Hydrogeology and Contaminant Migration

Groundwater flow is generally eastward toward the Connecticut River in the bedrock aquifer and may be south/southeast in the deltaic sediments where depositional features may be dipping south. There is evidence of groundwater flow vertically downward into bedrock as inferred by water levels in overburden and bedrock wells. Based on several shallow monitoring well installations in Tylerville, sand, silt, and clay layers exist in the overburden aquifer, likely affecting vertical groundwater migration where present. The silt and clay lenses from glacial deltaic deposits are generally not continuous, especially where depositional bedding has collapsed, and may inhibit vertical migration in areas where these are present. Where the silt and clay lenses pinch out, vertical migration is possible, especially with dense contaminants, such as chlorinated solvents. Several pumping wells within the bedrock aquifer in the area may enhance the vertical gradient between the overburden aquifer and the bedrock aquifer below. Contaminants likely enter the bedrock fractures along the overburden/bedrock interface.

Advective transport with groundwater flow dispersing chemicals is the dominant mode of contaminant transport (as described above); however, diffusion may also play a role in the transport of contaminants through the silt and clay layers. Diffusion relies on concentration gradients rather than pressure gradients, and may play an important role in vertical migration through silt and clay if continuous low permeable layers are present.

Once contaminants reach bedrock, transport is a function of the fracture geometry and hydraulic conditions within the fracture network. Bedrock fracture networks are often unpredictable in their connectivity. Several bedrock wells located in close proximity may exhibit very different characteristics, including water quality and yield, depending on the fractures that they intersect. Depending on how the fracture network is connected, how often and at what rate the bedrock aquifer is pumped, contaminants can readily and rapidly become widely distributed in the subsurface.

As noted in the draft EPA *Technical Comments on Sibley Company Work Plan* (2000), the Study Area geology and hydrogeology is quite complex. Historic water quality data indicates multiple contaminant sources in the overburden aquifer (e.g. Sibley, Botelle, and gas stations); however, the limited availability of borehole logs, well construction details, well installation techniques, and incomplete/sporadic historic water quality data has complicated complete understanding of the area groundwater flow characteristics. Several residential and commercial wells are completed in the bedrock aquifer at variable depths with varying yield, identifying heterogeneity in the fracture networks within the study area (i.e. it does not appear that every well intersects and pumps from one particular fracture). In

a general sense, based on site topography and the presence of the Connecticut River, it is expected that water infiltrates the overburden aquifer and recharges the bedrock aquifer. Based on regional hydraulic gradients, groundwater from both the overburden and bedrock aquifers may ultimately discharge to the Connecticut River. However, based on the limited data in both the overburden and bedrock aquifers, available information is incomplete to fully understand hydrogeologic conditions at the Site.

2.3 Groundwater Impacts

Groundwater in the Tylerville Center area has been impacted as a result of documented releases of contaminants from multiple sources. **Figure 2** outlines the Study Area, historical detections of contaminants, contaminants detected at concentrations exceeding applicable regulatory criteria, and properties currently utilizing individual water treatment systems. **Appendix B** lists each property in the Study Area and provides a historic range of concentrations as well as the results from the latest round of sampling at each property.

2.3.1 Documented Release Areas

Current and historic land uses have resulted in impacted groundwater in the vicinity of the Study Area. Suspected release areas and contaminants are summarized below.

95 Bridge Road: The Former Sibley Company
The former Sibley Company Site is located at 95 Bridge Road. Manufacturing operations were conducted at the site from the 1950s until 1986. Historic sampling of the potable well has been completed by the Chatham Health District.

Past investigations identified impacts to soil and groundwater associated with the historic facility operations. Reported facility use of solvents and degreasers, including tetrachloroethene (PCE), trichloroethene (TCE) and 1,1,1-trichloroethane (TCA) have impacted on-site soil and groundwater and may have resulted in impacts to groundwater resources within the Study Area.

105 Bridge Road: Former CONN DOT Facility
The former CONN DOT maintenance facility is located at 105 Bridge Road. The facility conducted operations at the site from 1953 to the late 1980s or early 1990s. The facility was then moved to its current location at 1640 Saybrook Road, contiguous with the former location. The 105 Bridge Road parcel is now owned by the Town of Haddam. Several environmental investigations and groundwater monitoring events have been conducted at this site. The Chatham Health District and CT DEEP have sampled the CONN DOT wells since 2008.

Historic investigations identified impacts to soil and groundwater associated with the facility operations. Historically, sodium was detected in the shallow and deep overburden groundwater samples at concentrations that exceed CT DPH notification levels. Sodium impacts were also noted in neighboring property wells, including 95 Bridge Road. Total petroleum hydrocarbons (TPH), TCE, and chromium have been detected above GA Groundwater Protection Criteria (GWPC) at this location (CEE, 2000).

79-81 Bridge Road: Botelle Property
The Botelle property is located at 79-81 Bridge Road. The site was reportedly operated as a small manufacturer of antiqued copper powder kegs by a prior owner. Degreasing solvents were reportedly used during this operation. Septic tank sludge was sampled in 1981 and TCA was detected at an elevated concentration. An order was issued to the Botelles to remove the sludge. Compliance with the order was subsequently achieved. The CT DEEP conducted a limited subsurface investigation of the property in the 1990s and

again in the fall of 2009. Contaminants were not detected above the applicable regulatory criteria in the shallow subsurface soils and shallow groundwater.

1598 Saybrook Road (Rt. 154): Tylerville Mobil Gas Station
The Tylerville Mobil Gas Station (Mercury Fuel Services, Inc.) is located at 1598 Saybrook Road (Rt. 154) and is currently an active gasoline station. Several environmental investigations and groundwater monitoring events have been conducted at this site. Releases of benzene, toluene, ethylbenzene, and toluene (BTEX) and MTBE have been documented in soil and groundwater at this property. A Notice of Significant Environmental Hazard Report was filed in August 2009 and May 2011. In response to these notices, CT DEEP has required Mercury Fuel Services to conduct quarterly monitoring of 19 properties impacted or potentially impacted with gasoline constituents. Mercury Fuel Services has also been required to provide potable water to 5 of the 19 properties it is monitoring. In June 2012, Mercury Fuel entered into a consent order with CT DEEP to investigate and remediate pollution on and emanating from the site.

1618 Saybrook Road (Rt. 154): LukOil Gas Station
The LukOil Gas Station is located at 1618 Saybrook Road (Rt. 154) and is currently an active gasoline station. It is also referred to as the Tylerville General Store. Historic investigations detected MTBE, arsenic, barium, and selenium in groundwater at concentrations that exceeded the GWPC. Impacts to groundwater were identified in 1995. Historic investigations note that the release was terminated.

Little Meadow Road: Former Camelot Cruises
Contaminated soil was removed from the site in 1983; however, sampling of the on-site well in 1996 and 2003 yielded some of the highest solvent concentrations found in the Study Area to date. It is not clear whether shallow groundwater impacts of solvents to the former Camelot Cruise property resulted from releases occurring on the property, if the overburden in this location receives impacted groundwater from the bedrock aquifer, or if another contaminant source exists. Additional investigation is necessary to determine if a vertical gradient exists at this location.

2.3.2 Contaminants of Concern

Chlorinated volatile organic compounds (CVOCs), MTBE, and 1,4-dioxane are the primary COCs. CT DEEP and the Chatham Health District have conducted periodic sampling of potable water at many properties in the Tylerville Center area. Analyses include VOCs and MTBE at all locations with a subset including 1,4-dioxane. Recently, Mercury Fuel Services began quarterly sampling at 19 locations and analyzes for VOCs and MTBE. Laboratory results are typically distributed to the owner/occupant, Chatham Health District, and CT DEEP. In addition to sampling potable water, Mercury Fuel Services has installed and maintains granular activated carbon (GAC) filtration systems and/or provides bottled water service to five properties. **Figure 2** outlines the Study Area, historical detections of COCs, exceedances of regulatory criteria, and properties currently utilizing individual water treatment systems. Regulatory criteria are described in **Section 2.4**.

CVOCs detected in the Study Area include PCE, TCE, 1,1-dichloroethene (DCE), TCA, and associated breakdown products. These solvents are typical of degreasing/processing operations in industrial applications. Chlorinated solvents are generally denser than water and have high solubility. Depending on aquifer conditions they may be naturally biodegraded over time. In the absence of reducing conditions, CVOCs may persist for long periods until the aquifer can effectively flush out the contaminants. In the saturated overburden, solvents may be bound in silty layers. In fractured rock aquifers, long tailing of concentrations may occur where back diffusion from secondary pore spaces of the rock matrix transports contaminants to primary pore spaces. Typically, chlorinated solvents

respond well to GAC filtration, which is currently in use at several properties within the Study Area.

MTBE, a fuel oxygenate, was formerly used in gasoline until 2004. MTBE has high solubility and is not readily degraded in the environment, allowing it to become more widely distributed than other gasoline constituents. MTBE does not have a high affinity for aquifer-bound organic materials, so it is likely more widespread than other gasoline constituents. MTBE will likely persist in the aquifer until it is effectively flushed out and it may exhibit long tailing effects as it diffuses back out of secondary porosity. MTBE does not easily bind to active GAC sites given its affinity for staying in solution, and in the presence of other gasoline constituents, it may be the limiting factor in GAC filter lifetimes requiring more frequent filter change outs.

1,4-Dioxane is an emerging contaminant used as a solvent in numerous industrial processes, products, and as a solvent stabilizer in TCA (USEPA, 2009). 1,4-Dioxane is completely miscible in water and is not readily degraded in the environment, so it may be more widely distributed than other contaminants in the subsurface. It is likely to persist until flushing of the aquifer or remediation occurs because it is not readily biodegraded. Similar to MTBE, 1,4-dioxane does not respond well to GAC filtration. The contaminant does not bind strongly to carbon filter media and is easily displaced by other chlorinated solvents. As a result, 1,4-dioxane breaks through GAC filters relatively rapidly. Extended treatment trains, and extensive monitoring is required to ensure breakthrough of the contaminant has not occurred. More sophisticated oxidation mechanisms are needed to more efficiently and effectively remove 1,4-dioxane from drinking water.

Industrial/commercial land uses have been in place within the Study Area since at least the 1950s. It is conceivable that environmental impacts have been present since that time. COCs are likely to persist until remediation occurs, or the aquifer flushes contaminants to the Connecticut River over time. Additional environmental investigation is required to more fully understand fate and transport of contaminants within the Study Area.

2.4 Applicable Regulatory Criteria

The applicable regulatory criteria associated with an evaluation of the impacted groundwater within the Study Area include the CT DPH Drinking Water Action Levels (DWALs) and the EPA MCLs. The table below presents a summary of the applicable regulatory criteria for the contaminants of concern within the Study Area. **Table 1** provides maximum historic and current concentrations of COCs detected and **Appendix B** lists concentrations by property address with historic ranges and current concentrations for each parcel. **Figure 3** identifies properties with exceedances of applicable drinking water criteria.

Parameter	US EPA MCL (µg/L)	CT DPH Drinking Water Action Levels (µg/L)	CT DPH Showering/Bathing Action Levels (µg/L)
1,4-Dioxane	~	3	50
MTBE	~*	70	~
1,1,1-Trichloroethane	200	200	~
Tetrachloroethene	5	5	~
Trichloroethene	5	1**	~
1,1-Dichloroethene	7	7	~

*US EPA does not currently have an MCL for MTBE, but advises for a 20-40 µg/L limit for smell and taste.
**Recently established CT DPH Action Level

2.4.1 CT DPH Drinking Water Action Levels

The DWALs set forth by the CT DPH provide numeric screening criteria for contaminants prescribed in CGS Section 22a-471 which are identified in potable groundwater currently in use as the sole or primary source of drinking water. If contaminants are identified in drinking water wells at concentrations that exceed the DWALs, the CT DEEP is authorized to provide treatment or bottled water to residential users. According to CT DPH, the levels are set to avoid health risks from potential exposure. The DWALs for COCs present in the Study Area are included in the table above. The laboratory data for Study Area drinking water wells provided by CT DEEP and summarized in Appendix B were compared to the CT DPH DWALs.

2.4.2 Maximum Contaminant Levels

Drinking water standards are regulations that EPA sets to control the level of contaminants in the nation's drinking water. These standards are part of the Safe Drinking Water Act's "multiple barrier" approach to drinking water protection, which includes assessing and protecting drinking water sources; protecting wells and collection systems; making sure water is treated by qualified operators; ensuring the integrity of distribution systems; and making information available to the public on the quality of their drinking water.
After reviewing health effects studies, EPA sets a Maximum Contaminant Level Goal (MCLG), the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. MCLGs are non-enforceable public health goals. Since MCLGs consider only public health and not the limits of detection and treatment technology, sometimes they are set at a level which water systems cannot meet. When determining an MCLG, EPA considers the risk to sensitive subpopulations (infants, children, the elderly, and those with compromised immune systems) of experiencing a variety of adverse health effects.

Once the MCLG is determined, EPA sets an enforceable standard. In most cases, the standard is a MCL, the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. EPA's Drinking Water Strategy Goals propose to regulate 16 carcinogenic VOCs with a public health goal of 0 µg/L.

2.5 Impacted Groundwater Areas

Laboratory data focused on the COCs highlighted above, collected within the Study Area from 1980-2012 and provided primarily by the CTDEEP and Chatham Health District, is summarized and included in **Appendix B**. **Figure 2** presents a summary of those properties that have reported concentrations of COCs in groundwater, utilize GAC filtration, and/or receive bottled water.

In general, MTBE was identified in the vicinity of gasoline stations located at the intersection of Saybrook Road and Bridge Road. CVOCs and 1,4-dioxane were identified in the vicinity of former potential sources located east of the intersection along Bridge Road. Properties downgradient from both locations (Camp Bethel Road, Little Meadow Road) are generally impacted with multiple COCs. Additional details are summarized in **Section 2.5.1**.
Sampling data is not available for sodium; however, the Phase I ESA completed for Tylerville Center notes that the former CONN DOT facility located at 105 Bridge Road had concentrations of sodium at levels exceeding CT DPH criteria (AECOM, 2010). It was noted that neighboring properties also had elevated levels of sodium in the past; however, detailed investigation of the extent of sodium impacted groundwater has not yet been completed.

Many drinking water wells in the Study Area were completed in the bedrock aquifer. Some wells were completed in the sand and gravel overburden. Generally, bedrock wells intersect many water-bearing fractures, which yield enough water for consumptive use. Wells that are hydraulically connected to the source areas are impacted or may become impacted. Wells drilled into isolated fractures will likely remain potable. Based on the unpredictable nature of fracture geometry, properties in close proximity may exhibit very different water quality depending on the fracture geometry and induced groundwater flow directions. Due to the nature of the impacts, COCs will likely persist in groundwater at Tylerville Center for some time. On-going sampling of water supply wells has been utilized to monitor impacts and potential migration of COCs within Tylerville Center.

2.5.1 Tylerville Study Area

The properties contained within the Study Area are listed in **Table 2** with other defining characteristics (land use, population/building square footage, etc). Population data for **Table 2** was estimated for residential land use as four people per household. For many commercial and retail properties, the estimated population was not available, so the existing building square footage was included. It should be noted that not all properties within the Study Area have exhibited exceedances of applicable criteria in groundwater. The borders of the Study Area have been developed to provide the primary limits of the area for evaluation of water supply alternatives.

Properties in the Study Area utilize groundwater resources for potable water supplies. Individual wells supply water to each of the industrial/commercial and residential properties. Drinking water at approximately 37 properties is currently exceeding, or has historically exceeded, applicable drinking water criteria. An additional 34 properties have current detections, or have historically had detections, of COCs within the Study Area. Individual water treatment systems are currently utilized at approximately 23 locations. Eight locations receive bottled water. In addition, one commercial property currently receiving bottled water will be installing two individual filter systems (1610 Saybrook Road). Most of the commercial properties receive no water treatment or bottled water. A summary of land uses, detections and exceedences of regulatory criteria, and water treatment for Study Area properties is provided in the following table.

Overview of Study Area – Potable Water Impacts

Property Type (Zoning)	Total Properties	Relative Contaminant Concentrations				Current Water Treatment	
		ND	Detections	Exceed	No Information(3)	Filter	Bottled
Residential	58	8	18	24	8	16 (2)	3
Commercial	27	2	12	8	5	3	2
Industrial	10	0	4	5	1	4(1)	3
Totals	**95**	**10**	**34**	**37**	**14**	**23****	**8***

Notes:

* One residential, one industrial, and two commercial properties receive bottled water and also have treatment systems

** 25 filter systems are utilized on 24 properties (79/81 Bridge Road has 2 systems on one property)

(1) One industrial zoned property has two dwellings each with a filter system (79/81 Bridge Road)

(2) 64 Bridge Road has a filter system that serves 9 additional residential dwellings

(3) Either no access or no well present

Exceed – Contaminants exceed MCL or DWAL criteria for one or more contaminants

ND – Contaminants not detected

2.5.2 Proposed Water Supply Area

Within the Study Area, a Proposed Water Supply Area has been delineated to serve as the basis for evaluating potable water supply alternatives. The approximate limits of the Proposed Water Supply Area are illustrated on **Figure 3**. It includes a total of 84 properties, which are listed in **Table 3**. The area was defined to include properties where concentrations of COCs currently exceed or have historically exceeded applicable drinking water criteria, where documented releases have occurred, and adjacent properties. These properties are generally located on Bridge Road, Saybrook Road, a portion of Camp Bethel Road, Bridge Lane, South Side Bluff, and Little Meadow Road. Generally, detections of COCs have been identified in wells located in northern portions of the Study Area (not included in the Proposed Water Supply Area); however, the current and historic concentrations have not exceeded applicable drinking water criteria. Although groundwater flow is generally eastward toward the Connecticut River, this is complicated by the unpredictable nature of groundwater flow in bedrock. Also, continued pumping of existing water supply wells north of this portion of the Study Area may induce a hydraulic gradient allowing impacted groundwater to flow to the area. South of the Proposed Water Supply Area, Clark Creek and associated wetlands exist with few properties pumping groundwater, so similar changes are unlikely to affect areas south of the Study Area. To fully assess anticipated changes, additional characterization of the current impacts of COCs is needed since the distribution of existing groundwater contamination is not fully understood or delineated.

2.5.3 Connecticut Department of Health Regulated Water Supply Systems

The CT DPH regulates community water systems to ensure a safe and adequate supply of water is available. CT DPH regulates three types of systems:

Community water systems- Water systems with at least 15 service connections, which serve at least 25 residents throughout the year.

Non-transient, non-community water systems- non-residential water systems that regularly serve 25 or more of the same people on a daily basis for at least 6 months per year (e.g. schools, offices).

Transient, non-community water systems- non-residential water systems that serve 25 or more people, not necessarily the same people, on a daily basis for at least 60 days per year. According to CT DPH, the population served by transient, non-community water systems are difficult to estimate. Values for this type of well included in the table below are estimated.

Within the Study Area, 10 locations have water systems that are regulated by CT DPH. An additional four wells serve multiple properties, but are not regulated by CT DPH. These locations are:

- 79/81 Bridge Road which serves two separate residences (79 and 81 Bridge Road);
- 64 Bridge Road which serves 56, 64, and 72 Bridge Road; 6, 16, and 17 Bridge Lane; and 151, 155, 159, and 163 Camp Bethel Road;
- 1572 Saybrook Road serves 1564 Saybrook Road; and
- 149 Camp Bethel Road serves 143 Camp Bethel Road.

The CT DPH regulated systems are listed in the following table.

Connecticut Department of Health Regulated Water Systems Community Water Systems					
Address	**Land Use**	**In Proposed Water Supply Area**	**Population Served**	**Impacts**	**Filter**
1556 Saybrook Road	Residential	No	155	MTBE	No
Non-Transient, Non-Community Water Systems					
Address	**Land Use**	**In Proposed Water Supply Area**	**Population Served**	**Impacts**	**Filter**
95 Bridge Road	Commercial	Yes	65 (3 Connections)	MTBE	No
117 Bridge Road (located at 1610 Saybrook Road)	Commercial	Yes	100 (2 Connections)	N/A	Bottled water, owner to install filters
1610 Saybrook Road	Commercial	Yes	103	MTBE	Bottled water, owner to install filters
Transient, Non-Community Water Systems					
Address	**Land Use**	**In Proposed Water Supply Area**	**Population Served**	**Impacts**	**Filter**
106 Bridge Road	Commercial	Yes	25	MTBE	No
Camp Bethel	Residential	No	78 Service Connections	MTBE	No
1618 Saybrook Road	Commercial	Yes	25	MTBE	Yes
82 Bridge Road	Commercial	Yes	200	MTBE	Yes
1617 Saybrook Road	Commercial	Yes	25	ND	No
55 Bridge Road	Commercial	Yes	304	CVOCs, 1,4-Dioxane	Yes

Notes:
MTBE – Methyl Tert-Butyl Ether
CVOCs – Chlorinated Volatile Organic Compounds
ND – Compounds not detected
N/A – Information not available

3.0 Screening Level Evaluation of Water Supply Alternatives

Potential water supply alternatives have been identified and evaluated in accordance with CGS Section 22a-471 and RCSA Section 22a-471-1(f). The alternatives, as outlined in the statute, include the development of a community well system, individual household filtration systems (point of entry treatment), new individual wells and the extension of existing water mains. Initial screening criteria include an analysis of effectiveness in protecting human health, reliability, cost, and implementation.

3.1 Water Supply Alternatives

Four water supply alternatives have been identified for the impacted properties in the Proposed Water Supply Area. They include the development of a community groundwater supply and distribution system, the continued use of individual treatment systems, the installation of new wells at each property, and the extension of the neighboring Connecticut Water Company (CWC) water distribution system in Chester. Each potential alternative has been screened based on the criteria listed above.

3.1.1 Development of Community Groundwater Supply

Development of a community groundwater supply includes the development of a new groundwater source proximal to the Proposed Water Supply Area. A distribution system would be installed within or proximal to the Proposed Water Supply Area and would provide all potable water to identified properties. This alternative, combined with institutional controls limiting the use of groundwater from within the impacted area, would limit exposure to contaminated groundwater. Development of this alternative requires the following actions:

- Identify potential groundwater source outside of the Proposed Water Supply Area and the limits of the contaminant plume.
- Acquire and control land where wells will be located.
- Limitation on future groundwater use.
  (From Sections 19-13-B51(b) of the CT Public Health Code)
  No water supply well permit shall be given by the director of health:
  (1) To premises used for human occupancy when a community water supply system having at least fifteen service connections or regularly serving at least twenty-five individuals is deemed available if the boundary of the parcel of property in which the premises is on or will be located on is within two hundred feet, measured along a street, alley or easement, of the approved water supply: or
  (2) To non-residential premises, where the water may be used for human consumption, when a community water supply system having at least fifteen service connections or regularly serving at least twenty-five individuals is deemed available if the boundary of the parcel of property in which the premises is on or will be located on is within two hundred feet, measured along a street, alley or easement, of the approved water supply.

- Apply for CT DPH Diversion Permit, if necessary
- Road Encroachment Permit from the DOT
- Wetlands Permit from the Haddam Wetlands Commission

- Installation of community water distribution system
- Connect all properties in the Proposed Water Supply Area
- Abandon existing wells
- Groundwater monitoring to assess potential changes in contaminant mobility
- Operation and maintenance of installed infrastructure

Weston and Sampson Engineers, Inc. (WSE) previously performed a study to look at options for providing potable water to Tylerville Center (WSE, 1999). In this study, WSE identified a potential location for a new groundwater source at a former gravel pit, located on Rutty Ferry Road approximately ¾ mile north of the commercial area. Although this site is outside the Study Area, this or any other nearby site for groundwater extraction would likely require additional investigation to identify whether contamination would impact the new well field. This alternative may increase mobility of contaminants if the well field is hydraulically connected to the impacted portion of the bedrock aquifer. Extraction of groundwater from a single location may induce a large gradient which may pull contaminants toward it, eventually impacting the well field.

Implementation of this alternative includes installation and development of new groundwater supply wells, assumed to be upgradient of the Proposed Water Supply Area. Currently, there is no suitable land under the ownership or direct control of the Town of Haddam. Along with the new supply wells, a hydropneumatic station, water storage tank (back-up supply and fire suppression), and back-up power supply would be required including generator and fuel supply. A chemical treatment system and building will be required. The proposed distribution system would include the installation of gate valves, connections to impacted properties within the Proposed Water Supply Area, and meters in accordance with general industry practice. Once properties are connected, existing individual property wells would be properly abandoned.

AECOM expanded upon the water supply evaluation conducted by WSE and included updated estimated costs associated with the new community water source in the Modified Phase I Environmental Site Assessment and Review of Historical Data Report (AECOM, September 2010). The principal components of the cost include capital costs and cost for operation and maintenance (O&M). Capital costs of more than $6.6 million were estimated and consist of direct and indirect costs initially incurred to develop, construct and implement the alternative. O&M costs include maintenance of the installed infrastructure and operation and administration of the water distribution service area.

3.1.2 Individual Water Treatment

Individual water treatment includes the installation and/or continued use of individual filter systems. Currently, a number of treatment systems are operating in order to provide potable water to individual properties. CT DEEP personnel provide system oversight, operation and maintenance of 18 granular activated carbon (GAC) treatment systems on 17 residential properties where the contaminant levels in drinking water exceed DWALs for one or more constituents. CT DEEP also provides system effectiveness monitoring. In addition to treatment systems, CT DEEP provides bottled water to five locations to prevent exposure to 1,4-dioxane. Mercury Fuel is currently maintaining three treatment systems on three commercial properties. Mercury Fuel also provides bottled water for two properties. Four other commercial properties maintain their own systems. The following list summarizes actions necessary to implement this alternative:

- Routine potable water sampling of properties with and without treatment systems
- Installation of individual treatment systems, at each location with exceedances of applicable regulatory criteria

- Treatment systems to be selected for the contaminants of concern at each specific location (e.g., carbon adsorption)
- May include continued use of existing individual treatment systems components
- Regular treatment system operation and maintenance required (e.g., carbon change-out)
- Bottled water provision as a precaution for wells containing greater than 3 μg/L of 1,4 dioxane.

This alternative includes continued use and/or installation of new individual treatment systems to properties within the Proposed Water Supply Area. The systems will be specifically designed to treat contaminant concentrations found at each individual location. As stated previously, CVOCs, MTBE, and 1,4-dioxane are the primary contaminants of concern. CVOCs are more readily absorbed to GAC and may displace both MTBE and 1,4-dioxane from adsorption sites in the granular carbon or allow MTBE and 1,4-dioxane to flow through (e.g. solubility of MTBE and 1,4-dioxane is higher than TCE, thus it is energetically favorable for MTBE and 1,4-dioxane to stay in solution), so it is necessary to periodically monitor the performance of these systems to ensure breakthrough has not occurred. Additionally, the presence of 1,4-dioxane is of particular concern because its poor treatment by carbon adsorption requires provision of bottled water for locations that have concentrations greater than 3 µg/L (CT DPH DWAL).

The principal components of the cost include capital costs and cost for O&M. Capital costs consist of direct and indirect costs initially incurred to develop, construct and implement the installation of filter systems. O&M costs include maintenance of the installed systems including carbon changes and routine monitoring to verify system effectiveness. Additional details are provided in **Section 5.1**.

3.1.3 Development of New Individual Groundwater Supply

This alternative includes the development of a new groundwater source for each property within the Proposed Water Supply Area. This would require the installation of new wells at each property with exceedances of applicable criteria and groundwater monitoring to determine if COCs are present or become present in the newly installed wells. Many of the existing potable wells exceeding applicable drinking water criteria are installed in the bedrock aquifer. The location of the various contaminant plumes is uncertain, but documented in both the overburden and bedrock aquifers, thus installing additional wells in the immediate area with known contamination is not favorable. Additional mobilization of COCs in the subsurface may occur and potentially increase exposure to other users.

3.1.4 Extension of Existing Connecticut Water Company Water Distribution System

This alternative includes the connection to and the extension of the existing CWC Water Distribution System (system) located in the Town of Chester. The CWC system currently terminates on Route 154 at Denlar Drive, approximately two miles from the Proposed Water Supply Area. The extension would connect a new water main to the existing CWC water main. The new water main would be extended north on Route 154 into the Study Area. Water mains would be installed within the Proposed Water Supply Area, on Route 154 beyond Bridge Road, along Bridge Road, along Bridge Lane, along South Side Bluff, and then along Little Meadow Road to its termination. CWC would provide all operations and maintenance functions associated with the implementation of this alternative, and these costs would be borne by the property owners through the water rates.

This alternative, combined with Health Code requirements limiting the use of groundwater from within the new service area, would limit exposure to contaminated groundwater. The following list summarizes actions necessary to implement this alternative:

- Limitations on future groundwater use, per Section 19-13-B51(b)(1) and (2) of the Public Health Code (properties will be required to hook up to a water main if within 200 feet of the main)
- Connection to existing CWC system in Town of Chester and extension of system into the Proposed Water Supply Area
- Connect all properties in the Proposed Water Supply Area
- Abandon existing wells
- Operation and maintenance of installed infrastructure by CWC

The proposed distribution system would include the installation of gate valves and connections to impacted constituents within the Proposed Water Supply Area and service meters in accordance with general industry practice.

The principal components of the cost estimate include capital costs and cost for O&M. The costs for water provided by CWC are not included in the cost estimate. Capital costs consist of direct and indirect costs initially incurred to develop, construct and implement the alternative. O&M costs include maintenance of the installed infrastructure and administration of the water distribution. Details for this alternative are outlined in **Section 5.2.**

3.2 Alternatives Screening

Several water supply alternatives were proposed in the preceding sections including:

- Development of a community groundwater supply
- Installation of individual treatment systems
- Installation of new individual groundwater supplies
- Extension of the water main from existing CWC facilities in the Town of Chester

Initial screening of each of these alternatives included an analysis of the effectiveness in protecting human health, reliability, cost, and implementation, as discussed below.

The development of a new community groundwater supply is not a recommended alternative based on many uncertainties associated with implementation. Suitable land would need to be identified and acquired, and well yield and groundwater quality are uncertain. Additionally, without a thorough understanding of current plume dynamics, a groundwater supply located near Tylerville may become contaminated in the future. Further, suitable land would need to be identified to install the infrastructure needed for the community system, including a hydropneumatic water booster station, water storage tank, water treatment building, and emergency generator and fuel supply. Costs for this alternative are comparable to others.

Individual treatment systems, already used in the Study Area to treat individual water wells, are proposed as a viable alternative. One potential drawback is the presence of 1,4-dioxane. 1,4-Dioxane is resistant to treatment by GAC filters and would require the provision of bottled water for concentrations greater than 3 μg/L. Additional filter canisters in the treatment train and/or frequent canister replacement is required to eliminate the potential for breakthrough of this difficult to treat contaminant. This option, currently in use in the Study Area, requires extensive monitoring of contaminants to ensure that the water

systems remain potable. These actions impose on residents and business owners in the area with intrusive O&M activities. This option poses limited environmental impacts since site buildings are already in place and systems can be housed inside (with the exception of a few of the smaller buildings).

Installation of new individual groundwater supplies is not feasible since many polluted drinking water supply wells are completed in both the overburden and bedrock aquifers. Without full characterization to understand the location and transport of contaminants, this option would likely result in impacts to the newly installed wells.

Extending the water main from the Town of Chester to the Tylerville Center area is a feasible option. Homes and businesses would be served by a reliable source of water. Extension of the existing CWC Chester System is one of the proposed means to serve the Tylerville Center area.

Based on the application of the screening criteria detailed previously in this section, two alternatives are recommended for additional evaluation. They are the installation and/or continued use of individual treatment systems and the extension of the CWC water distribution system currently located in the Town of Chester. These two alternatives will be further evaluated with respect to their effectiveness in protecting human health, reliability, relative cost and implementation. The development of a community groundwater supply and distribution system is eliminated from further consideration due to implementation, reliability, relative cost, and uncertainties in a new system's well yield and water quality. The installation of new individual groundwater supplies is also eliminated from further consideration due to concerns associated with the protection of human health and reliability since new wells installed within the Proposed Water Supply Area may also become contaminated.

4.0 Water Demand Calculations

Estimated water demands within the Proposed Water Supply Area were calculated and are included in **Tables 4 and 5**. Additionally, estimated water demands were calculated for the Route 154 corridor from Chester to Haddam, with the anticipation that properties along that section may connect to the water main (**Table 6**). Average daily, maximum daily and peak hourly demands were calculated based on CT DPH flow estimating techniques. Water demand was categorized as residential, commercial or industrial, based on the zoning of each lot within the designated Area. Street address, land use, zoning and building information were compiled from the Haddam Geographic Information System (GIS) for each parcel located in the Proposed Water Supply Area. A summary of water use for the Proposed Water Supply Area and the Chester/Haddam Route 154 corridor is included in **Table 7**.

4.1 Residential Water Demands

Residential water demands were estimated based on the number of service connections times the number of people per service connection times 75 gallons per capita per day (gpcd). This estimating technique is detailed in "Guidelines for Design and Operation of Public Water System, Treatment, Works, and Sources, State of Connecticut Department of Public Health, Water Section", Section III.B.2 Water Quantity. The number of people per service connection was estimated at 4 people for single-family residences, two for mixed use apartments, and one multi-family home was estimated to have 4 one bedroom units with an estimated population of 2 people per unit.

The number of households was estimated from a combination of the zoning information and the land use information provided by the Town of Haddam. In some cases, mixed land use was identified (e.g. industrial property with multiple buildings- residence and warehouse or single family apartment in a commercial building, etc). Where multiple buildings/uses were identified, Haddam tax information was used to determine the applicable land uses for the most appropriate water demand calculation, assuming that separate service connections would be made. In the Proposed Water Supply Area, 64 single-family homes (including properties with multiple single family homes), 4 mixed-use apartments, and 1 multi-family home were identified.

4.2 Commercial and Industrial Water Demands

Commercial and industrial demands were estimated based on zoning information, total building size, and current land uses. The Connecticut Public Health Code On-Site Sewage Disposal Regulations and Technical Standards for Subsurface Sewage Disposal Systems, Technical Standards Section IV, Table 4 specifies flow calculations based on square footage and land use for commercial and industrial properties. In addition to the residential connections described above, the Proposed Water Supply Area is comprised of 6 food service facilities, 5 commercial garages (3 of which are active), 1 CONN DOT garage, 9 office spaces, 15 retail spaces, and 7 industrial spaces.

4.3 Future Development

In addition to what is currently developed/utilized within the Proposed Water Supply Area, water demands were calculated for two undeveloped and one proposed redevelopment/subdivision within the Proposed Water Supply Area. Maximum build out

scenarios were assumed for a conservative estimate of potential future use. Each scenario listed below assumes a single story building:

- Portions of Parcel 22-2 are currently zoned for industrial use with smaller portions of the parcel zoned for residential use (as mentioned above). Approximately 15 acres of land are currently zoned for industrial use. Based on information from the Town of Haddam, up to 25% of an industrial-zoned parcel may be covered by the footprint of a building. This allows for an industrial building approximately 163,000 square feet in size.
- One commercially-zoned lot, Parcel 2-1, is 6 acres. The Town of Haddam allows up to 40% of the commercial property to be covered by the footprint of a building. This permits a building area of approximately 104,500 square feet.
- Proposed redevelopment/subdivisions are proposed for 1564 and 1572 Saybrook Road. The two lots comprise an area of approximately 9.4 acres. Three commercial and two industrial lots are proposed. Assuming equally sized lots, the commercial lots would permit a total of approximately 98,000 square feet of building space (sum of all lots). The industrial lots would permit up to approximately 41,000 square feet of building space.

4.4 Chester/Haddam Route 154 Corridor

The Chester/Haddam Route 154 corridor includes both residential and commercial land uses between Denlar Drive in Chester and the Proposed Water Supply Area. Water use for residential and commercial properties was estimated similarly to those in the Proposed Water Supply Area. These properties are included as a conservative estimate of additional water demand if they are permitted to tie into a water main (if installed).

4.5 Estimated Study Area Water Demands

The total average daily demand (ADD) for the Proposed Water Supply Area is approximately 46,251 gallons per day (GPD). With 10% contingency, the ADD increases to 50,876 GPD. The maximum day water demand was estimated using a demand multiplier of 1.50 as recommended by CT DPH, which results in a maximum day flow (MDF) of 69,376 (76,314 with 10% contingency) GPD. Peak hour demand (PHD) was calculated using “Guidelines for Design and Operation of Public Water System, Treatment, Works, and Sources, State of Connecticut Department of Public Health, Water Section”. The PHD factor is one-third of the ADD, resulting in a PHD of approximately 260 gallons per minute (GPM). Water usage from parcels along the Haddam/Chester Route 154 corridor (which may connect in the case of CWC system extension) accounts for an ADD of approximately 13,975 (15,373 with 10% contingency) GPD or an MDF of approximately 20,963 (23,979 with 10% contingency) GPD. The PHD was estimated to be approximately 78 GPM.

The total ADD for the existing consumption within the Proposed Water Supply Area and the Chester/Haddam Route 154 Corridor is approximately 60,226 (66,249 with 10% percent contingency) GPD. The MDF and PHD were estimated to be approximately 90,339 (99,373 with 10% contingency) GPD and 338 GPM, respectively. If maximum development of undeveloped parcels within the Water Supply Area is included, the total ADD for the Water Supply Area and Route 154 Corridor increases to approximately 100,342 (110,376 with 10% contingency) GPD and the MDF increases to 150,513 (165,564 with 10% contingency) GPD. The PHD for this scenario increases to 557 GPM. As shown, the maximum development estimates are very conservative and increase the estimated demand substantially.

Table 7 provides a summary of the ADD, MDF, and PHD for the Proposed Water Supply Area, the Chester/Haddam Route 154 corridor, the combination of the Water Supply Area with the additional parcels along Route 154 in Chester and Haddam, and for the combined area including the potential future maximum development of undeveloped parcels.

CWC estimated water demand, projected on the 5 year horizon, for the Haddam/Chester-Route 154 corridor and the Tylerville area based on census data consisting of; current average household size, projected population growth, and projected additional development. Industrial and commercial use was estimated on a per acre basis. Average daily demand was estimated to be approximately 46,338 GPD for residential, industrial, and commercial properties. Maximum month average daily demand (a different metric than MDF) was estimated to be 64,873 GPD. Peak day demand (a different metric than PHD) was estimated at 82,482 GPD. For direct comparison, CWC's ADD was used as a base to calculate MDF and PHD to compare directly with the calculations for this evaluation. The comparison is shown in the table below.

Comparison of AECOM and CWC Water Demand Calculations			
Method	Total ADD (GPD)	MDF (GPD)	PHD (GPM)
CWC	46,338	69,507	257
AECOM Existing Demand	66,249	99,373	338
AECOM Maximum Development	110,376	165,564	557

In general, the existing demand estimates for this study are comparable (but higher) than the CWC demand estimates. The study estimates of total demand including a very conservative future development scenario are substantially higher than the CWC estimates.

4.6 Fire Protection

In addition to the base (consumption) demand discussed above, flows required for fire protection to the Proposed Water Supply Area have also been evaluated at the request of the Town of Haddam. Fire protection needs were evaluated based on the Insurance Service Office's (ISO) Public Protection Classification (PPC™) Program on Water Supply Evaluations found in **Appendix C**. ISO looks at whether a community has sufficient water for fire suppression beyond a community's daily maximum consumption for other purposes. For residential areas with one and two family dwellings, ISO determines the needed fire flow by considering the distance between buildings in an effort to account for increased fire risks when buildings are closely spaced. Based on the existing building spacing along Route 154 and within the Tylerville area, a minimum fire flow of between 500 and 1,000 GPM is needed to maintain a desirable ISO PPC grading.

For individual buildings, ISO calculates the needed fire flow based on the specific building's characteristics. Fire flows required for individual buildings can vary substantially from a minimum of 500 GPM to a maximum of 12,000 GPM dependent on factors such as building use, materials of construction, and occupancy. In its previous study, WSE calculated the needed fire flow for a typical 16,000 square foot, one story, un-sprinklered building of masonry construction to be approximately 2,500 GPM. Buildings protected by an automatic sprinkler system typically have smaller needed fire flows due to the ability of a sprinkler system to divide the building into smaller hazard exposure zones. When evaluating a

community's PPC grading, ISO does not typically consider individual buildings with a needed fire flow greater than 3,500 GPM, nor those with an automatic sprinkler system.

Considering these factors, should fire protection be desired by the Town of Haddam, additional water demand of at least 500 GPM should be included for planning purposes.

5.0 Detailed Evaluation of Alternatives

The water supply alternatives identified in **Section 3.0** for additional evaluation include the installation and/or continued use of individual treatment systems and the connection to the existing CWC water distribution system in the Town of Chester. This section provides a detailed evaluation of these alternatives in accordance with RCSA Section 22a-471-1(f)(1)(A-F). The objective of these alternatives is to provide potable water to all properties within the Proposed Water Supply Area as well as to prevent exposure to contaminated groundwater.

5.1 Individual Treatment Systems

This alternative includes the installation, or continued use of existing, individual treatment systems, specifically designed to treat contaminant concentrations found at each individual location. As stated previously, VOCs are the primary contaminants of concern. A particular contaminant of concern is 1,4-dioxane, because of its resistance to efficient treatment by carbon adsorption.

CT DEEP currently maintains 18 residential GAC treatment systems, Mercury Fuel maintains 3 systems, and two commercial properties maintain their own systems within the Proposed Water Supply Area (total of 23 systems in use). CT DPH regulates three systems. Many residential systems along Bridge Road have been in use since the late 1980s, whereas properties along Little Meadow Road have seen installations as recently as 2010/2011.

Based on information provided by CT DEEP, drinking water at residential properties with filter systems is generally sampled before the first filter (raw), between filters (mid), and after the second filter (treated) to determine if/when breakthrough has occurred. The majority of the properties are sampled on a quarterly basis.

CT DPH regulates three non-community wells with treatment systems on commercial properties. Sampling frequencies and parameters are established by the CT DPH and implemented by individual system operators.

This water supply alternative includes installation of individual GAC treatment systems at every location within the Proposed Water Supply Area as a conservative approach to ensure potable water is supplied to all properties. Estimated costs include a new system for each location within the Proposed Water Supply Area, which includes replacement of existing systems. At a minimum, existing systems will require inspection to ensure their condition is adequate for future use and existing carbon canisters will likely require a base change out. Based on available sampling data, two classifications of individual GAC treatment systems have been developed. In general the classifications are as follows:

- *Standard residential and commercial/industrial treatment systems (two carbon units)* – 71 locations (72 systems) (Note: Subdivision and redevelopment at 1564 Saybrook Road would require 4 additional basic systems.)
- *Enhanced residential and commercial/industrial treatment systems (three carbon units)* – 13 locations (14 systems)

The standard residential and commercial/industrial systems are identical to the existing systems. They include two carbon units, each with approximately 2 cubic feet of activated carbon. The standard systems are specified for those locations with elevated

concentrations of CVOCs and MTBE, but without elevated concentrations of 1,4-dioxane. CVOCs are more readily absorbed to GAC and may displace MTBE from adsorption sites in the granular carbon and allow MTBE to break through (e.g. solubility of MTBE is higher than TCE, thus it is energetically favorable for MTBE to stay in solution), so it is necessary to periodically monitor the performance of these systems to ensure breakthrough has not occurred.

The enhanced residential and commercial/industrial systems contain three carbon units to prevent 1,4-dioxane breakthrough and to reduce 1,4-dioxane concentration to acceptable levels. Similar to MTBE, 1,4-dioxane does not readily sorb to carbon and is easily displaced from the carbon media by CVOCs with which it co-occurs. However, 1,4-dioxane has a much lower DWAL than MTBE; thus three filters are proposed to be used. Proposed locations for the enhanced systems have historically, or are currently exceeding, the CT DPH DWAL of 3 µg/L for 1,4-dioxane. In addition to the enhanced GAC treatment systems, bottled water must also be provided to these locations with 1,4-dioxane as a precaution based on the low DWAL. Advanced Oxidation Processes (AOP) would provide more effective removal of 1,4-dioxane, but the practicality of these systems begins at flow rates of approximately 6 to 10 GPM and greater. Many locations within Tylerville currently utilize water at flow rates much less than 10 GPM. Multiple carbon unit systems with frequent carbon changes and bottled water provision are proposed to address those locations with 1,4-dioxane contamination in drinking water. Additional monitoring will be required to ensure the 50 µg/L bathing/showering action level is not exceeded in the post-treatment water.

Table 8 summarizes the locations in the Proposed Water Supply Area receiving enhanced and standard GAC individual treatment systems. **Figure 4** outlines the properties receiving enhanced and standard filter systems.

The individual treatment system alternative would not provide water capacity for fire protection use within the Proposed Water Supply Area.

5.1.1 Long Term Reliability and Feasibility

Reliability of the individual treatment alternative, particularly GAC units, is dependent on routine monitoring of raw water, between filters, and after filter to determine whether contaminant concentrations are increasing prior to filtration and whether contaminant breakthrough has occurred. Proper operation and maintenance of the individual treatment systems is feasible on a long term basis. Continued migration of the contaminant plume(s) may require modification of treatment schemes at individual properties, particularly if 1,4-dioxane is detected above applicable CT DPH action levels. Thus, consistent treatment efficacy associated with 1,4-dioxane will also require monitoring.

Drinking water criteria for given contaminants may change in the future as additional data and research modifies acceptable exposure levels in potable water. Currently, EPA is revisiting MCLGs and MCLs for TCE and other VOCs. It may be necessary to modify treatment systems in the future to address changes in acceptable drinking water criteria.

5.1.2 Capital Cost and Operating and Maintenance Cost Estimates

Detailed capital cost and O&M cost estimates are included in **Table 9**. For purposes of capital cost estimating, it is assumed that all existing individual treatment systems would be replaced. At a minimum, existing systems will require inspection to ensure all systems are operational and in good condition with a likely base carbon filter change out on existing systems. Without performing an initial inspection of the systems, conservative cost calculations assume that existing systems will require replacement. Properties currently

undeveloped or without facilities (e.g. Parcel 22-2) have been included since systems will be required should future development or expansion of facilities occur. Capital costs consist of direct and indirect costs initially incurred to develop, install, and implement this alternative. Direct capital costs include system engineering/design, implementation, procurement of the system components and hardware, installation, removal of existing individual treatment system (if necessary), and initial system monitoring. Indirect capital costs are generally included in labor rates; however, generally include overhead costs (e.g. communications, office supplies, copies, etc) associated, but not directly billable to the project.

O&M costs include maintenance of the individual treatment systems as well as carbon filter change-out costs and water quality sampling and analysis. A 20-year planning horizon has been used to evaluate future O&M costs. In accordance with EPA guidance, annual cash outflows associated with O&M costs are estimated in constant dollars (i.e. year 0) and are not impacted by price inflation. A discount rate of 3% has been applied to calculate the present value of future costs. It is also assumed that system replacement would occur on a 20 year basis.

The total capital cost to implement this alternative within the Proposed Water Supply Area is **$348,738**. The net present value of twenty year O&M costs for this alternative is **$3,154,390**.

5.1.3 Consistency with Plans of Conservation and Development

Implementation of this alternative is consistent with the 2007 Adopted Town of Haddam Plan of Conservation and Development (POCD) and the State of Connecticut Conservation and Development Plan (C&D Plan). This alternative would continue to support the land uses highlighted in the POCD; namely the commercial land uses clustered around the Bridge Road (Route 82) and Route 154 intersections and the bordering residential use. The C&D Plan identifies the majority of the Proposed Water Supply Area as a Rural Community Center for mixed-use development. Lands immediately adjacent to the Connecticut River are identified as Preservation and Conservation Areas (Eagle Landing State Park).

Four undeveloped parcels identified below are located within the Proposed Water Supply Area. All the parcels are zoned for commercial (C-1) except for the 17 acre plot (Parcel 22-2) directly south of 55 Bridge Road which is zoned for Industrial (I-1) with residential frontage on Bridge Road. In the future, these currently undeveloped parcels can be serviced with individual treatment systems to support potable water needs; however, the fact that the systems will require periodic maintenance and sampling may detract potential buyers and developers, where applicable.

- Map 49, Lot 2-1 (Old Chester Road North) - Commercial
- Map 49, Lot 22-2 (located south of 55 Bridge Road) – Residential frontage, industrial interior
- Map 49, Lot 22-1A (14 Little Meadow Road) – Eagle Landing State Park
- Map 49, Lot 22-1 (located south of 14 Little Meadow Road) – Eagle Landing State Park

5.1.4 Environmental Impacts

The purpose of the Connecticut Environmental Policy Act (CEPA) – administered by the Connecticut Office of Policy & Management - is to identify and evaluate the impacts of proposed State projects ("actions") that could have the potential to significantly affect the environment (for the purposes of CEPA, the term "environment" means "*the physical, biological, social, and economic surroundings and conditions which exist within an area which may be affected by a proposed action including land, air, water, minerals, flora, fauna, noise, objects of historic or aesthetic significance and community or neighborhood characteristics"*). This evaluation enables the State agency proposing or funding a project to judge the appropriateness of proceeding with the action in light of its environmental impacts. The process also provides opportunity for public review and comment through an early public scoping process, as well as later review of an Environmental Impact Evaluation (EIE), if required.

As stipulated in the CEPA, sponsoring agencies must prepare environmental classification and impact documents. An evaluation of an action must be made with respect to potential direct and indirect effects and cumulative impacts to the environment. A full evaluation of this proposed alternative is not within the scope of this document; however, short term and long term environmental impacts are limited and it is unlikely that a full CEPA evaluation would be required. Existing wells would continue to be used. The treatment systems would be installed within the existing structures. Long term impacts would be limited to the O&M activities associated with system monitoring and carbon change-outs. Long-term system monitoring may impose on families and operations within businesses as it is an invasive procedure requiring access to interior portions of buildings at the Proposed Water Supply Area properties. Carbon change-outs also require access to site buildings and may require site activities to cease while change out occurs.

5.1.5 Potential for Future Contamination

Current and historic land uses in the Tylerville area have contributed to adverse groundwater impacts. MTBE, CVOCs and/or 1,4-dioxane have been detected in many drinking water samples collected from within the Study Area. Portions of the Study Area not included in the Proposed Water Supply Area have trace to low levels of MTBE not exceeding regulatory criteria. The distribution of COCs within Tylerville will likely continue to change under pumping-induced gradients with the use of individual treatment systems. New developments and water wells may also alter groundwater flow, likely changing the flow and transport in Tylerville. Newly identified releases of gasoline constituents may continue to migrate away from source areas at the intersection of Bridge Road and Saybrook Road. For this alternative, monitoring would continue to occur to determine if GAC filter systems continue to effectively treat contaminant loads and to ensure that breakthrough has not occurred. 1,4-Dioxane may potentially continue to migrate, requiring system modifications in the future.

In the absence of an extensive hydrogeological study of flow, transport, and distribution of contaminants in the Tylerville Center area, detailed environmental investigations would be required to more accurately estimate plume boundaries for both current and future plume migration.

5.1.6 Public Acceptance

Public acceptance of this alternative is likely to be problematic due to the continued use of impacted groundwater within the Proposed Water Supply Area and the fact that individual water treatment systems have been in use at some properties since the late 1980s (almost 25 years).

5.1.7 Implementation Schedule

Implementation of this alternative, assuming the replacement of all existing individual treatment systems and installation of new systems, would require approximately six months. This would include system selection and design, removal of existing systems, new system installation, and an initial round of sampling (raw, between filters, post-filters) to ensure proper operation of the systems.

5.2 Connection to Connecticut Water Company Water Distribution System

This alternative includes extension of the existing CWC public community water system to the Proposed Water Supply Area. The CWC system currently terminates on Route 154 (Saybrook Road) at Denlar Drive in the Town of Chester, approximately three quarters of a mile from the Town of Haddam line. Two different layouts have been developed for the extension of the existing CWC system.

Base Layout

The Base Layout is consistent with existing CWC plans and includes installing a water main along Route 154 from the termination of the CWC system at Denlar Drive in Chester to beyond the intersection with Bridge Road (Route 82), easterly along Bridge Road to the intersection with Little Meadow Road, and along Little Meadow Road to its termination. Water main spurs would be installed as necessary within the Proposed Water Supply Area to provide service to all properties within this area. An additional extension of approximately 1,100 feet along Route 154 has been added to service the impacted residents north of the intersection of Route 154 and Bridge Road (Route 82). Other sections of proposed main include small water main spurs down Bridge Lane and South Side Bluff, and a spur down Camp Bethel Road to serve those residents affected by groundwater contamination.

Alternate Layout

The Alternate Layout seeks to decrease the total linear distance of water main installed by connecting from Route 154 to Little Meadow Road before Tylerville. The difference is approximately 1,900 linear feet, however, the Alternate Layout would require crossing train tracks twice (Bridge Road and Little Meadow Road) and a wetland/stream area. This would complicate installation and potentially adversely impact a sensitive ecological area. This alternative also does not provide water service to a 1,600 foot length of Route 154 and 12 properties located outside of the Proposed Water Supply Area.

Water Main Size

In addition to two different possible layouts for the proposed water main extension, two different water main sizes are being considered for the extension – 8” or 12 “ diameter ductile iron piping. CWC has evaluated each size main using a hydraulic model to simulate the performance of its existing system and the proposed extension and found that either size main will have adequate capacity for the anticipated base (consumption) water demand associated with the extension. Although the 12” main would cost more than the 8” main, there are several potential benefits to this larger main size:

- The additional hydraulic capacity of the 12” main would accommodate larger increases in demand associated with future development within the service area;
- The additional hydraulic capacity of the 12” main would accommodate greater increases in demand associated with future expansion of the water system beyond the Proposed Water Supply Area;

- The additional hydraulic capacity of the 12" main would provide greater available fire flow, improving the community's safety and the ability of the local fire department to provide fire protection, as well as potentially lowering insurance rates for the community within the service area.

Implementation

The CWC has prepared detailed engineering drawings for the extension of their water distribution system from the Town of Chester into the Tylerville Center area similar to the Base Layout. The plans depict water main installation that would provide service to an area that is slightly larger than the Study Area. Specifically, the CWC plans propose water main installation that extends outside the north boundaries of the Study Area along Camp Bethel Road. However, the Base Layout includes extension of the main along Route 154 beyond the intersection with Bridge Road to serve affected properties in this area. The CWC plans terminate the main extension along Route 154 at the Bridge Road intersection. Certain other minor differences exist between the CWC plans and the Base Layout described herein, including small water main spurs along several local residential roads to distribute water to these neighborhoods. Given that work would be required within state highway right of ways, CONN DOT review and approval will be required. In addition, CT DPH review and approval of the water system expansion will be required.

It is anticipated that once installation of the water main is complete and connections are made, all existing potable wells would be properly abandoned in accordance with regulation [RCSA Section 22a-471-1(g)(2)(B)]. Existing individual water treatment systems would also be removed.

5.2.1 Base Layout (8-Inch)

Figure 5-A provides a schematic layout of the proposed (base layout) extension of an 8" water main from the Town of Chester to service the Proposed Water Supply Area. **Figure 5-B** provides a detailed view of this base layout. The Proposed Water Supply Area includes service to 84 properties (with one property receiving two service connections) for a total of 85 connections. Segments of the proposed 8" water main base layout are outlined in the following table.

Water Main Extension Proposed Water Supply Area – Base Layout (8-Inch)

Section	Pipe Diameter (in.)	Length (ft)
Route 154 – Chester	8	4,082
Route 154 – Haddam	8	8,863
Route 82 (Bridge Road)	8	2,735
Little Meadow Road	8	3,368
Camp Bethel Road	8	750
Bridge Lane	8	450
South Side Bluff	8	750
	Total Length	**20,998**

5.2.2 Alternate Layout (8-Inch)

An alternate layout for the 8" main extension, presented in **Figures 6-A and 6-B**, has also been developed. It includes routing the water main from Route 154 directly to Little

Meadow Road and extending the main via this route through the Proposed Water Supply Area. Segments of the alternate 8" water main layout are outlined in the table below.

Water Main Extension Proposed Water Supply Area – Alternate Layout (8-Inch)

Section	Pipe Diameter (in.)	Length (ft)
Route 154 – Chester	8	4,082
Route 154 – Haddam	8	5,618
Route 82 (Bridge Road)	8	2,735
Little Meadow Road	8	4,669
Camp Bethel Road	8	750
Bridge Lane	8	450
South Side Bluff	8	750
	Total Length (ft)	**19,054**

5.2.3 Base Layout (12-Inch)

Figure 7-A provides a schematic layout of the proposed (base layout) of a 12" main extension from the Town of Chester to service the Proposed Water Supply Area. **Figure 7-B** provides a detailed view of this base layout. Segments of the proposed 12" water main base layout are outlined in the following table. Note that certain minor water main spurs serving smaller areas would remain 8" diameter as opposed to the primary 12" distribution main.

Water Main Extension Proposed Water Supply Area – Base Layout (12-Inch)

Section	Pipe Diameter (in.)	Length (ft)
Route 154 - Chester	12	4,082
Route 154 – Haddam	12	8,863
Route 82 (Bridge Road)	12	2,735
Little Meadow Road	8	3,368
Camp Bethel Road	8	750
Bridge Lane	8	450
South Side Bluff	8	750
	Total Length	**20,998**

5.2.4 Alternate Layout (12-Inch)

An alternate layout for the 12" main extension, presented in **Figures 8-A and 8-B**, has also been developed. It includes routing the water main from Route 154 directly to Little Meadow Road and extending the main via this route through the Proposed Water Supply Area. Segments of the 12" alternate water main layout are outlined in the table below.

Water Main Extension Proposed Water Supply Area – Alternate Layout (12-Inch)

Section	Pipe Diameter (in.)	Length (ft)
Route 154 - Chester	12	4,082
Route 154 - Haddam	12	5,618
Route 82 (Bridge Road)	12	2,735
Little Meadow Road	12	4,669
Camp Bethel Road	8	750
Bridge Lane	8	450
South Side Bluff	8	750
	Total Length (ft)	**19,054**

5.2.5 Fire Protection

In addition to supplying water for consumptive use, the water main extension could also help to address fire protection needs in the area. In accordance with ISO evaluation requirements, needed fire flows for residential areas range from 500 to 1000 GPM for the study area depending on the distance between buildings. Needed fire flows for un-sprinklered commercial and industrial buildings is determined based upon the building area, construction, occupancy and exposure and can range from a minimum of 500 GPM to a maximum of 12,000 GPM, above the base domestic water demand. Needed fire flow for buildings with automatic sprinkler systems can be significantly less. In cases where the needed fire flow for a larger commercial or industrial building is greater than the capacity of the water distribution system to provide this, the building's owner may construct his own private fire suppression system which may include private fire suppression water storage tanks and dedicated fire pumps.

Available fire flows will vary throughout the system depending on several factors including the elevation, distance from the source, and other additional demand on the system. CWC evaluated the capacity of its system with the proposed water main extension (for either an 8" or 12" main extension) using a hydraulic model to simulate the system performance. For this simulation, CWC applied estimated peak summer demand throughout the system and then evaluated the available fire flow at the point in the system expected to be the hydraulically weakest. This simulation estimated the maximum fire flow that could be discharged from the system at this location until the system pressure reached a minimum of 20 psi. This evaluation found that:

- An 8" main extension could provide a needed fire flow of up to approximately 650 GPM above the base (consumption) demand;
- A 12" main extension could provide a needed fire flow of up to approximately 1250 GPM above the base (consumption) demand for fire flow.

Based on these estimates, the 8" main extension would be marginal in addressing the residential needed fire flow required by ISO to achieve a desirable PPC grading. The 12" main would be adequate for meeting residential needed fire flow demand.

Provisions for fire protection would also include the installation of fire hydrants along the proposed water main extension. The layout and locations of the fire hydrants would be based on ISO requirements and input provided by the local fire department. The spacing of fire hydrants shown in the CWC water main extension plans (July 2010) is generally consistent with these requirements. The hydrants have been spaced at approximately

1,000 foot intervals in less developed areas and closer together at approximately 600 foot intervals in more densely populated areas. Final locations would be dependent on field conditions and input from the local fire department to optimize areal coverage and hydrant accessibility.

5.2.6 Long Term Reliability and Feasibility

Public water mains provide the greatest degree of reliability with respect to supplying a continuous supply of potable water. Considering the resistance of 1,4-dioxane to treatment with GAC filtration, public water service ensures that high quality water is available to all recipients without monitoring individual locations and having to change out filters. Bottled water would not be required to be provided at properties with 1,4-dioxane. This alternative provides the greatest degree of long term feasibility. Proper operation and maintenance of the system, to be performed by CWC, is feasible on a long term basis. Public water would eliminate the long term intrusion upon home and business owners needed for long term filter operation and water quality monitoring.

5.2.7 Capital Cost and Operating and Maintenance Cost Estimates

Capital cost estimate summaries are included for the Proposed Water Supply Area (base and alternate layouts) in **Tables 10 and 11**. Detailed cost estimate backup for the Proposed Water Supply Area is included in **Appendix D**. The total estimated capital cost to implement this alternative is $6,825,750 for the eight-inch base layout, $6,368,750 for the eight-inch alternate layout, $7,339,750 for the twelve-inch base layout and $6,946,750 for the twelve-inch alternate layout. These costs do not include any additional infrastructure for fire protection such as hydrants. Note that the difference in cost between the 8” and the 12” mains is fairly small relative to the overall water system cost and is due almost entirely to the difference in the material cost of the pipe. All other costs such as excavation, installation and surface restoration remain the same.

Estimated Capital Costs for Public Water Main Alternatives		
Alternative:	**8” Main**	**12” Main**
Base Layout	$6,825,750	$7,339,750
Alternative Layout	$6,368,750	$6,946,750
Fire Protection (hydrants)	$169,250	$175,250

Operation and maintenance costs would be provided by CWC and included within the service fees paid by the property owners. **Appendix E** includes rate information provided by CWC and summarized below.

Users would incur costs associated with typical water usage rates and service fees. Based on CWC rate schedules, users would be responsible for the costs once the water main is installed and individual connections are made to the properties:

Estimated Costs for Public Water Service for End Users		
Property Type:	**Residential**	**Commercial**
Service Turn On (one time):	$40.00	$40.00
Basic Service Charge (per month):	$24.02	$76.88
Water Usage (per 1,000 gallons):	$7.34	$6.42

Service connections from the water main to the individual building are included in the cost estimate for each alternative and would not be the responsibility of the individual property owner.

The estimated cost for installing fire hydrants in conjunction with the water main extension is approximately $169,250 for the 8" main base layout alternative and $175,250 for the 12" main base layout option (the only difference being the different size fitting to connect the hydrant assembly to the actual main). This cost estimate is summarized in **Appendix F.**

5.2.8 Consistency with Plans of Conservation and Development

Implementation of this alternative is consistent with the 2007 Adopted Town of Haddam POCD. This alternative would continue to support the land uses highlighted in the POCD; namely the commercial land uses clustered around the Bridge Road (Route 82) and Saybrook Road (Route 154) intersections and the bordering residential use. Designated conservation and preservation lands are not included within the Proposed Water Supply Area, though such lands border the proposed water main route along Route 154 in both Chester and Haddam. However, provisions to limit or prohibit connection to the water main could be implemented to achieve consistency with the POCD. Development opportunities within Tylerville Center may be enhanced as a result of the implementation of this alternative. As discussed in **Section 5.1.3**, four properties within the Proposed Water Supply Area are currently undeveloped.

Further mixed use development is consistent with the State C&D Plan, as defined by the Rural Community Center designation for the Proposed Water Supply Area. The Rural Community Center boundary generally includes all of Tylerville, but extends farther north on Route 154 to an area just north of the Study Area, inclusive of the Saybrook at Haddam (a large assisted living facility). This facility is not considered in the Proposed Water Supply Area and represents the greatest added demand beyond the Proposed Water Supply Area. The Rural Community Center boundary also extends south on Route 154 to areas just south of the Route 82 intersection. Estimated water demands for this area are accounted for in the water demand calculations. It is worth noting that Parcel 22-2 is currently included in the Rural Community Center area, thus development is a possibility. Mixed use development is encouraged within Rural Community Centers. Areas adjacent to the Connecticut River are designated conservation or preservation land.

Short term and long term environmental impacts are limited. Water mains associated with the base and alternative layouts would be installed along the edge of existing roads where rights-of-way exist and service connection construction would be limited. The alternate layout does include more significant environmental impacts related to the Clark Creek stream crossing.

5.2.9 Connecticut Environmental Policy Act

The purpose of the CEPA – administered by the Connecticut Office of Policy & Management - is to identify and evaluate the impacts of proposed State projects ("actions") that could have the potential to significantly affect the environment (for the purposes of CEPA, the term "environment" means "*the physical, biological, social, and economic surroundings and conditions which exist within an area which may be affected by a proposed action including land, air, water, minerals, flora, fauna, noise, objects of historic or aesthetic significance and community or neighborhood characteristics"*). This evaluation enables the State agency proposing or funding a project to judge the appropriateness of proceeding with the action in light of its environmental impacts. The process also provides opportunity for public review and comment through an early public scoping process, as well as later review of an Environmental Impact Evaluation (EIE), if required.

To determine if a given project is subject to CEPA review, the State agency conducting the project must review the generic Environmental Classification Document (ECD). The ECD indicates the types of projects which will automatically require that an EIE be prepared, and one of those may apply to this water supply alternative:

> *II.g Any other action ... which may significantly affect the environment in an adverse manner. The significance of a likely consequence should be assessed by the agency in connection with its setting, its probability of occurring, its duration, its irreversibility, its controllability, its geographic scope and its magnitude.*

The base water main layout is not likely to trigger the requirement to complete an EIE. However, the alternate layout may result in the need to prepare an EIE due to the stream crossing and associated wetlands impacts. There are no provisions or requirements listed in the generic ECD that would require a water main project to complete an EIE (with exception to that listed above). It is worth noting that previous iterations of specific agency ECDs required EIEs if capital improvement grants were to be utilized to fund a water main project when pipe sizing would allow for significant future growth. However, in this case, properties located along the Route 154 corridor from Chester to the Proposed Water Supply Area in Haddam could be restricted from connecting to the water main, thereby preventing undesirable growth in designated preservation and conservation areas.

The following tasks would be completed in order to address CEPA requirements:

- Submit a data request to the National Diversity Database (NDDB) to determine the type and distribution of rare species and/or Significant Natural Communities at the site. The information received from this request would be incorporated into the project description included in the CEPA public notice.

- Publish public notice in the *Environmental Monitor.*

- Review any public comments received and determine if public scoping meeting and EIE is required.

The cost to address CEPA requirements will likely range from approximately $5,000 to $75,000. This is dependent on the necessity to prepare a comprehensive EIE. The schedule would also be dependent on the complexity of the CEPA process and could range from two months to one year to complete the process.

5.2.10 Potential for Future Contamination

Current and historic land uses in the Tylerville area have contributed to adverse groundwater impacts. MTBE, CVOCs and/or 1,4-dioxane have been detected in many drinking water samples collected from the Study Area. Low concentrations of MTBE and CVOCs (not exceeding applicable criteria) have been detected in northern portions of the Study Area. The distribution of COCs within Tylerville is likely to change somewhat with the installation of a water main in the Proposed Water Supply Area and cessation of well use within the Area. However, the contaminant plumes are still expected to flow east/southeast toward the Connecticut River. Detailed environmental investigations would be required to define plume boundaries for both current and future plume migration.

5.2.11 Public Acceptance

The public typically widely accepts connection to a community water supply and distribution system. Eliminating access and use of impacted groundwater is typically considered the main benefit of connection to a community water supply. In addition, residents and business owners would no longer be inconvenienced by on-going, long term visits from contractors for maintenance and monitoring of individual filter systems. Some residents may object to fees associated with public water.

5.2.12 Implementation Schedule

Implementation of this alternative is anticipated to take approximately 12-15 months provided funding is available. This assumes a comprehensive EIE is not required.

6.0 Summary and Recommended Water Supply Alternative

Groundwater contamination in the Tylerville Center area was identified in the late 1970s and early 1980s. The evaluation of contamination focused on the apparent discharge of solvents to groundwater, sodium chloride and MTBE. Several sites where releases have occurred have been identified. This report has identified a Proposed Water Supply Area which encompasses properties with significantly impacted groundwater within the Tylerville Center Study Area.

Water supply alternatives for the Proposed Water Supply Area have been identified and evaluated in accordance with CGS Section 22a-471 and RCSA Section 22a-471-1. The alternatives evaluated included the extension of the existing CWC water distribution system located in the Town of Chester, the development of a local groundwater supply and distribution system, the development of new individual wells, and the continued use of individual water treatment systems. The alternatives were evaluated based on effectiveness in protecting human health, reliability, typical cost, and implementability.

Based on an initial screening process, the development of a local groundwater supply and distribution system and the development of new individual wells were eliminated from detailed evaluation. The extension of the CWC water distribution system and the use of individual water treatment systems were evaluated in detail.

6.1 Recommended Alternative

The recommended alternative to supply potable water to the Proposed Water Supply Area in the Tylerville Center area is the base layout extension of the existing water main from the Town of Chester. Water mains provide the greatest degree of long term reliability, especially in the presence of 1,4-dioxane, which is resistant to treatment with GAC filtration. Under the recommended alternative, drinking water would be supplied to the Proposed Water Supply Area from existing water supply sources monitored and maintained by the CWC. This alternative is preferable to individual GAC treatment systems, which would require consistent, invasive monitoring, carbon canister exchanges, and maintenance over the service life to ensure a continuous supply of potable water. In addition if GAC filters were used, bottled water would still need to be supplied to properties with 1,4-dioxane well water contamination.

Installation of the water main is also the most feasible option for long term water supply. To reiterate, the individual treatment systems would require consistent, periodic monitoring and maintenance, which imposes undue intrusion on residences and business owners. Water mains, while not maintenance free, require far less than the individual treatment option.

Water mains of either an 8” or 12” diameter have been considered for this alternative, and a preliminary evaluation of fire suppression needs and costs has also been completed. CWC has estimated that either an 8” main or 12” main will have sufficient capacity to meet the existing domestic (consumption) demands of the Proposed Water Supply Area. However, the 12” main would provide additional capacity (to the benefit of all stakeholders) and differs only in the additional cost of the 12” pipe. This additional capacity would help to accommodate future development within the Proposed Water Supply Area, consistent with Town and State Plans of Conservation and Development. Also, while the 8” main is marginal in meeting needed residential fire flow requirements, the 12” main is adequate for this purpose and provides additional capacity for greater fire flows needed for larger

individual buildings. Ultimately, the decision as to which water main size to utilize will be made by the Town of Haddam.

Engineering and institutional controls would likely be required to limit human exposure to impacted groundwater in this area. Institutional controls (e.g. CT DPH requirement that properties must connect when they are located within 200 feet of a water main, notifying future property owners) can provide a legally binding means of limiting exposure. Engineering controls consist of proper abandonment of potable wells, or conversion of potable wells to monitoring wells.

CWC is the designated Exclusive Service Provider (ESP) for Tylerville. In the CWC 2004 Water Supply Plan, CWC did not anticipate serving the Tylerville area until the 20/50 year planning periods. However, the recommended alternative does not negatively impact the Margin of Safety (MOS) associated with the CWC Chester Water System. Based on CWC's 2010 Water Service Plan, CWC specifically states that they intend to serve Tylerville within the five year planning period. Based on the projected needs of Tylerville, and Chester's water usage rates, the Chester Water System presently has an adequate margin of safety and excess water under all demand conditions to serve Tylerville. Correspondence between CT DPH and CWC in June 2012 reinforces CWC's commitment to providing Tylerville with adequate potable water and also indicates CT DPH concurrence with this. The correspondence is included in **Appendix G**.

CWC has prepared detailed engineering drawings for the extension of their water distribution system from the Town of Chester into the Tylerville Center area. The plans depict a 12" water main with 8" branch main installation that would provide service to an area that is slightly larger than the Proposed Water Supply Area. These CWC plans are generally consistent with the Base Layout discussed in this study except for minor differences discussed previously. Both CONN DOT and CT DPH review and approval of these plans will be required.

6.1.1 Funding for the Recommended Alternative

The Town of Haddam has initiated the procurement of funds for the water main installation option. The Town of Haddam is planning to apply for Small Town Economic Assistance Program (STEAP) grant for $500K to install a water main extension to Tylerville Center consistent with the Base Layout (Route 154 to Tylerville). In addition to these funds, the Town of Haddam applied to the CT DPH for a Drinking Water State Revolving Fund (DWSRF) loan in the amount of an additional $3M. On February 24, 2011, the State Bond Commission awarded the Town of Haddam $2.1M through the CT DEEP for lateral hookups and well abandonments associated with extension of water mains to the Tylerville area. The Town of Haddam is researching additional funding opportunities to fund the water main installation.

Unallowable Project Costs for State Funding Assistance

Section 22a-471-1 of the Regulations of CT State Agencies (RCSA) establishes the regulatory framework for "Grants to Municipalities and Water Companies for Potable Water Supplies" for situations "where groundwater pollution has rendered existing supplies unusable for potable drinking water." Section 22a-471-1(g)(3) of these regulations states, "those costs which are not necessary for the construction of the potable water supply facilities are unallowable" for state funding assistance under this program. Unallowable project costs associated with the recommended water main extension alternative would be related to costs for fire suppression or use of a 12" water main size, as described below.

Section 22a-471-1(g)(3)(H) of the RCSA identifies as an unallowable project cost, “the incremental cost of a potable water supply facility that provides incremental capacity for fire flow protection.” If fire suppression is included in the water main alternative, the cost to install hydrants would be an unallowable project cost. In addition, if the 12” water main extension is chosen to provide additional capacity for fire flow beyond the capacity of the 8” main, the additional cost for the 12” main would not be eligible for state funding under this program.

Further, Section 22a-471-1(g)(3)(I) of the RCSA states, “for those potable water supply facilities that may provide capacity beyond that necessary to serve the area of contaminated wells or the area of potential contamination, unallowable project costs shall be determined by the following formula…,” which involves a ratio of the difference between the 8” and 12” pipe sizes. Because an 8” pipe size would provide sufficient capacity to convey potable water to the Proposed Water Supply Area, use of a 12” pipe size would result in a reduction in state funding for the water main project amounting to 37% of the total construction contract cost of installing the larger pipe proposed by the municipality.

The Town of Haddam should be aware of these reductions in state funding as project elements are finalized.

7.0 References

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Tables

Table 1

Summary of Applicable Drinking Water Regulatory Criteria and Maximum Concentrations Detected

Parameter	US EPA MCL (µg/L)	CT DPH Drinking Water Action Levels (µg/L)	CT DPH Bathing/Showering Action Levels (µg/L)	Maximum Historic Concentrations (µg/L)	Location, Year	Maximum 2012 Concentrations (µg/L)	Location
1,4-Dioxane	~	3	50	**62**	77 Little Meadow Road, 2012	**62**	77 Little Meadow Road
MTBE	50,000	70	~	**900**	1618 Saybrook Road, 1997	**406**	100 Bridge Road
1,1,1-Trichloroethane	200	200	~	**590**	14 Little Meadow Road, 1997	42	14 Little Meadow Road
Tetrachloroethene	5	5	~	**330**	71 Little Meadow Road, 1991	4.1	14 Little Meadow Road
Trichloroethene	5	1*	~	**1,600**	14 Little Meadow Road, 1996	**340**	77 Little Meadow Road
1,1-Dichloroethene	7	7	~	**180**	14 Little Meadow Road, 1998	**72**	77 Little Meadow Road

Notes:
MCL Maximum Contaminant Level
*Newly established CT DPH Action Level
Bold indicates regulatory exceedance

Table 2
Study Area - Properties, Land Use, and Impacts

AECOM

Street #	Street Address	Land Use Description	Zone	Relative Concentration	Contaminant	Water Treatment	Est. Population	Building Area (ft^2)	Note
Bethel Lane									
10	Bethel Lane	Existing Home	R-2A	Not Sampled	N/A	- - -	4	- - -	
18	Bethel Lane	Existing Home	R-2A	Detections	MTBE	- - -	4	- - -	
Bridge Lane									
6	Bridge Lane	Existing Apartment	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
16	Bridge Lane	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
17	Bridge Lane	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
Bridge Road									
1	Bridge Road	Existing Home	Commercial	Exceedances	CVOCs, Low MTBE	- - -	4	- - -	
22	Bridge Road	Commercial	Commercial	Detections	Low MTBE, Trace CVOCs	- - -	- - -	3,610	
27	Bridge Road	Existing Home	Commercial	Exceedances	CVOCs	- - -	4	- - -	
55/57	Bridge Road	Restaurant/Existing Home	Commercial	Exceedances	CVOCs, Low MTBE, Low 1,4-Dioxane	Filter System	4	12,078	Commercial banquet facility with a single family home on premises. Shares same lot.
56	Bridge Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
61	Bridge Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane, Low MTBE	CT DEEP Filter System	4	- - -	
64	Bridge Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System	4		Serves nine other residences. Additional home on property also considered 6 Bridge Lane.
71	Bridge Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane, Low MTBE	CT DEEP Filter System	4	- - -	
72	Bridge Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
Lot 22-2	Bridge Road	Land - CT DEEP	Industrial/R-2A	Not Sampled	N/A	- - -	0	- - -	Clark Creek Wildlife Management Area. Undeveloped Land. Majority of land zoned for industrial use, frontage along Bridge Road zoned for residential use.
76	Bridge Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane, Low MTBE	CT DEEP Filter System, Bottled Water	4	- - -	
78	Bridge Road	Existing Home	R-2A	Detections	Trace MTBE	- - -	4	- - -	
80	Bridge Road	Existing Home	R-2A	Detections	Low MTBE	- - -	4	- - -	
79/81	Bridge Road	2 Existing Homes	Industrial	Exceedances	CVOCs, 1,4-Dioxane, Low MTBE	2x CT DEEP Filter System/Bottled Water	8	- - -	
82	Bridge Road	Restaurant	Industrial	Detections	Low MTBE	Filter System	- - -	1,993	
85	Bridge Road	Commercial	Industrial	Exceedances	MTBE, Trace CVOCs	Filter System	- - -	2,640	Provided by Mercury Fuel
88	Bridge Road	Self Storage	Industrial	Exceedances	MTBE	- - -	- - -	34,540	Multiple self storage buildings.
95	Bridge Road	Commercial/Industrial	Industrial	Detections	Low MTBE, CVOCs	- - -	- - -	27,624	Multiple buildings: market, industrial buildings
98	Bridge Road	Commercial	Commercial	Exceedances	MTBE, Trace CVOCs	Bottled Water	- - -	1,784	Provided by Mercury Fuel
100	Bridge Road	Commercial	Commercial	Exceedances	MTBE, Trace CVOCs	Filter System	- - -	3,364	Provided by Mercury Fuel
105	Bridge Road	Industrial/Offices	Industrial	Exceedances	MTBE	Bottled Water	- - -	8,512	Multiple vacant buildings: office, 6 bay garage, 4 bay garage
106	Bridge Road	Restaurant/Commercial	Commercial	Detections	Low MTBE	- - -	- - -	5,280	
112	Bridge Road	Commercial	Commercial	Detections	Low MTBE	- - -	- - -	7,900	
116	Bridge Road	Commercial	Commercial	Detections	Trace MTBE	- - -	- - -	1,182	
Camp Bethel Road									
115	Camp Bethel Road	2 Existing Homes	R-2A	Detections	Low MTBE	- - -	8	- - -	
117	Camp Bethel Road	Existing Home	R-2A	Detections	Low MTBE	- - -	4	- - -	
121	Camp Bethel Road	Existing Home	R-2A	Detections	Low MTBE	- - -	4	- - -	
124	Camp Bethel Road	Camp Bethel	R-2A	Detections	Low MTBE	- - -	288	- - -	Two wells located at this property (east and west), historic PCE detection is ND now.
125	Camp Bethel Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
129	Camp Bethel Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
133	Camp Bethel Road	Existing Home	R-2A	Not Sampled	N/A	- - -	4	- - -	
137	Camp Bethel Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
143	Camp Bethel Road	Existing Home	R-2A	Detections	Trace MTBE	- - -	4	- - -	Served by 149 Camp Bethel
149	Camp Bethel Road	Existing Home	R-2A	Detections	Trace MTBE	- - -	4	- - -	Serves 143 Camp Bethel
151	Camp Bethel Road	Existing Home	R-2A	Not Sampled	CVOCs, Low MTBE (64 Bridge Road)	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
155	Camp Bethel Road	Existing Home	R-2A	Not Sampled	CVOCs, Low MTBE (64 Bridge Road)	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
156	Camp Bethel Road	Existing Home	R-2A	Detections	MTBE	- - -	4	- - -	
159	Camp Bethel Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
160	Camp Bethel Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System	4	- - -	
163	Camp Bethel Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System (64 Bridge Road)	4	- - -	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
168	Camp Bethel Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
180	Camp Bethel Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System	4	- - -	
Harper's Landing									
4	Harper's Landing	Marina/Commercial/Residential	Commercial	Detections	Trace CVOCs, Low MTBE	- - -	8	693	Marina with retail space, two residential buildings
Little Meadow Road									
14	Little Meadow Road	Former Camelot Cruises	Commercial	Exceedances	CVOCs, 1,4 Dioxane, low MTBE	- - -	- - -	704	Eagle Landing State Park, Docking for Lady Katherine Cruises
Lot 22-1	Little Meadow Road	Marine Parking -DEP	Commercial	Not Sampled	N/A	- - -	0	- - -	Eagle Landing State Park, Clark Creek Wildlife Management Area
69	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, Low 1,4-Dioxane	CT DEEP Filter System	4	- - -	
71	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane, Low MTBE	CT DEEP Filter System	4	- - -	
74	Little Meadow Road	Existing Home	R-2A	Not Sampled	N/A	- - -	4	- - -	Presence of water supply well unknown
75	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE, Low 1,4-Dioxane	CT DEEP Filter System	4	- - -	
76	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane, Low MTBE	CT DEEP Filter System	4	- - -	
77	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane, Trace MTBE	CT DEEP Filter System/Bottled Water	4	- - -	
78	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE, Low 1,4-Dioxane	CT DEEP Filter System/Bottled Water	4	- - -	
84	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, Low MTBE	CT DEEP Filter System	4	- - -	
88	Little Meadow Road	Existing Home	R-2A	Not Sampled	N/A	- - -	4	- - -	No well at property
90	Little Meadow Road	Existing Home	R-2A	Not Sampled	N/A	- - -	4	- - -	No well at property
94	Little Meadow Road	Existing Home	R-2A	Not Sampled	N/A	- - -	4	- - -	Well identified at property
98	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs	- - -	4	- - -	
102	Little Meadow Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
104	Little Meadow Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
106	Little Meadow Road	Existing Home	R-2A	Detections	Trace MTBE	- - -	4	- - -	

Table 2
Study Area - Properties, Land Use, and Impacts

AECOM

Street #	Street Address	Land Use Description	Zone	Relative Concentration	Contaminant	Water Treatment	Est. Population	Building Area (ft^2)	Note
109	Little Meadow Road	Existing Home	R-2A	Detections	Trace CVOCs	- - -	4	- - -	
110	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs	CT DEEP Filter System	4	- - -	
116	Little Meadow Road	Existing Home and Apartment	R-2A	Detections	Trace MTBE	- - -	8	- - -	
120	Little Meadow Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
124	Little Meadow Road	Existing Home	R-2A	Non Detections	ND	- - -	4	- - -	
128	Little Meadow Road	2 Existing Homes	R-2A	Detections	MTBE	- - -	8	- - -	
130	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane	CT DEEP Filter System	4	- - -	
134	Little Meadow Road	Existing Home	R-2A	Exceedances	CVOCs, 1,4-Dioxane	CT DEEP Filter System	4	- - -	
Old Chester Road-North									
0	Old Chester Road-N	Land	Commercial	Not Sampled	N/A	- - -	4	- - -	Undeveloped land
Saybrook Road									
1556	Saybrook Road	72 Unit Health Care Facility	Commercial	Detections	Trace MTBE	- - -	150	- - -	
1557	Saybrook Road	Existing Home	Commercial	Detections	Trace MTBE	- - -	4	- - -	
1564	Saybrook Road	Industrial Buildings/Residential	Industrial	Detections	Trace MTBE (1572 Saybrook Road)	- - -	4	8,909	Served by 1572 Saybrook Road. Three buildings: industrial, warehouse, home. Applications/hearing scheduled for redevelopment. New lots will have individual wells.
1565	Saybrook Road	Commerical/Residential	Commercial	Not Sampled	N/A	- - -	4	2,891	Per Town of Haddam - Water supply well on property
1569	Saybrook Road	Apartments Residential	Commercial	Not Sampled	N/A	- - -	8	1,900	Per Town of Haddam - Water supply well on property
1572	Saybrook Road	Existing 2 Family Residential	Commercial	Detections	Trace MTBE	- - -	- - -	3,036	Well also serves 1564 Saybrook Road, to be redeveloped
1573	Saybrook Road	Auto Service/Residential	Commercial	Detections	MTBE, CVOCs	- - -	4	2,368	Significant Hazard #607 Notification 1/17/2007, No action required
1583	Saybrook Road	Commercial	Commercial	Non Detections	ND	- - -	- - -	7,470	
1584	Saybrook Road	Commercial/Residential	Commercial	Not Sampled	N/A	- - -	- - -	1,805	
1586	Saybrook Road	Industrial Buildings/Residential	Industrial	Detections	Low MTBE	- - -	4	27,465	Multiple buildings: 2 industrial, 1 residential
1588	Saybrook Road	Commercial/Residential	Commercial	Detections	Low MTBE	- - -	- - -	2,737	
1598	Saybrook Road	Service Station	Commercial	Detections	Low MTBE	- - -	- - -	1,972	
1609	Saybrook Road	Commercial/Office	Commercial	Detections	Low CVOCs, Trace MTBE	- - -	- - -	1,152	
1610	Saybrook Road	Restaurant/Commercial/Res	Commercial	Exceedances	MTBE	Bottled Water	4	11,707	Multiple commercial buildings, two wells at this location. Currently receiving bottled water, will soon utilize two filter systems.
1617	Saybrook Road	Restaurant/Residential	Commercial	Non Detections	ND	- - -	4	4,624	
1618	Saybrook Road	Service Station/Commercial	Commercial	Exceedances	MTBE	Filter System	- - -	7,466	Multiple buildings: service station, commercial, 3 service bays
1640	Saybrook Road	ConnDOT Facility	Industrial	Exceedances	CVOCs	- - -	- - -	19,824	
South Side Bluff									
16	South Side Bluff	Existing Home	R-2A	Detections	Trace MTBE	- - -	4	- - -	
22	South Side Bluff	Existing Home	R-2A	Detections	Trace MTBE	- - -	4	- - -	
26	South Side Bluff	Existing Home	R-2A	Detections	Low MTBE	- - -	4	- - -	
30	South Side Bluff	Existing Home	R-2A	Detections	Trace MTBE, Trace CVOCs	- - -	4	- - -	

Notes:
MTBE - Methyl Tert-Butyl Ether
CVOC - Chlorinated Volatile Organic Compound
N/A - No access or no well present
ND - Non detection

Table 3
Proposed Water Supply Area
List of Included Properties

AECOM

Street #	Street Address	Land Use Description	Zone	Current Water Treatment	Note
Bridge Lane					
6	Bridge Lane	Existing Apartment	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
16	Bridge Lane	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
17	Bridge Lane	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
Bridge Road					
1	Bridge Road	Existing Home	Commercial		
22	Bridge Road	Commercial	Commercial		
27	Bridge Road	Existing Home	Commercial		
55/57	Bridge Road	Restaurant/Existing Home	Commercial	Filter System	Commercial banquet facility with a single family home on premises. Shares same lot.
56	Bridge Road	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
61	Bridge Road	Existing Home	R-2A	CT DEEP Filter System	
64	Bridge Road	Existing Home	R-2A	CT DEEP Filter System	Serves nine other residences. Additional home on property also considered 6 Bridge Lane.
71	Bridge Road	Existing Home	R-2A	CT DEEP Filter System	
72	Bridge Road	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
Parcel 22-2	Bridge Road	Land - CT DEEP	Industrial/R-2A		Clark Creek Wildlife Management Area. Undeveloped land. Majority of land zoned for industrial use, frontage along Bridge Road zoned for residential use.
76	Bridge Road	Existing Home	R-2A	CT DEEP Filter System/Bottled Water	
78	Bridge Road	Existing Home	R-2A		
80	Bridge Road	Existing Home	R-2A		
79/81	Bridge Road	2 Existing Homes	Industrial	2x CT DEEP Filter System/Bottled Water	
82	Bridge Road	Restaurant	Industrial	Filter System	
85	Bridge Road	Commercial	Industrial	Filter System	Supplied by Mercury Fuel.
88	Bridge Road	Self Storage	Industrial		
95	Bridge Road	Commercial/Industrial	Industrial		Supplied by Mercury Fuel.
98	Bridge Road	Commercial	Commercial	Bottled Water	Supplied by Mercury Fuel.
100	Bridge Road	Commercial	Commercial	Filter System	Supplied by Mercury Fuel.
105	Bridge Road	Industrial/Offices	Industrial	Bottled Water	Currently vacant.
106	Bridge Road	Restaurant/Commercial	Commercial		
112	Bridge Road	Commercial	Commercial		
116	Bridge Road	Commercial	Commercial		
Camp Bethel Road					
143	Camp Bethel Road	Existing Home	R-2A		Served by 149 Camp Bethel
149	Camp Bethel Road	Existing Home	R-2A		Serves 143 Camp Bethel
151	Camp Bethel Road	Existing Home	R-2A		
155	Camp Bethel Road	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
156	Camp Bethel Road	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
159	Camp Bethel Road	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
160	Camp Bethel Road	Existing Home	R-2A	CT DEEP Filter System	
163	Camp Bethel Road	Existing Home	R-2A	CT DEEP Filter System (64 Bridge Road)	Served by 64 Bridge Road. Receives filtered water from 64 Bridge Road.
168	Camp Bethel Road	Existing Home	R-2A		
180	Camp Bethel Road	Existing Home	R-2A	CT DEEP Filter System	

Table 3
Proposed Water Supply Area
List of Included Properties

Street #	Street Address	Land Use Description	Zone	Current Water Treatment	Note
Harper's Landing					
4	Harper's Landing	Marina/Commercial/Residential	Commercial		Marina with retail space, two residential buildings
Little Meadow Road					
14	Little Meadow Road	Former Camelot Cruises	Commercial		Eagle Landing State Park, docking for Lady Katherine Cruises
Lot 22-1	Little Meadow Road	Marine Parking -DEP	Commercial		Eagle Landing State Park
69	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
71	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
74	Little Meadow Road	Existing Home	R-2A		Presence of water supply well unknown
75	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
76	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
77	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System/Bottled Water	
78	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System/Bottled Water	
84	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
88	Little Meadow Road	Existing Home	R-2A		No well at property
90	Little Meadow Road	Existing Home	R-2A		No well at property
94	Little Meadow Road	Existing Home	R-2A		Well present
98	Little Meadow Road	Existing Home	R-2A		
102	Little Meadow Road	Existing Home	R-2A		
104	Little Meadow Road	Existing Home	R-2A		
106	Little Meadow Road	Existing Home	R-2A		
109	Little Meadow Road	Existing Home	R-2A		
110	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
116	Little Meadow Road	Existing Home and Apartment	R-2A		
120	Little Meadow Road	Existing Home	R-2A		
124	Little Meadow Road	Existing Home	R-2A		
128	Little Meadow Road	2 Existing Homes	R-2A		
130	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
134	Little Meadow Road	Existing Home	R-2A	CT DEEP Filter System	
Old Chester Road-North					
0	Old Chester Road-N	Land	Commercial		
Saybrook Road					
1557	Saybrook Road	Existing Home	Commercial		
1564	Saybrook Road	Existing Garage	Industrial		Served by 1572 Saybrook Road. Three buildings: 8 bay garage, warehouse, home. Applications/hearing scheduled for redevelopment.
1565	Saybrook Road	Commerical/Residential	Commercial		Per Town of Haddam - Water supply well on property
1569	Saybrook Road	Apartments Residential	Commercial		Per Town of Haddam - Water supply well on property
1572	Saybrook Road	Existing 2 Family Residential	Commercial		Well also serves 1564 Saybrook Road. Applications/hearing scheduled for redevelopment.
1573	Saybrook Road	Auto Service/Residential	Commercial		Significant Hazard #607 Notification 1/17/2007, No action required
1583	Saybrook Road	Commercial	Commercial		
1584	Saybrook Road	Commercial/Residential	Commercial		
1586	Saybrook Road	Industrial Buildings/Residential	Industrial		Multiple buildings: 2 industrial, 1 residential
1588	Saybrook Road	Commercial/Residential	Commercial		
1598	Saybrook Road	Service Station	Commercial		
1609	Saybrook Road	Commercial/Office	Commercial		
1610	Saybrook Road	Restaurant/Commercial/Res	Commercial	Bottled Water	Multiple commercial buildings, two wells at this location. Property owner is having two filter systems installed at this location.
1617	Saybrook Road	Restaurant/Residential	Commercial		
1618	Saybrook Road	Service Station/Commercial	Commercial	Filter System	Multiple buildings: service station, commercial
1640	Saybrook Road	ConnDOT Facility	Industrial		
South Side Bluff					
16	South Side Bluff	Existing Home	R-2A		
22	South Side Bluff	Existing Home	R-2A		
26	South Side Bluff	Existing Home	R-2A		
30	South Side Bluff	Existing Home	R-2A		

Table 4
Proposed Water Supply Area - Water Use Calculations
Existing Site Uses

AECOM

Residential							
Land Use	Building Type	Quantity	People	Water Demand GPD/Person*	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Residential	Single Family	64	4	75	19,200	28,800	107
Residential	Mixed Use Apartment	4	2	75	600	900	3
Residential	Multi-family	1	8	75	600	900	3
Commercial/Industrial							
Food Service							
Land Use	Address	Square Footage	Seats/Meals	Water Demand GPD/(Seat/Meals)**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Banquet	55/57 Bridge Road	12,078	300	30	6,000	9,000	33
Carry-out Food Service[1]	1610 Saybrook Road	5,347	100	5	500	750	3
Carry-out Food Service[1]	82 Bridge Road	1,993	100	5	500	750	3
Carry-out Food Service[1]	106 Bridge Road	NA	100	5	500	750	3
Restaurant[2]	106 Bridge Road	NA	25	30	750	1,125	4
Restaurant[2]	1617 Saybrook Road	4,624	50	30	1,500	2,250	8
Automotive Service							
Land Use	Address	Square Footage	Vehicles Serviced	Water Demand GPD/Vehicle**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Commercial Garage[3]	105 Bridge Road	4,452	40	5	200	300	1
Storage Building/Garage	105 Bridge Road	1,540					
Commercial Garage[3]	1573 Saybrook Road	2,368	12	5	60	90	1
Commercial Garage[3]	1618 Saybrook Road	4,316	12	5	60	90	1
DOT Garage[4]	1640 Saybrook Road	19,824	24	5	120	180	1
Office Space							
Land Use	Address	Square Footage	People (200 sq. ft/person)	Water Demand GPD/Person**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Chiropractic	1609 Saybrook Road	1,152	6	20	115	173	1
Office/Park	14 Little Meadow Road	704	4	20	70	106	1
Lady Katherine Cruises[5]	14 Little Meadow Road	NA	NA	NA	263	395	1
Office	105 Bridge Road	2,520	13	20	252	378	1
Office	116 Bridge Road	1,182	6	20	118	177	1
Office	1610 Saybrook Road	668	3	20	67	100	1
Office	98 Bridge Road	1,784	9	20	178	268	1
Office	1588 Saybrook Road	2,737	14	20	274	411	2
Office	1584 Saybrook Road	1,805	9	20	181	271	1
Retail Space							
Land Use	Address	Square Footage		Water Demand GPD/sq. ft**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Retail	22 Bridge Road	3,610		0.1	361	542	2
Retail/Marina	4 Harper's Landing	693		0.1	69	104	1
Retail	85 Bridge Road	2,640		0.1	264	396	1
Retail	100 Bridge Road	3,364		0.1	336	505	2
Retail	106 Bridge Road	1,000		0.1	100	150	1
Retail	106 Bridge Road	1,000		0.1	100	150	1
Retail	112 Bridge Road	7,900		0.1	790	1,185	4
Retail	1583 Saybrook Road	7,470		0.1	747	1,121	4
Retail	1618 Saybrook Road	1,560		0.1	156	234	1
Retail	1610 Saybrook Road	5,692		0.1	569	854	3
Retail Petroleum	1618 Saybrook Road	1,350		0.1	135	203	1
Retail Petroleum	1598 Saybrook Road	1,972		0.1	197	296	1
Retail	1572 Saybrook Road	1,746		0.1	175	262	1
Retail/Bakery	1565 Saybrook Road	2,891		0.1	289	434	2
Supermarket	95 Bridge Road	17,136		0.1	1,714	2,570	10
Industrial Space							
Land Use	Address	Square Footage		Water Demand GPD/sq. ft**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Industrial	88 Bridge Road	34,540		0.1	3,454	5,181	19
Industrial	95 Bridge Road	6,000		0.1	600	900	3
Industrial	95 Bridge Road	4,488		0.1	449	673	2
Industrial	1564 Saybrook Road	6,000		0.1	600	900	3
Industrial	1564 Saybrook Road	2,909		0.1	291	436	2
Industrial	1586 Saybrook Road	15,465		0.1	1,547	2,320	9
Warehouse	1586 Saybrook Road	12,000		0.1	1,200	1,800	7
Totals							
					AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
				SUBTOTALS	46,251	69,376	260
				TOTAL (GPD) Assumed additional 10% for unaccounted water	50,876	76,314	
				TOTAL (GPM) Assumed flow divided by 16 hours	53	79	

Notes:

[1] Estimated 100 meals/day

[2] Estimated number of seats

[3] Estimated 4 vehicles/day/garage bay

[4] Estimated 1 vehicle/day/garage bay

[5] Estimated usage for 6 months/year

* Values from CT Department of Public Health

**Values from CT Public Health Code, Table 4

Table 5
Proposed Water Supply Area - Maximum Development
Undeveloped Parcels and Parcels in Application/Hearing Process

AECOM

Potential Development/Redevelopment - Maximum Build Out Scenario							
Land Use	Address	Maximum Square Footage[1]	Use/Pop.	Estimated Water Demand GPD/Person* or sq. ft**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Residential and Industrial	Parcel 22-2, Bridge Road						
Residential (Frontage on Bridge Road, potential for 2 lots)		NA	8	75	600	900	3
Interior Portion of the Lot- Industrial (~15 Acres)		163,350	NA	0.1	16,335	24,503	91
Commercial	Parcel 2-1, Old Chester Road North (6 Acres)	104,500	NA	0.1	10,450	15,675	58
Industrial/Commercial	1564 Saybrook Road (8.33 Acres) Redevelopment						
	TBD - 3 Commercial Lots	98,272	NA	0.1	9,827	14,741	55
	TBD - 2 Industrial Lots	40,947	NA	0.1	4,095	6,142	23
Totals							
					AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
				SUBTOTALS	41,307	61,960	229
				TOTAL (GPD) Assumed additional 10% for unaccounted water	45,437	68,156	
				TOTAL (GPM) Assumed flow divided by 16 hours	47	71	

Notes:

[1]Estimated maximum build out based on Haddam Town Planner input (% of total lot size- 25% industrial, 40% commercial)

* Values from CT Department of Public Health

**Values from CT Public Health Code, Table 4

Table 6
Route 154 - Water Use Calculations
Existing Site Uses

AECOM

Chester - From Denlar Drive to Town Line							
Residential							
Land Use	Building Type	Quantity	People	Water Demand GPD/Person*	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Residential[1]	Single Family	13	4	75	3,900	5,850	22
Commercial							
Land Use	Address	Square Feet[2]	Population, Beds, Slips	Water Demand GPD/sq. ft/bed/slip**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Commercial- Motor Sports	244 Middlesex Turnpike	2,500	NA	0.1	250	375	1
Commercial- Veterinary Clinic	264 Middlesex Turnpike	2,500	NA	0.2	500	750	3
Commercial- Assisted Living	268 Middlesex Turnpike	2,500	16	150	2,400	3600	13
Commercial- Marina	276 Middlesex Turnpike	2,500	50	20	1,000	1500	6
Haddam - From Town Line to Water Supply Area							
Residential							
Land Use	Building Type	Quantity	People	Water Demand GPD/Person*	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Residential[3]	Single Family	17	4	75	5,100	7,650	28
Commercial							
Land Use	Address	Square Feet		Water Demand GPD/sq. ft**	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
Commercial	1697 Saybrook Road	2,732		0.1	273	409.8	2
Commercial- Veterinary Clinic	1721 Saybrook Road	2,760		0.2	552	828	3
Totals							
					AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
				SUBTOTAL	13,975	20,963	78
				TOTAL (GPD) Assumed additional 10% for unaccounted water	15,373	23,059	
				TOTAL (GPM) Assumed flow divided by 16 hours	16	24	

Notes:
* Values from CT Department of Public Health
**Values from CT Public Health Code, Table 4
[1]Online database not available for Chester- assume 50% of all residential lots are developed
[2]Square footage assumed
[3] 17 of 21 lots developed

Table 7
Summary of Water Use Calculations

AECOM

Proposed Water Supply Area (Tylerville) Totals - Existing Demand	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
SUBTOTAL	46,251	69,376	260
TOTAL (GPD) Assumed additional 10% for unaccounted water	50,876	76,314	
TOTAL (GPM) Assumed flow divided by 16 hours	53	79	

Route 154 - Chester/Haddam Adjoining Properties - Existing Demand	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
SUBTOTAL	13,975	20,963	78
TOTAL (GPD) Assumed additional 10% for unaccounted water	15,373	23,059	
TOTAL (GPM) Assumed flow divided by 16 hours	16	24	

Totals for Proposed Water Supply Area (Tylerville) and Route 154 - Chester/Haddam - Existing Demand	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
SUBTOTAL	60,226	90,339	338
TOTAL (GPD) Assumed additional 10% for unaccounted water	66,249	99,373	
TOTAL (GPM) Assumed flow divided by 16 hours	69	104	

Proposed Water Supply Area (Tylerville) - Maximum Buildout Parcels Additional Demand	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
SUBTOTAL	41,307	61,960	229
TOTAL (GPD) Assumed additional 10% for unaccounted water	45,437	68,156	
TOTAL (GPM) Assumed flow divided by 16 hours	47	71	

Totals for Proposed Water Supply Area (Tylerville) and Route 154 - Chester/Haddam - Maximum Buildout Scenario	AVG. Daily Demand (ADD) (gpd)	MAX Day Flow (ADD X 1.5) (gpd)	PEAK Hour Flow (ADD/3) (gpm)
*TOTAL	100,342	150,513	557
TOTAL (GPD) Assumed additional 10% for unaccounted water	110,376	165,564	
TOTAL (GPM) Assumed flow divided by 16 hours	115	172	

Note:
* Total Maximum Buildout Scenario ADD does not include existing water demand at 1564 Saybrook Road. Redevelopment plans include demolition of the existing building.

Table 8
Proposed Water Supply Area
Individual Water Treatment Summary

Street #	Street Address	Water Treatment System	Note
Bridge Lane			
6	Bridge Lane	Standard	Served by 64 Bridge Road
16	Bridge Lane	Standard	Served by 64 Bridge Road
17	Bridge Lane	Standard	Served by 64 Bridge Road
Bridge Road			
1	Bridge Road	Standard	
22	Bridge Road	Standard	
27	Bridge Road	Standard	
55/57	Bridge Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
56	Bridge Road	Standard	Served by 64 Bridge Road
61	Bridge Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
64	Bridge Road	Standard	Serves nine other residences
71	Bridge Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
72	Bridge Road	Standard	Served by 64 Bridge Road
Parcel 22-2	Bridge Road	Standard	
76	Bridge Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
78	Bridge Road	Standard	
80	Bridge Road	Standard	
79/81	Bridge Road	**2x Enhanced/ Bottled Water**	1,4-Dioxane present
82	Bridge Road	Standard	
85	Bridge Road	Standard	
88	Bridge Road	Standard	
95	Bridge Road	Standard	
98	Bridge Road	Standard	
100	Bridge Road	Standard	
105	Bridge Road	Standard	
106	Bridge Road	Standard	
112	Bridge Road	Standard	
116	Bridge Road	Standard	
Camp Bethel Road			
143	Camp Bethel Road	Standard	Served by 149 Camp Bethel
149	Camp Bethel Road	Standard	Serves 143 Camp Bethel
151	Camp Bethel Road	Standard	Served by 64 Bridge Road
155	Camp Bethel Road	Standard	Served by 64 Bridge Road
156	Camp Bethel Road	Standard	
159	Camp Bethel Road	Standard	Served by 64 Bridge Road
160	Camp Bethel Road	Standard	
163	Camp Bethel Road	Standard	Served by 64 Bridge Road
168	Camp Bethel Road	Standard	
180	Camp Bethel Road	Standard	
Harper's Landing			
4	Harper's Landing	Standard	
Little Meadow Road			
14	Little Meadow Road	**Enhanced/ Bottled Water**	Eagle Landing State Park
Parcel 22-1	Little Meadow Road	Standard	Clark Creek Wildlife Management Area. No well at property - will require a filter if well is installed
69	Little Meadow Road	Standard	
71	Little Meadow Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
74	Little Meadow Road	Standard	Presence of water supply well unknown

Table 8
Proposed Water Supply Area
Individual Water Treatment Summary

Street #	Street Address	Water Treatment System	Note
75	Little Meadow Road	**Enhanced/ Bottled Water**	
76	Little Meadow Road	**Enhanced/ Bottled Water**	
77	Little Meadow Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
78	Little Meadow Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
84	Little Meadow Road	Standard	
88	Little Meadow Road	Standard	No well at property - will require a filter if well is installed
90	Little Meadow Road	Standard	No well at property - will require a filter if well is installed
94	Little Meadow Road	Standard	Well present
98	Little Meadow Road	Standard	
102	Little Meadow Road	Standard	
104	Little Meadow Road	Standard	
106	Little Meadow Road	Standard	
109	Little Meadow Road	Standard	
110	Little Meadow Road	Standard	
116	Little Meadow Road	Standard	
120	Little Meadow Road	Standard	
124	Little Meadow Road	Standard	
128	Little Meadow Road	Standard	
130	Little Meadow Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
134	Little Meadow Road	**Enhanced/ Bottled Water**	1,4-Dioxane present
Old Chester Road-North			
0	Old Chester Road-N	Standard	Will require a filter when developed
Saybrook Road			
1557	Saybrook Road	Standard	
1564	Saybrook Road	5x Standard	Served by 1572 Saybrook Road, total of 5 lots proposed for 1564 Saybrook Road, thus 5 filter systems will be required once developed
1565	Saybrook Road	Standard	Per Town of Haddam - Water supply well on property
1569	Saybrook Road	Standard	Per Town of Haddam - Water supply well on property
1572	Saybrook Road	Standard	Well also serves 1564 Saybrook Road
1573	Saybrook Road	Standard	Significant Hazard #607 Notification 1/17/2007, No action required
1583	Saybrook Road	Standard	
1584	Saybrook Road	Standard	
1586	Saybrook Road	Standard	
1588	Saybrook Road	Standard	
1598	Saybrook Road	Standard	
1609	Saybrook Road	Standard	
1610	Saybrook Road	2x Standard	Two wells located at this property
1617	Saybrook Road	Standard	
1618	Saybrook Road	Standard	
1640	Saybrook Road	Standard	
South Side Bluff			
16	South Side Bluff	Standard	
22	South Side Bluff	Standard	
26	South Side Bluff	Standard	
30	South Side Bluff	Standard	

Standard - 2 canister granular activated carbon filtration system
Enhanced - 3 canister granular activated carbon filtration system

Table 9
Proposed Water Supply Area - Individual Water Treatment
Cost Overview

Item Description - Capital Cost	Unit	Quantity	Unit Cost	Total	Present Value
Standard Residential - Commercial GAC System	EA	76	$2,445	$185,820	$185,820
Enhanced Residential - Commercial GAC System	EA	14	$3,055	$42,770	$42,770
Remove existing POU equipment	EA	23	$1,200	$27,600	$27,600
Bottled Water - Residential Properties	EA	12	$200	$2,400	$2,400
Bottled Water - Commercial Properties	EA	2	$200	$400	$400
Initial GW Monitoring, Engineering Design	LS	1	$20,000	$20,000	$20,000
Contingency (25%)				$69,748	$69,748
Capital Cost Total				$348,738	$348,738

Item Description - O&M Cost (20 year horizon)	Unit	Quantity	Unit Cost	Annual Cost	Present Value
Standard System GAC changeout (every third year/20 years)*	EA	76	$765	$58,140	$289,957
Enhanced GAC changeout (annually for 20 years)**	EA	14	$1,085	$15,190	$225,989
Sediment Filter changeout (monthly x 20 years)***	EA	90	$110	$9,900	$147,287
Standard System Monitoring (quarterly - years 0-5)	EA	300	$325	$97,500	$446,521
Standard System Monitoring (semi-annual - years 6-20)	EA	150	$325	$48,750	$502,016
Enhanced System Monitoring (quarterly - years 0-5)	EA	60	$500	$30,000	$137,391
Enhanced System Monitoring (semi-annual years 6-20)	EA	30	$500	$15,000	$154,467
Bottled Water - Residential Properties***	EA	144	$200	$28,800	$428,471
Bottled Water - Commercial Properties***	EA	24	$200	$4,800	$71,412
Subtotal				$308,080	$2,403,512
Emergency on-call service allowance					$150,000
Contingency (25%)					$600,878
O&M Cost Total					$3,154,390

*Costs are calculated for one filter changeout/one filter rotation every third year
**Costs are calculated under the assumption that two filters will be changed out/one filter rotated annually
***Costs are calculated on an annualized basis

Table 10
Proposed Water Supply Area - Proposed 8" Water Main Extension
Preliminary Capital Cost Estimate Summary

(8-Inch) Base Layout - Route 154 to Tylerville Center

Item Description	Total Cost
Route 154, Chester Section - CWC connection to Chester/Haddam line	$992,000
Route 154, Haddam Section - Chester/Haddam line to Bridge Road area	$2,698,000
Bridge Road (Rt. 82) Section	$1,166,000
Bridge Lane Section	$99,000
Little Meadow Road Section	$842,000
Camp Bethel Road Section	$231,000
South Side Bluff Section	$153,000
Service Connections and Well Abandonment	$469,750
Engineering Design, Permitting, Legal	$175,000
Total	**$6,825,750**

(8-Inch) Alternate Layout - Route 154 to Little Meadow Road to Tylerville Center

Item Description	Total Cost
Route 154, Chester Section - CWC connection to Chester/Haddam line	$992,000
Route 154, Haddam Section - Chester/Haddam line to Little Meadow Road Connector and Route 154 Section within Water Supply Area	$1,701,000
Bridge Road (Rt. 82) Section	$1,166,000
Bridge Lane Section	$99,000
Little Meadow Road Section & Route 154 Connector	$1,312,000
Camp Bethel Road Section	$231,000
South Side Bluff Section	$153,000
Service Connections and Well Abandonment	$469,750
Engineering, Design, Permitting, Legal	$245,000
Total	**$6,368,750**

Table 11
Proposed Water Supply Area - Proposed 12" Water Main Extension
Preliminary Capital Cost Estimate Summary

AECOM

(12-Inch) Base Layout - Route 154 to Tylerville Center

Item Description	Total Cost
Route 154, Chester Section - CWC connection to Chester/Haddam line	$1,126,000
Route 154, Haddam Section - Chester/Haddam line to Bridge Road area	$2,995,000
Bridge Road (Rt. 82) Section	$1,296,000
Bridge Lane Section	$99,000
Little Meadow Road Section	$842,000
Camp Bethel Road Section	$184,000
South Side Bluff Section	$153,000
Service Connections and Well Abandonment	$469,750
Engineering Design, Permitting, Legal	$175,000
Total	**$7,339,750**

(12-Inch) Alternate Layout - Route 154 to Little Meadow Road to Tylerville Center

Item Description	Total Cost
Route 154, Chester Section - CWC connection to Chester/Haddam line	$1,126,000
Route 154, Haddam Section - Chester/Haddam line to Little Meadow Road Connector and Route 154 Section within Water Supply Area	$1,887,000
Bridge Road (Rt. 82) Section	$1,296,000
Bridge Lane Section	$99,000
Little Meadow Road Section & Route 154 Connector	$1,487,000
Camp Bethel Road Section	$184,000
South Side Bluff Section	$153,000
Service Connections and Well Abandonment	$469,750
Engineering, Design, Permitting, Legal	$245,000
Total	**$6,946,750**

Figures

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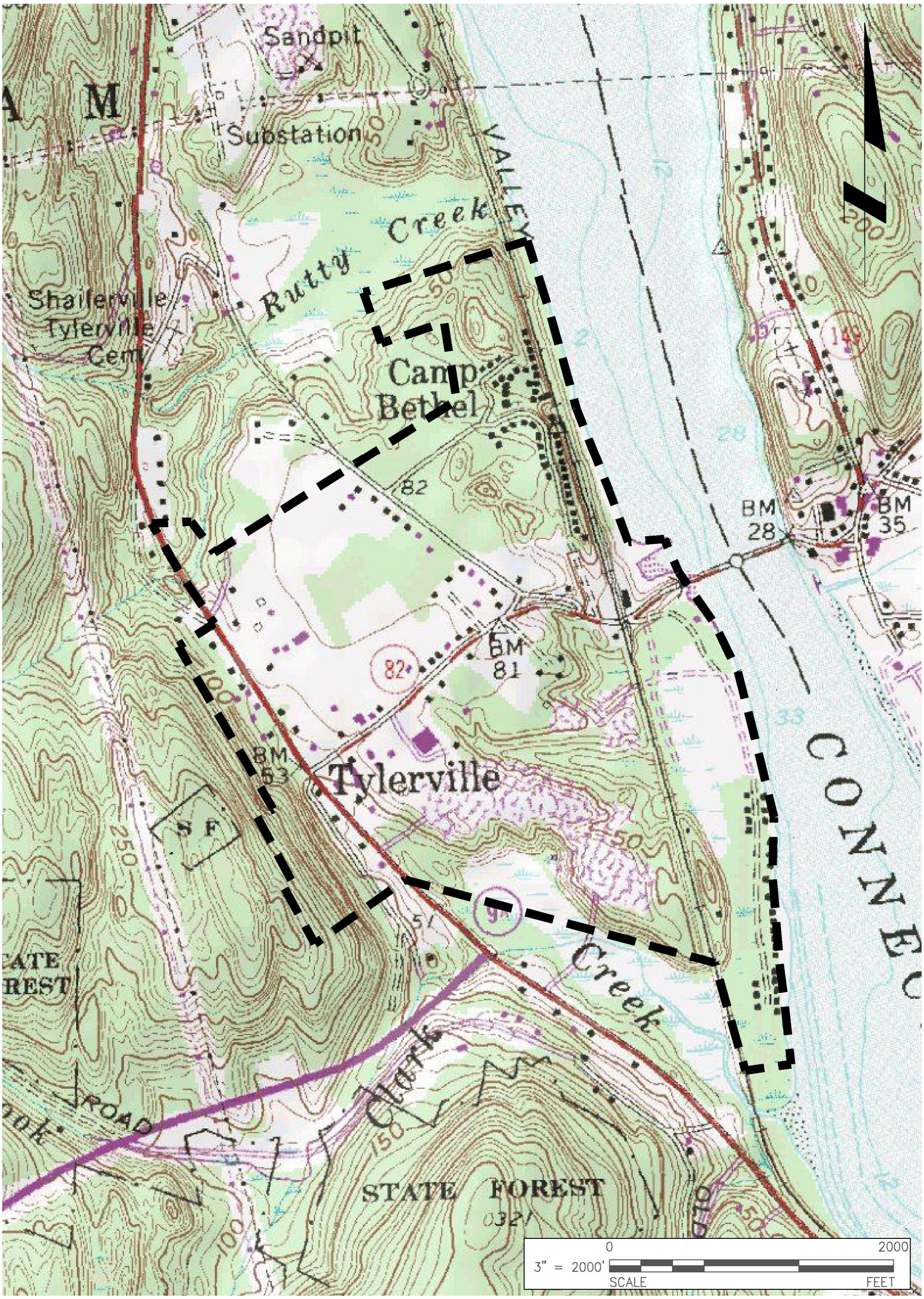

LEGEND:

▪▪▪ APPROXIMATE BOUNDARY OF TYLERVILLE CENTER STUDY AREA

FIGURE:

1-A

AECOM

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500 ENTERPRISE DR, STE 1A
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SITE LOCATION MAP
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 3" = 2000' | DATE: 5/13/13 | PN: 60285195

MAP SOURCE: MyTopo.com

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LEGEND:

GENERAL LOCATION OF STUDY AREA

FIGURE:

1-B

AECOM

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SITE LOCATION MAP
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 3" = 3500' | DATE: 5/13/13 | PN: 60285195

MAP SOURCE: Connecticut 2008 NAIP 4 Band Color and Color Infrared Orthophoto

Publication Date: 3/10/09

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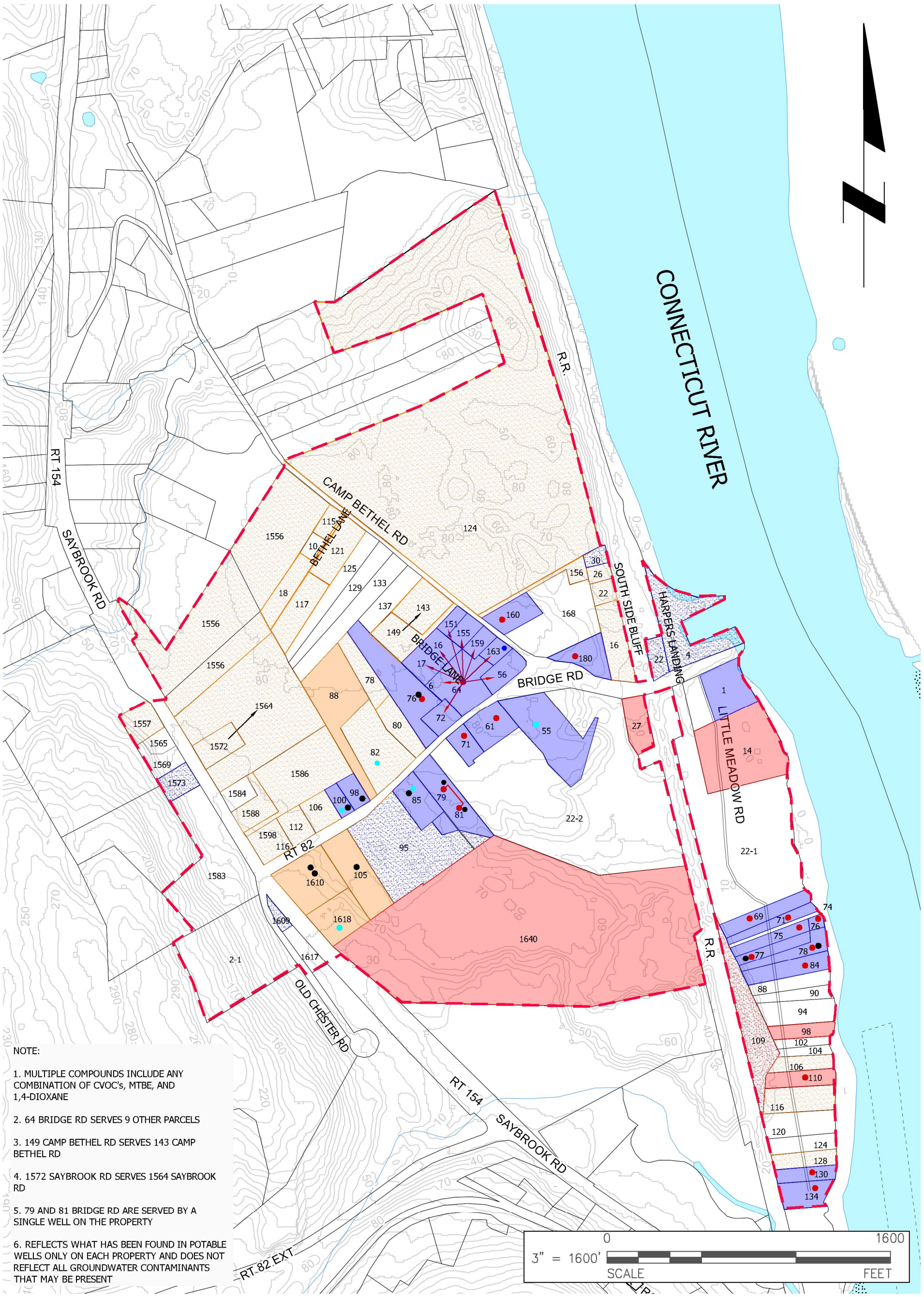

NOTE:

1. MULTIPLE COMPOUNDS INCLUDE ANY COMBINATION OF CVOC's, MTBE, AND 1,4-DIOXANE

2. 64 BRIDGE RD SERVES 9 OTHER PARCELS

3. 149 CAMP BETHEL RD SERVES 143 CAMP BETHEL RD

4. 1572 SAYBROOK RD SERVES 1564 SAYBROOK RD

5. 79 AND 81 BRIDGE RD ARE SERVED BY A SINGLE WELL ON THE PROPERTY

6. REFLECTS WHAT HAS BEEN FOUND IN POTABLE WELLS ONLY ON EACH PROPERTY AND DOES NOT REFLECT ALL GROUNDWATER CONTAMINANTS THAT MAY BE PRESENT

LEGEND:

		EXCEEDANCE	DETECTION	CURRENT WATER TREATMENT
STUDY AREA		CVOC's	CVOC's	FILTER
123	ADDRESS NO.	MTBE	MTBE	BOTTLED WATER
2-1	PARCEL #	MULTIPLE COMPOUNDS	MULTIPLE COMPOUNDS	DEEP FILTER
				WELL SERVICE

FIGURE: 2

AECOM

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STUDY AREA

CHARACTERISTICS AND IMPACTS - BY COC

TYLERVILLE WATER SUPPLY STUDY

HADDAM, CONNECTICUT

SCALE: 3" = 1600' | DATE: 5/13/13 | PN: 60285195

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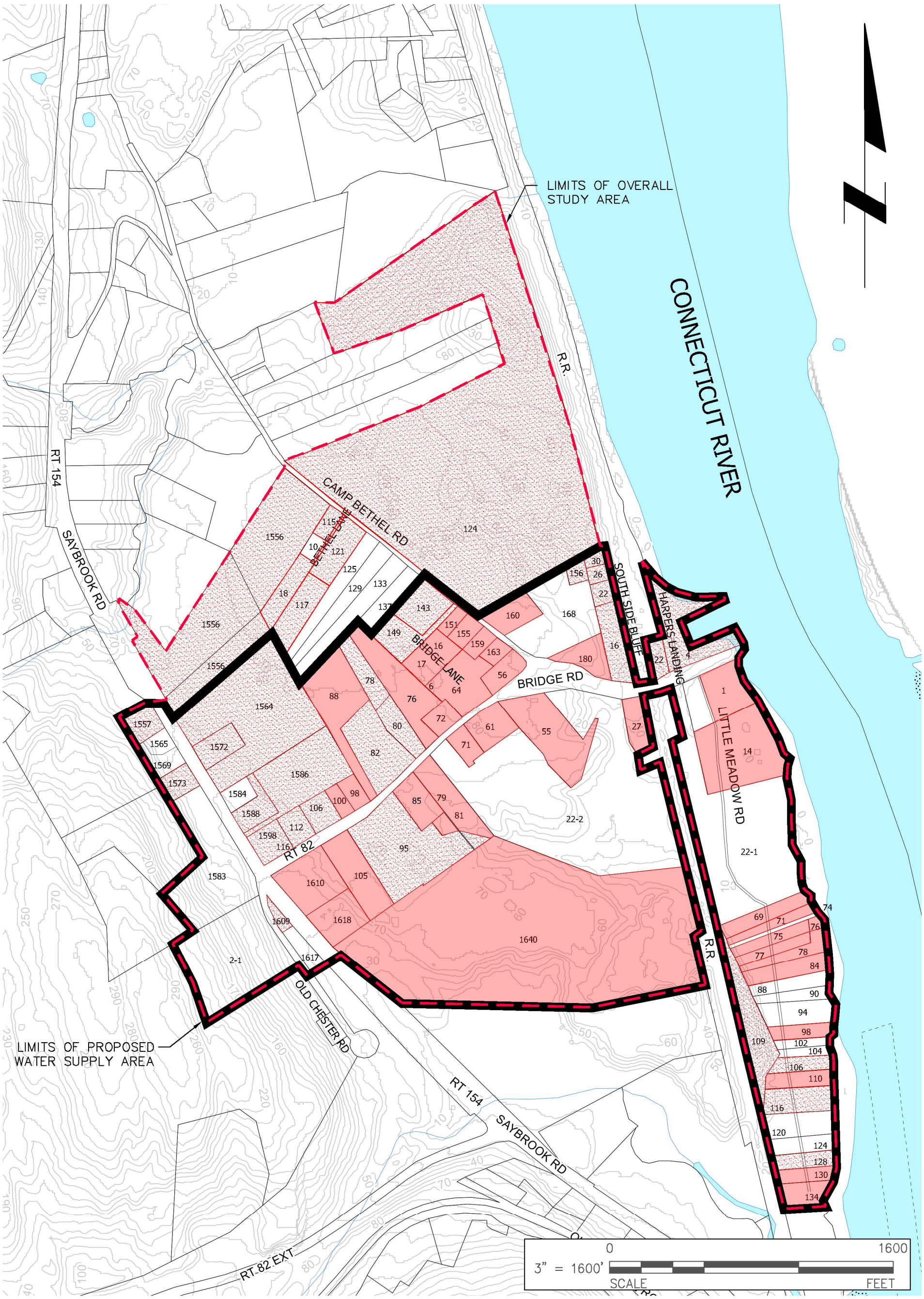

LEGEND:

- PROPOSED WATER SUPPLY AREA
- STUDY AREA
- 123 ADDRESS NO.
- 2-1 PARCEL #

EXCEEDENCE

- EXCEEDENCE OF MAXIMUM CONTAMINANT LEVEL OR DRINKING WATER ACTION LEVEL

DETECTION

- DETECTION OF A CONTAMINANT OF CONCERN

FIGURE: 3

AECOM

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STUDY AREA IMPACTED PROPERTIES SUMMARY
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 3" = 1600' | DATE: 5/13/13 | PN: 60285195

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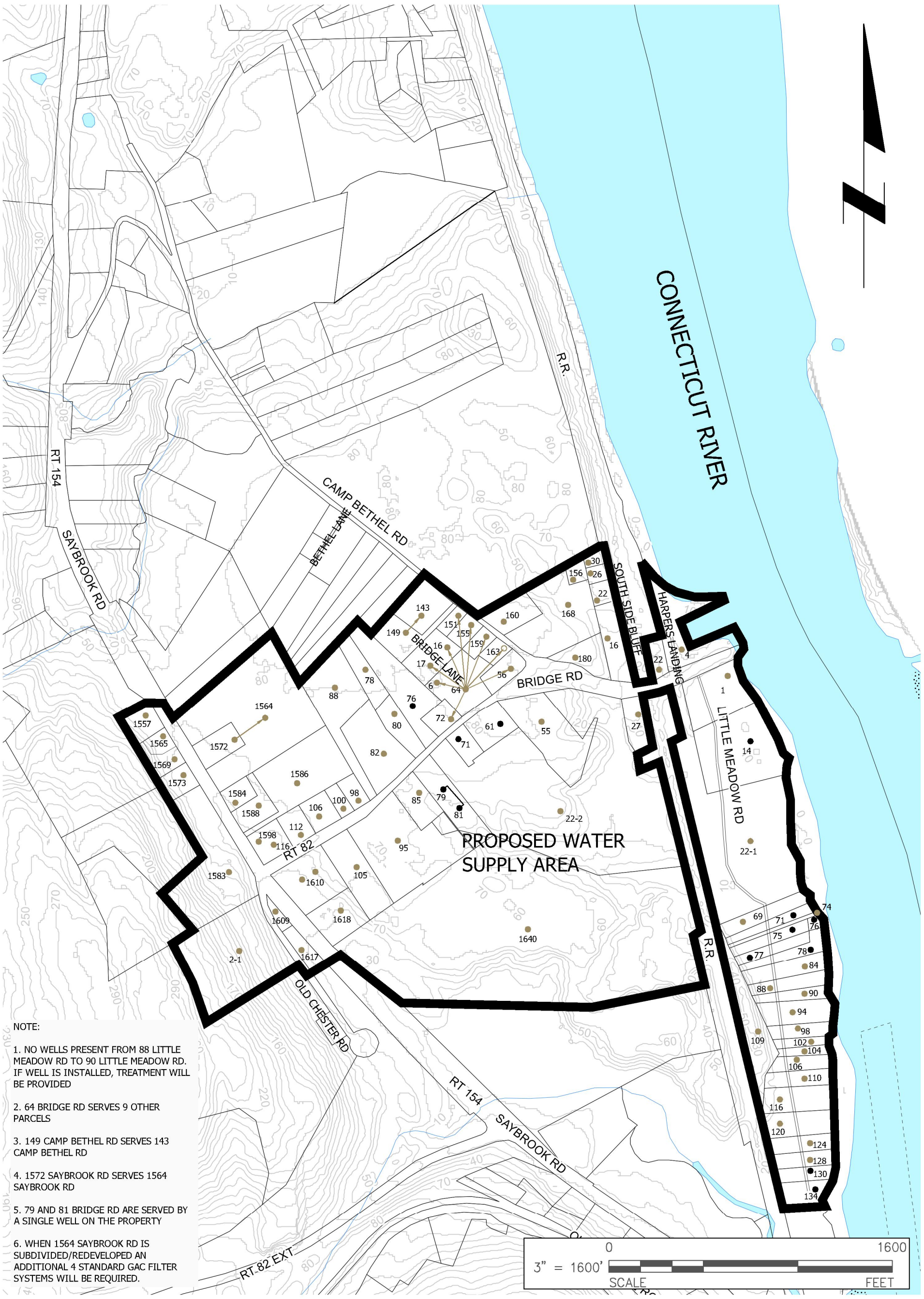

NOTE:

1. NO WELLS PRESENT FROM 88 LITTLE MEADOW RD TO 90 LITTLE MEADOW RD. IF WELL IS INSTALLED, TREATMENT WILL BE PROVIDED

2. 64 BRIDGE RD SERVES 9 OTHER PARCELS

3. 149 CAMP BETHEL RD SERVES 143 CAMP BETHEL RD

4. 1572 SAYBROOK RD SERVES 1564 SAYBROOK RD

5. 79 AND 81 BRIDGE RD ARE SERVED BY A SINGLE WELL ON THE PROPERTY

6. WHEN 1564 SAYBROOK RD IS SUBDIVIDED/REDEVELOPED AN ADDITIONAL 4 STANDARD GAC FILTER SYSTEMS WILL BE REQUIRED.

LEGEND:

PROPOSED WATER SUPPLY AREA

123 ADDRESS NO.

2-1 PARCEL #

FILTER DATA

PROPERTY RECEIVES ENHANCED GAC FILTER AND BOTTLED WATER SERVICE

PROPERTY RECEIVES STANDARD GAC FILTER

WELL SERVICE

FIGURE: 4

AECOM

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PROPOSED INDIVIDUAL WATER TREATMENT SYSTEMS

PROPOSED WATER SUPPLY AREA

TYLERVILLE WATER SUPPLY STUDY

HADDAM, CONNECTICUT

SCALE: 3" = 1600' | DATE: 5/13/13 | PN: 60285195

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11X17 – 9/16/11

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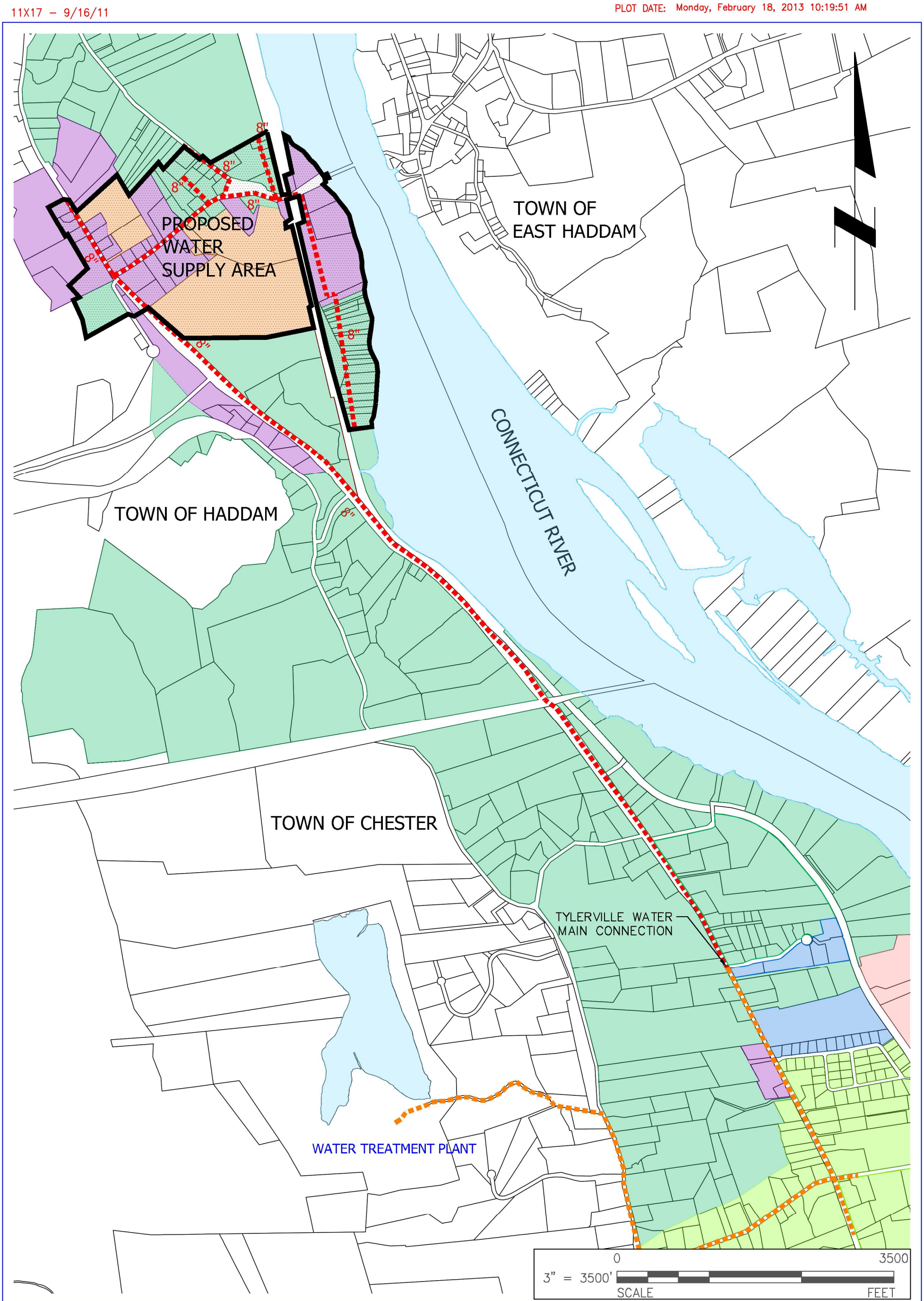

LEGEND:

- PROPOSED WATER SUPPLY AREA
- PROPOSED WATER MAIN
- CHESTER EXISTING WATER MAIN

LAND USE/ZONING

- RESIDENTIAL (R-1)
- RESIDENTIAL (R-2)
- COMMERCIAL (C-1)
- INDUSTRIAL (I-1)
- RESEARCH/LIGHT MANUFACTURING (RLM)
- WATERFRONT DESIGN DISTRICT (WDD2)
- WATER

FIGURE: 5-A

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
www.aecom.com

PROPOSED WATER MAIN EXTENSION
BASE LAYOUT (8-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 3" = 3500' | DATE: 2/18/13 | PN: 60285195

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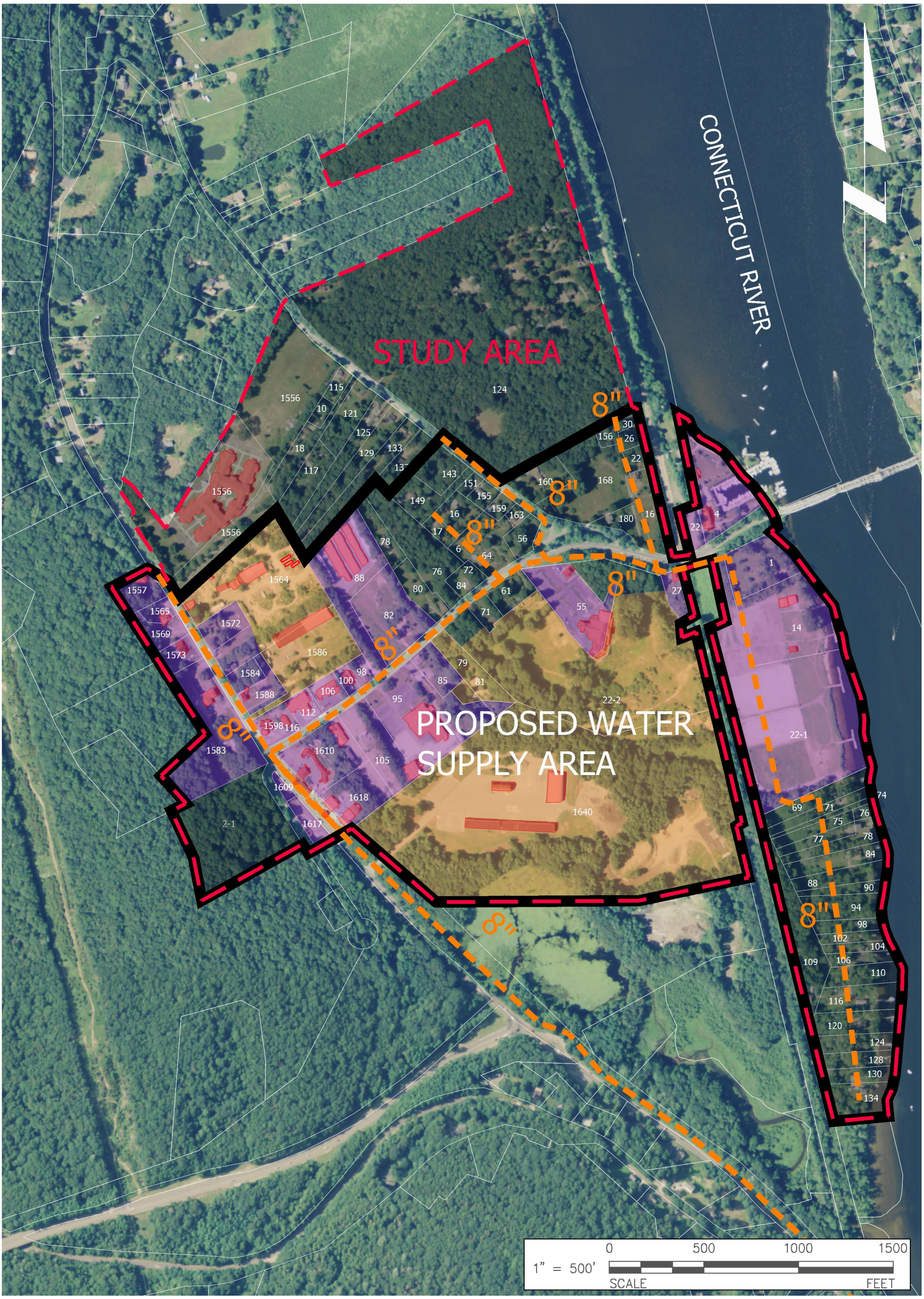
LAST UPDATE: Monday, May 13, 2013 3:25:33 PM

11X17 – 9/16/11

PLOT DATE: Monday, May 13, 2013 3:31:17 PM



LEGEND:

PROPOSED WATER SUPPLY AREA	PROPOSED WATER MAIN	LAND USE/ZONING	
STUDY AREA	BUILDING OUTLINE	RESIDENTIAL (R-2)	
123 ADDRESS NO.		COMMERCIAL (C-1)	
		INDUSTRIAL (I-1)	

FIGURE: 5-B

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
www.aecom.com

PROPOSED WATER MAIN EXTENSION
BASE LAYOUT (8-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 1" = 500' DATE: 5/13/13 PN: 60285195

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11X17 – 9/16/11

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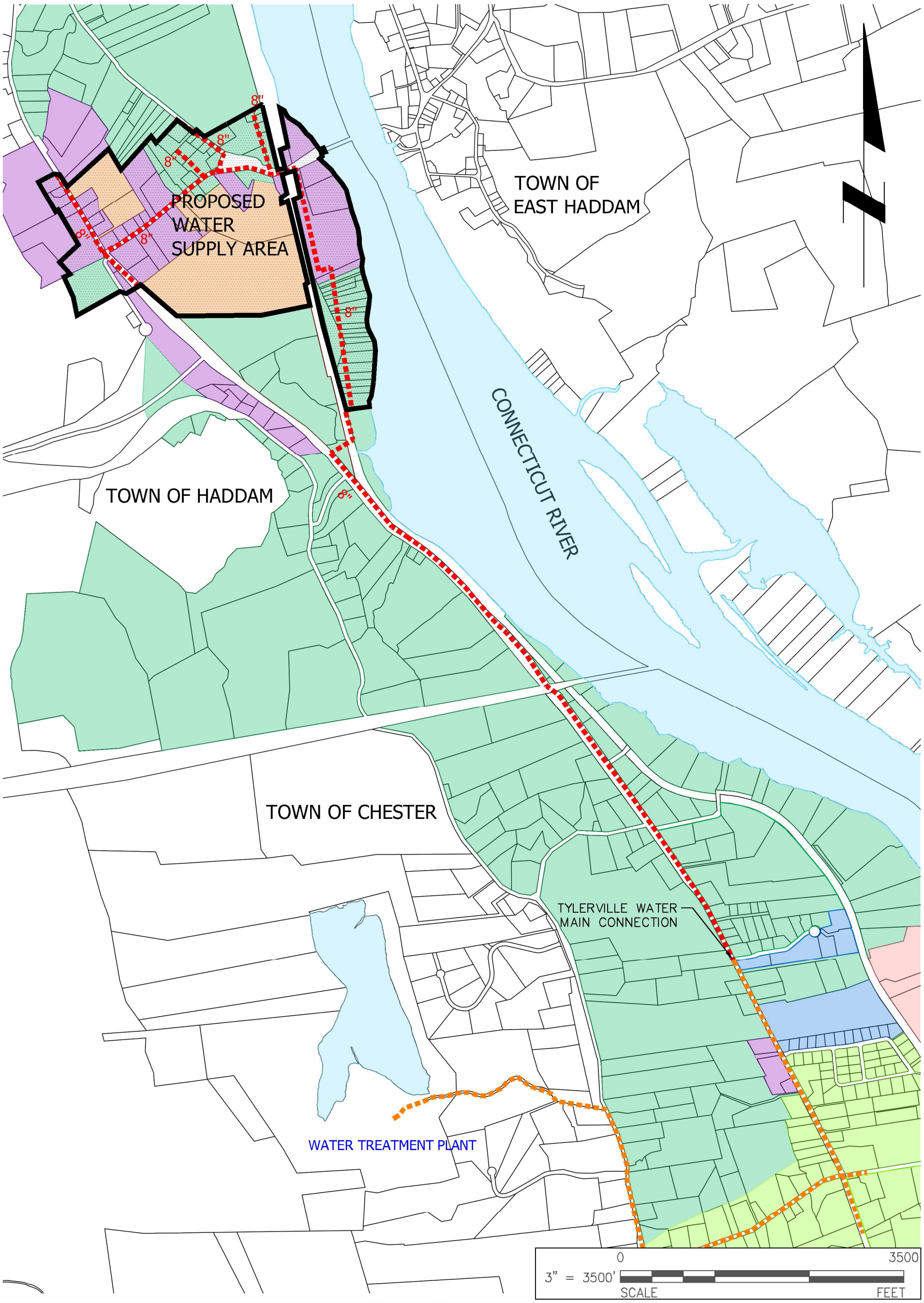

LEGEND:

- PROPOSED WATER SUPPLY AREA
- ALTERNATE WATER MAIN
- CHESTER EXISTING WATER MAIN

LAND USE/ZONING

- RESIDENTIAL (R-1)
- RESIDENTIAL (R-2)
- COMMERCIAL (C-1)
- INDUSTRIAL (I-1)
- RESEARCH/LIGHT MANUFACTURING (RLM)
- WATERFRONT DESIGN DISTRICT (WDD2)
- WATER

FIGURE: 6-A

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
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PROPOSED WATER MAIN EXTENSION
ALTERNATE LAYOUT (8-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 3" = 3500' | DATE: 5/13/13 | PN: 60285195

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11X17 – 9/16/11

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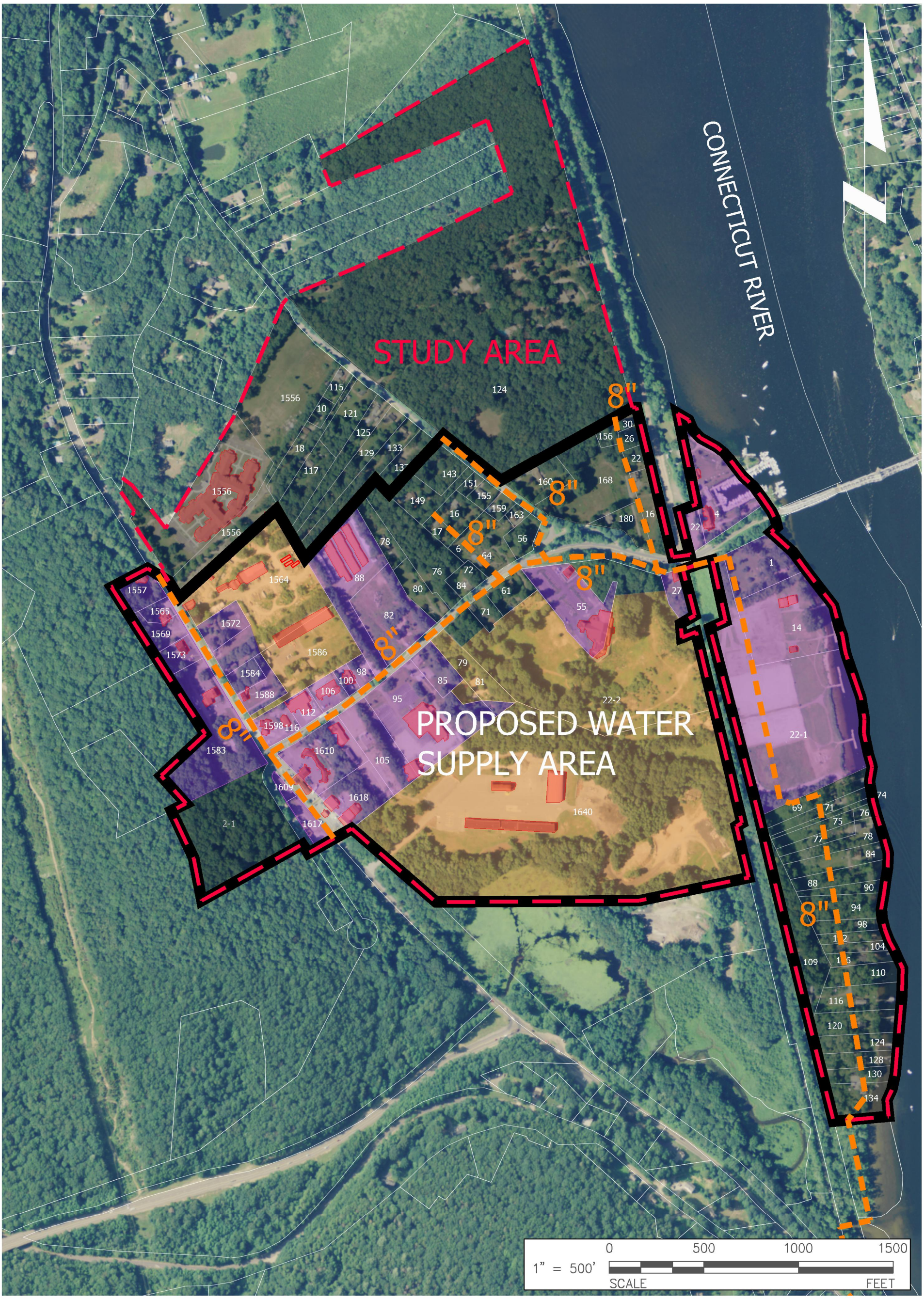

LEGEND:

- PROPOSED WATER SUPPLY AREA
- STUDY AREA
- 123 ADDRESS NO.
- ALTERNATE WATER MAIN
- BUILDING OUTLINE

LAND USE/ZONING

- RESIDENTIAL (R–2)
- COMMERCIAL (C–1)
- INDUSTRIAL (I–1)

FIGURE: 6-B

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
www.aecom.com

PROPOSED WATER MAIN EXTENSION
ALTERNATE LAYOUT (8-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 1" = 500' | DATE: 2/18/13 | PN: 60285195

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LAST UPDATE: Monday, May 13, 2013 3:25:33 PM

11X17 – 9/16/11

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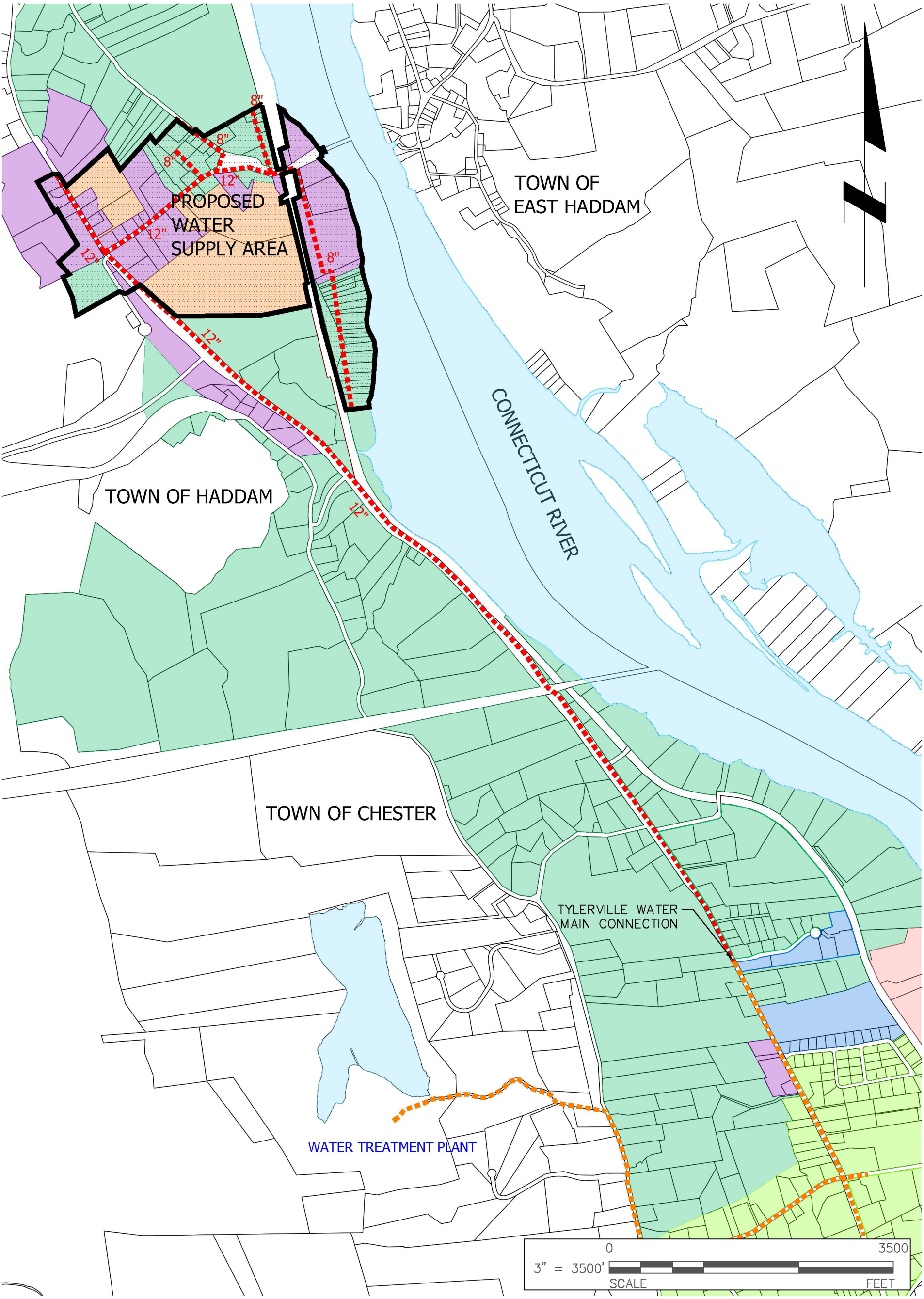


LEGEND:

- PROPOSED WATER SUPPLY AREA
- PROPOSED WATER MAIN
- CHESTER EXISTING WATER MAIN

LAND USE/ZONING

- RESIDENTIAL (R-1)
- RESIDENTIAL (R-2)
- COMMERCIAL (C-1)
- INDUSTRIAL (I-1)
- RESEARCH/LIGHT MANUFACTURING (RLM)
- WATERFRONT DESIGN DISTRICT (WDD2)
- WATER

FIGURE: 7-A

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
www.aecom.com

PROPOSED WATER MAIN EXTENSION
BASE LAYOUT (12-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

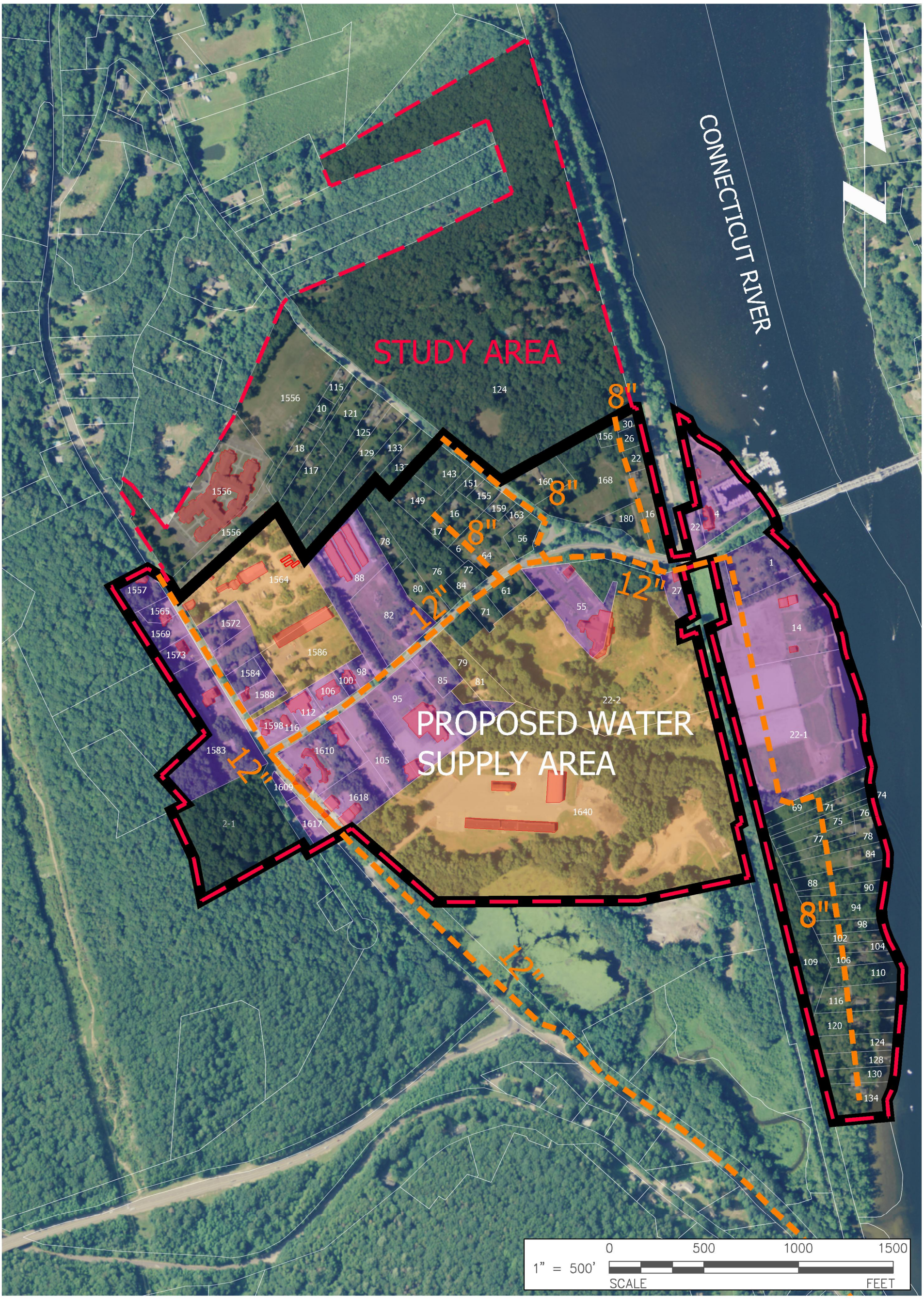
SCALE: 3" = 3500' | DATE: 5/13/13 | PN: 60285195

PATH/FILENAME: X:\60190457 CTDEP TYLERVILLE WATER SUPPLY\400 BACKGROUND INFORMATION\OLD DWGS\TYLERVILLE STUDY AREA 012511 UPDATED.DWG

LAST UPDATE: Monday, May 13, 2013 3:25:33 PM

11X17 – 9/16/11

PLOT DATE: Monday, May 13, 2013 3:33:05 PM



LEGEND:

- PROPOSED WATER SUPPLY AREA
- STUDY AREA
- 123 ADDRESS NO.
- PROPOSED WATER MAIN
- BUILDING OUTLINE

LAND USE/ZONING

- RESIDENTIAL (R-2)
- COMMERCIAL (C-1)
- INDUSTRIAL (I-1)

FIGURE: 7-B

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
www.aecom.com

PROPOSED WATER MAIN EXTENSION
BASE LAYOUT (12-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 1" = 500' | DATE: 5/13/13 | PN: 60285195

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LAST UPDATE: Monday, May 13, 2013 3:25:33 PM

11X17 – 9/16/11

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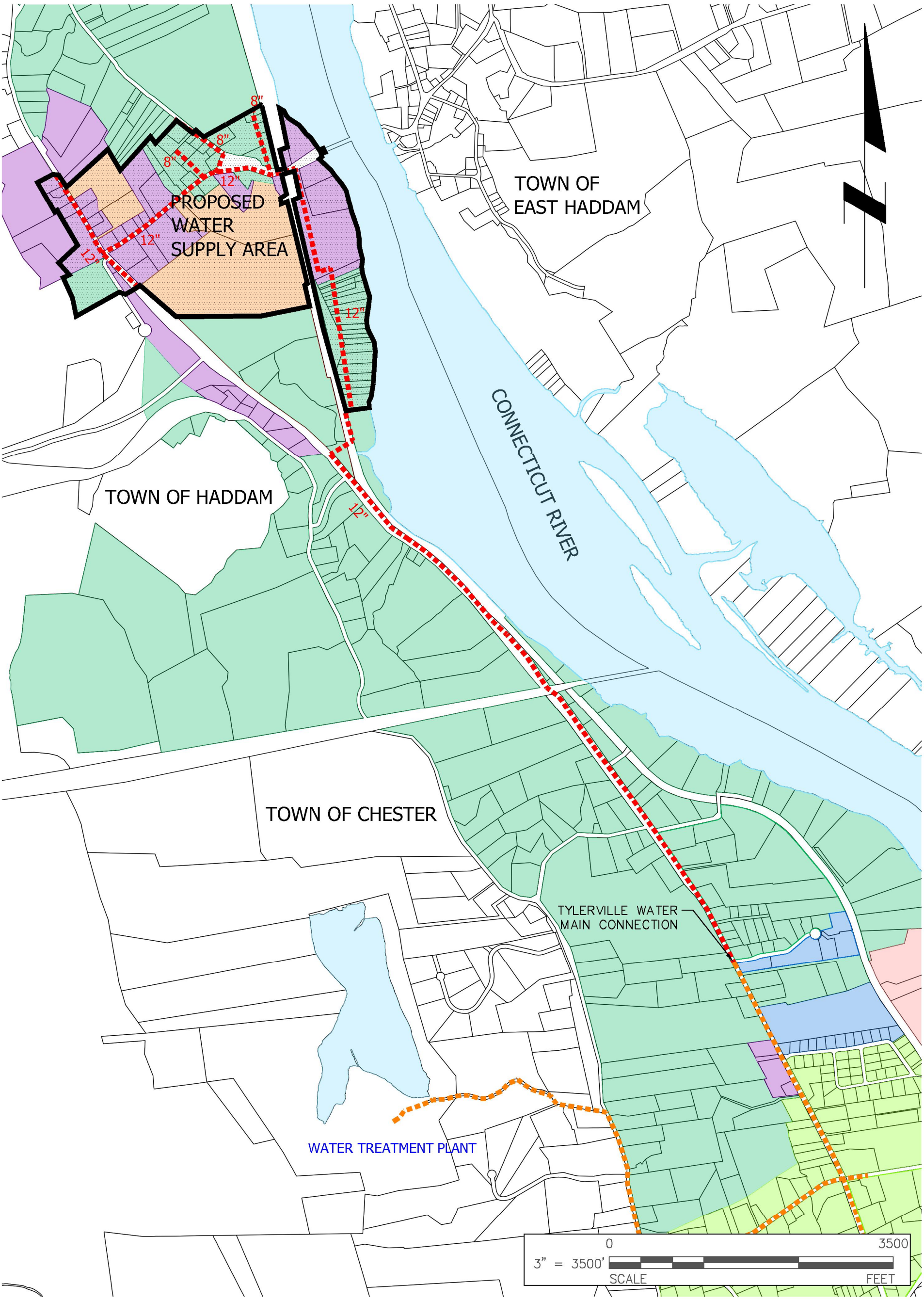

LEGEND:

- PROPOSED WATER SUPPLY AREA
- ALTERNATE WATER MAIN
- CHESTER EXISTING WATER MAIN

LAND USE/ZONING

- RESIDENTIAL (R–1)
- RESIDENTIAL (R–2)
- COMMERCIAL (C–1)
- INDUSTRIAL (I–1)
- RESEARCH/LIGHT MANUFACTURING (RLM)
- WATERFRONT DESIGN DISTRICT (WDD2)
- WATER

FIGURE: 8-A

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
www.aecom.com

PROPOSED WATER MAIN EXTENSION
ALTERNATE LAYOUT (12-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 3" = 3500' | DATE: 5/13/13 | PN: 60285195

PATH/FILENAME: X:\60190457 CTDEP TYLERVILLE WATER SUPPLY\400 BACKGROUND INFORMATION\OLD DWGS\TYLERVILLE STUDY AREA 012511 UPDATED.DWG

LAST UPDATE: Monday, May 13, 2013 3:25:33 PM

11X17 – 9/16/11

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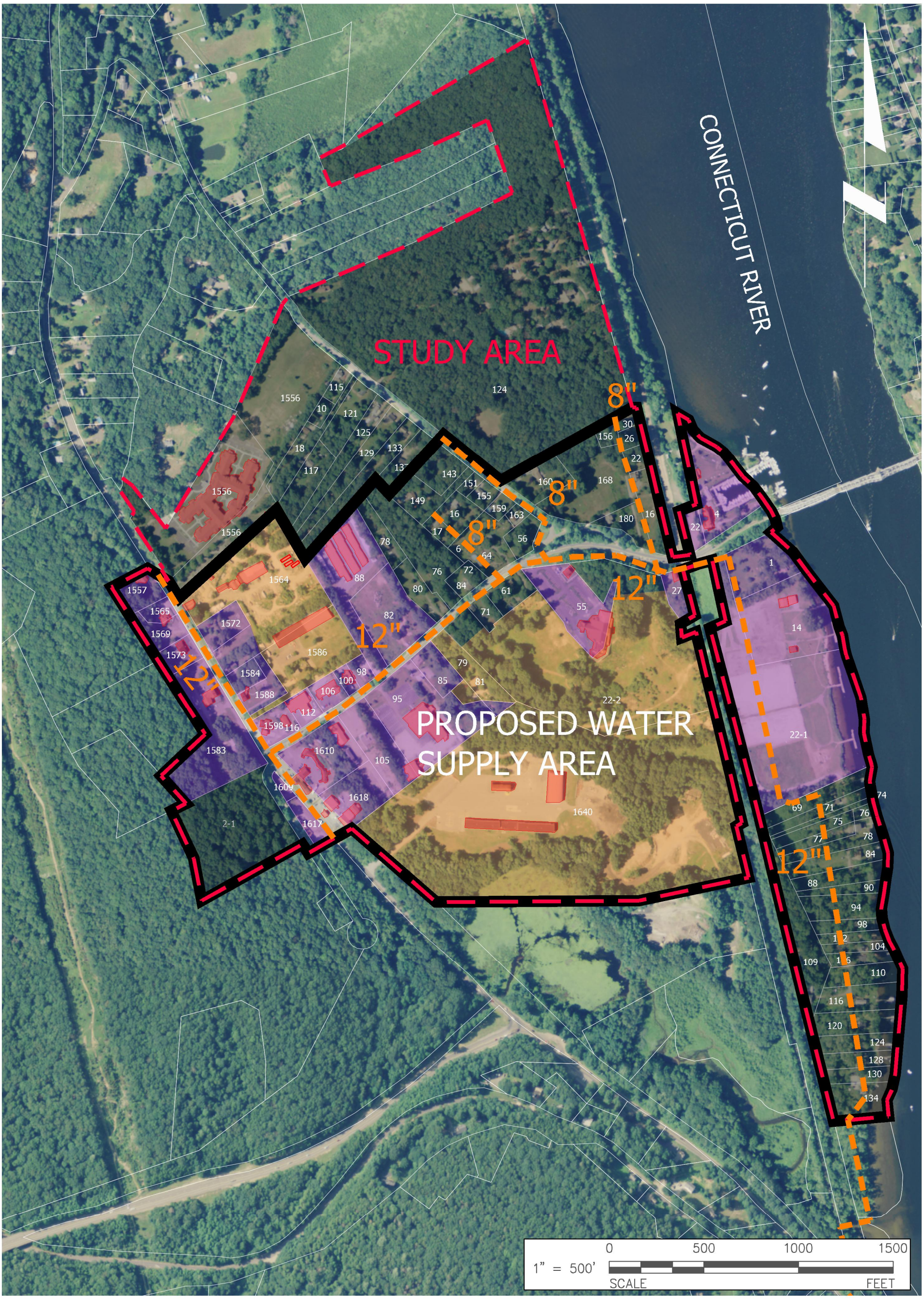

LEGEND:

- PROPOSED WATER SUPPLY AREA
- STUDY AREA
- 123 ADDRESS NO.
- PROPOSED WATER MAIN
- BUILDING OUTLINE

LAND USE/ZONING

- RESIDENTIAL (R–2)
- COMMERCIAL (C–1)
- INDUSTRIAL (I–1)

FIGURE: 8-B

AECOM

AECOM Environment
500 ENTERPRISE DR, STE 1A
ROCKY HILL, CT 06067
(860) 263-5800
www.aecom.com

PROPOSED WATER MAIN EXTENSION
ALTERNATE LAYOUT (12-INCH)
TYLERVILLE WATER SUPPLY STUDY
HADDAM, CONNECTICUT

SCALE: 1" = 500' | DATE: 5/13/13 | PN: 60285195

Appendix A

Statement of Limitations

STATEMENT OF LIMITATIONS

The data presented and the opinions expressed in this report are qualified as follows:

1. The sole purpose of this report is to present a preliminary assessment of the physical characteristics of the Site with respect to the presence or absence in the environment of oil or hazardous materials and substances as defined in the applicable state and federal environmental laws and regulations and to identify and evaluate potential water supply alternatives for the Site.

2. AECOM derived the data in this report primarily from visual inspections, examinations of records provided by the Client, interviews with individuals with information about the Site. The passage of time, manifestation of latent conditions or occurrence of future events may require further exploration at the Site, analysis of the data, and reevaluation of the findings, observations, and conclusions expressed in the report.

3. In preparing this report, AECOM has relied upon and presumed accurate certain information (or the absence thereof) about the Site and adjacent properties provided by governmental officials and agencies, the Client, and others identified herein. Except as otherwise stated in the report, AECOM has not attempted to verify the accuracy or completeness of any such information.

4. The data reported and the findings, observations, and conclusions expressed in the report are limited by the Scope of Services. The Scope of Services was defined by the requests of the Client, the time and budgetary constraints imposed by the Client, and the availability of access to the Site.

5. Because of the limitations stated above, the findings, observations, and conclusions expressed by AECOM in this report are not, and should not be considered, an opinion concerning the compliance of any past or present owner or operator of the site with any federal, state or local law or regulation. No warranty or guarantee, whether express or implied, is made with respect to the data reported or findings, observations, and conclusions expressed in this report. Further, such data, findings, observations, and conclusions are based solely upon site conditions in existence at the time of investigation.

6. This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the Agreement and the provisions thereof.

Appendix B

Laboratory Data Summary Tables

AECOM

Appendix B - Table B1

Study Area Raw Well Water Analytical Results - From Most Recent Sampling Event

		COC	1,1-Dichloroethene (µg/L)	Tetrachloroethene (µg/L)	1,1,1-Trichloroethane (µg/L)	Trichloroethene (µg/L)	1,4-Dioxane (µg/L)	Methyl T-Butyl Ether (µg/L)	Current Treatment	Notes
		US EPA MCL	7	5	200	5	---	50,000		
		CT DPH DWAL	7	5	200	1	3	70		
		CT DPH B/SAL	---	---	---	---	50	---		
Street #	**Street Address**	**Most Recent Sample Date**	**1,1-Dichloroethene (µg/L)**	**Tetrachloroethene (µg/L)**	**1,1,1-Trichloroethane (µg/L)**	**Trichloroethene (µg/L)**	**1,4-Dioxane (µg/L)**	**Methyl T-Butyl Ether (µg/L)**		
Bethel Lane										
10	Bethel Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
18	Bethel Lane	5/18/2011	ND	ND	ND	ND	ND	**<0.5**	- - -	
Bridge Lane										
6	Bridge Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
16	Bridge Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
17	Bridge Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
Bridge Road										
1	Bridge Road	7/19/2012	ND	ND	ND	ND	ND	ND	- - -	
22	Bridge Road	7/6/2012	ND	ND	ND	ND	ND	ND	- - -	
27	Bridge Road	8/30/2012	ND	ND	ND	ND	ND	ND	- - -	
55/57	Bridge Road	7/31/2012	ND	ND	**0.75**	**1.5**	ND	ND	Filter System	55/57 Bridge Rd.
56	Bridge Road	3/27/2002	**<0.5**	ND	ND	**3.3**	N/A	ND	64 Bridge Road	Served/filtered by 64 Bridge Road.
61	Bridge Road	11/2/2012	**0.79**	ND	ND	**8.8**	**1.1**	ND	CT DEEP Filter System	
64	Bridge Road	8/24/2012	ND	ND	ND	ND	ND	ND	CT DEEP Filter System	Serves 9 other residences
71	Bridge Road	11/2/2012	**0.75**	ND	ND	**8.0**	ND	ND	CT DEEP Filter System	
72	Bridge Road	6/4/2010	ND	ND	ND	ND	N/A	ND	64 Bridge Road	Served/filtered by 64 Bridge Road.
Lot 22-2	Bridge Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Undeveloped, no well
76	Bridge Road	9/21/2012	**8.0**	**0.63**	ND	**68.0**	**6.5**	ND	CT DEEP Filter System/Bottled Water	
78	Bridge Road	7/6/2012	ND	ND	ND	ND	N/A	ND	- - -	
80	Bridge Road	7/31/2012	ND	ND	ND	ND	ND	**1.6**	- - -	
79/81*	Bridge Road	10/5/2012	**18.0**	**1.6**	**0.64**	**180.0**	**17.0**	**1.1**	2x CT DEEP Filter System/Bottled Water	
82	Bridge Road	3/22/2011	ND	ND	ND	ND	N/A	**3.2**	Filter System	
85	Bridge Road	10/10/2012	ND	ND	ND	ND	N/A	**201.0**	Filter System	
88	Bridge Road	12/19/1997	ND	ND	ND	ND	N/A	**4.9**	- - -	
95	Bridge Road	10/9/2012	ND	ND	**0.64**	ND	N/A	ND	- - -	
98	Bridge Road	10/9/2012	ND	ND	ND	ND	N/A	**211.0**	Bottled Water	
100	Bridge Road	10/9/2012	ND	ND	ND	ND	N/A	**123.0**	Filter System	
105	Bridge Road	7/18/2011	ND	ND	ND	ND	N/A	**114.0**	Bottled Water	
106	Bridge Road	10/9/2012	ND	ND	ND	ND	N/A	ND	- - -	
112	Bridge Road	10/9/2012	ND	ND	ND	ND	N/A	**0.56**	- - -	
116	Bridge Road	4/9/2012	ND	ND	ND	ND	N/A	ND	- - -	
Camp Bethel Road										
115	Camp Bethel Road	5/18/2011	N/A	N/A	N/A	N/A	ND	**1.6**	- - -	
117	Camp Bethel Road	5/16/2011	N/A	N/A	N/A	N/A	ND	**1.6**	- - -	
121	Camp Bethel Road	5/20/2011	ND	ND	ND	ND	ND	**1.3**	- - -	
124	Camp Bethel Road	8/30/2012	ND	ND	ND	ND	ND	**0.69**	- - -	
125	Camp Bethel Road	5/16/2011	ND	ND	ND	ND	ND	ND	- - -	
129	Camp Bethel Road	5/18/2011	N/A	N/A	N/A	N/A	ND	ND	- - -	
133	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
137	Camp Bethel Road	9/20/2012	ND	ND	ND	ND	ND	ND	- - -	
143	Camp Bethel Road	5/16/2011	N/A	ND	ND	ND	ND	**<0.5**	- - -	
149	Camp Bethel Road	8/30/2012	ND	ND	ND	ND	ND	ND	- - -	
151	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
155	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
156	Camp Bethel Road	7/5/2012	ND	ND	ND	ND	ND	ND	- - -	
159	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
160	Camp Bethel Road	11/2/2012	ND	ND	ND	**2.9**	ND	ND	CT DEEP Filter System	
163	Camp Bethel Road	6/6/2002	**<0.5**	ND	ND	**5.0**	N/A	ND	64 Bridge Road	Served/filtered by 64 Bridge Road.
168	Camp Bethel Road	8/30/2012	ND	ND	ND	ND	ND	ND	- - -	
180	Camp Bethel Road	11/30/2012	ND	ND	ND	ND	ND	ND	CT DEEP Filter System	
Harper's Landing										
4**	Harper's Landing	7/5/2012	ND	ND	ND	ND	ND	ND	- - -	

AECOM

Appendix B - Table B1

Study Area Raw Well Water Analytical Results - From Most Recent Sampling Event

		COC	1,1-Dichloroethene (µg/L)	Tetrachloroethene (µg/L)	1,1,1-Trichloroethane (µg/L)	Trichloroethene (µg/L)	1,4-Dioxane (µg/L)	Methyl T-Butyl Ether (µg/L)	Current Treatment	Notes
		US EPA MCL	7	5	200	5	---	50,000		
		CT DPH DWAL	7	5	200	1	3	70		
		CT DPH B/SAL	---	---	---	---	50	---		
Street #	**Street Address**	**Most Recent Sample Date**	**1,1-Dichloroethene (µg/L)**	**Tetrachloroethene (µg/L)**	**1,1,1-Trichloroethane (µg/L)**	**Trichloroethene (µg/L)**	**1,4-Dioxane (µg/L)**	**Methyl T-Butyl Ether (µg/L)**		
Little Meadow Road										
14	Little Meadow Road	7/26/2012	**39.0**	**4.1**	**42.0**	**160.0**	**10.0**	ND	- - -	Formerly known as 1 Marina Park
Lot 22-1	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
69	Little Meadow Road	9/20/2012	ND	ND	ND	ND	ND	ND	CT DEEP Filter System	
71	Little Meadow Road	11/30/2012	**13.0**	**1.1**	**15.0**	**83.0**	**4.9**	ND	CT DEEP Filter System	
74	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Supply well unknown
75	Little Meadow Road	7/6/2012	**6.3**	ND	**8.0**	**41.0**	**1.8**	ND	CT DEEP Filter System	
76	Little Meadow Road	7/6/2012	**5.7**	ND	**7.9**	**38.0**	**2.7**	ND	CT DEEP Filter System/Bottled Water	
77	Little Meadow Road	8/28/2012	**52.0**	ND	ND	**280.0**	**55.0**	ND	CT DEEP Filter System	1,4-Dioxane 12/6/12
78	Little Meadow Road	10/5/2012	**4.8**	ND	**6.4**	**27.0**	**1.8**	ND	CT DEEP Filter System/Bottled Water	Dioxane 1,4 tested on 12/6/2012, All other COCs sampled on 10/5/2012
84	Little Meadow Road	8/2/2012	**0.74**	ND	**0.61**	**1.5**	ND	ND	CT DEEP Filter System	Dioxane 1,4 tested on 8/31/2012 All other COCs sampled on 8/2/2012
88	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	No well
90	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	No well
94	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Well identified at property
98	Little Meadow Road	7/31/2012	ND	ND	ND	**2.2**	ND	ND	- - -	
102	Little Meadow Road	7/5/2012	ND	ND	ND	ND	ND	ND	- - -	
104	Little Meadow Road	8/31/2012	ND	ND	ND	ND	ND	ND	- - -	
106	Little Meadow Road	7/19/2012	ND	ND	ND	ND	ND	ND	- - -	
109	Little Meadow Road	7/31/2012	ND	ND	ND	ND	ND	ND	- - -	
110	Little Meadow Road	7/19/2012	ND	ND	ND	**22.0**	ND	ND	CT DEEP Filter System	
116	Little Meadow Road	7/18/2012	ND	ND	ND	ND	ND	ND	- - -	
120	Little Meadow Road	8/31/2012	ND	ND	ND	ND	ND	ND	- - -	
124	Little Meadow Road	9/2/2009	N/A	N/A	N/A	N/A	ND	N/A	- - -	
128	Little Meadow Road	7/31/2012	ND	ND	ND	ND	ND	ND	- - -	
130	Little Meadow Road	7/18/2012	**6.7**	ND	ND	**6.2**	**11.0**	ND	CT DEEP Filter System	
134	Little Meadow Road	7/6/2012	**11.0**	ND	ND	**10.0**	**20.0**	ND	CT DEEP Filter System	
Old Chester Road-N										
0	Old Chester Road-N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Undeveloped, no well
Saybrook Road										
1556	Saybrook Road	5/18/2011	ND	ND	ND	ND	ND	**<0.5**	- - -	
1557	Saybrook Road	10/25/2012	ND	ND	ND	ND	N/A	ND	- - -	
1564	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
1565	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
1569	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
1572	Saybrook Road	10/25/2012	ND	ND	ND	ND	N/A	ND	- - -	
1573	Saybrook Road	5/20/2011	ND	ND	ND	ND	N/A	ND	- - -	
1583	Saybrook Road	10/10/2012	ND	ND	ND	ND	N/A	ND	- - -	
1584	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
1586	Saybrook Road	10/9/2012	ND	ND	ND	ND	N/A	ND	- - -	
1588	Saybrook Road	10/10/2012	ND	ND	ND	ND	N/A	ND	- - -	
1598	Saybrook Road	10/9/2012	ND	ND	ND	ND	N/A	ND	- - -	
1609	Saybrook Road	10/10/2012	ND	ND	ND	ND	N/A	**0.5**	- - -	
1610	Saybrook Road	10/10/2012	ND	ND	ND	ND	N/A	**108.0**	Bottled Water	Two wells located at this property- two filters will be installed
1617	Saybrook Road	7/6/2012	ND	ND	ND	ND	N/A	ND	- - -	
1618	Saybrook Road	10/10/2012	ND	ND	ND	ND	N/A	**5.0**	Filter System	
1640	Saybrook Road	9/20/2012	ND	ND	ND	**1.4**	ND	ND	- - -	
South Side Bluff										
16	South Side Bluff	7/5/2012	ND	ND	ND	ND	ND	ND	- - -	
22	South Side Bluff	8/2/2012	ND	ND	ND	ND	ND	ND	- - -	
26	South Side Bluff	7/5/2012	ND	ND	ND	ND	ND	ND	- - -	
30	South Side Bluff	7/31/2012	ND	ND	ND	ND	ND	ND	- - -	

* 79 Bridge Road is also considered 81 Bridge Road (two separate houses served by one well)
** 4 Harpers Landing is also considered 12 Andrews Marina.

Notes:	
	Value exceeds both US EPA MCL and CT DPH DWAL
	Value exceeds CT DPH DWAL or CT B/SAL
BOLD	Detected compound
ND	Non detect
N/A	No access, no well present, or constituent not analyzed

AECOM

Appendix B - Table B2

Study Area Raw Well Water Analytical Results - Historic Concentration Ranges

	COC	1,1-Dichloroethene (µg/L)		Tetrachloroethene (µg/L)		1,1,1-Trichloroethane (µg/L)		Trichloroethene (µg/L)		1,4-Dioxane (µg/L)		Methyl T-Butyl Ether (µg/L)		Current Treatment	Notes
	US EPA MCL	7		5		200		5		---		50,000			
	CT DPH DWAL	7		5		200		1		3		70			
	CT DPH B/SAL	---		---		---		---		50		---			
Street #	**Street Address**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**		
Bethel Lane															
10	Bethel Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
18	Bethel Lane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.5**	**<0.5**	- - -	
Bridge Lane															
6	Bridge Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
16	Bridge Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
17	Bridge Lane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
Bridge Road															
1	Bridge Road	ND	ND	ND	ND	ND	**17.0**	ND	**150.0**	ND	ND	ND	**<0.5**	- - -	
22	Bridge Road	ND	ND	ND	ND	ND	**0.1**	ND	**0.1**	ND	ND	ND	**1.6**	- - -	
27	Bridge Road	ND	ND	ND	ND	ND	ND	ND	**85.0**	ND	ND	ND	ND	- - -	
55/57	Bridge Road	ND	**8.8**	ND	**1.9**	ND	**6.3**	ND	**100.0**	ND	**1.7**	ND	**7.8**	Filter System	55 and 57 bridge Rd serviced by the same well
56	Bridge Road	**<0.5**	**<0.5**	ND	ND	ND	ND	**3.3**	**3.3**	N/A	N/A	ND	ND	64 Bridge Road	Served/filtered by 64 Bridge Road.
61	Bridge Road	ND	**7.3**	ND	**0.53**	ND	**1.2**	ND	**60.0**	ND	**28.0**	ND	**<0.5**	CT DEEP Filter System	1,4 Dioxane = 41 in second filter, 1.5 in 3rd filter
64	Bridge Road	ND	**<0.5**	ND	ND	ND	ND	ND	**4.1**	ND	ND	ND	**3.1**	CT DEEP Filter System	Serves 9 other residences
71	Bridge Road	ND	**2.1**	ND	**0.7**	ND	**14.0**	ND	**69.0**	ND	**3.8**	ND	**0.1**	CT DEEP Filter System	
72	Bridge Road	ND	ND	ND	ND	ND	ND	ND	**3.3**	N/A	N/A	ND	ND	64 Bridge Road	Served/filtered by 64 Bridge Road.
Lot 22-2	Bridge Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Undeveloped, no well
76	Bridge Road	ND	**18.0**	ND	**1.5**	ND	**10.0**	**9.5**	**270.0**	ND	**12.0**	ND	**8.6**	CT DEEP Filter System/Bottled Water	
78	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.1**	- - -	
80	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.7**	- - -	
79/81*	Bridge Road	ND	**48.0**	ND	**10.0**	**<0.5**	**10.0**	**51.0**	**620.0**	**1.5**	**29.1**	ND	**2.5**	2x CT DEEP Filter System/Bottled Water	
82	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**3.2**	Filter System	
85	Bridge Road	ND	ND	ND	**0.1**	ND	ND	**0.1**	**0.9**	N/A	N/A	**56.0**	**220.0**	Filter System	
88	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**160.0**	- - -	
95	Bridge Road	ND	ND	ND	ND	ND	**0.64**	ND	ND	ND	ND	ND	**45.0**	- - -	
98	Bridge Road	ND	ND	ND	**<0.5**	ND	ND	ND	**1.0**	N/A	N/A	**26.0**	**490.0**	Bottled Water	
100	Bridge Road	ND	ND	ND	**0.5**	ND	ND	ND	**0.6**	N/A	N/A	**25.0**	**840.0**	Filter System	
105	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	**114.0**	**150.0**	Bottled Water	
106	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**30.0**	- - -	
112	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**2.6**	- - -	
116	Bridge Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**<0.5**	- - -	
Camp Bethel Road															
115	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.6**	**1.6**	- - -	
117	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.6**	**1.6**	- - -	
121	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**1.3**	**1.3**	- - -	
124	Camp Bethel Road	ND	ND	ND	**4.0**	ND	ND	ND	ND	ND	ND	ND	**1.9**	- - -	PCE detection considered an anomaly (CT DEEP). 2 wells located at property
125	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	- - -	
129	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	- - -	
133	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
137	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	- - -	
143	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**<0.5**	**<0.5**	- - -	Served by 149 Camp Bethel Road
149	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.5**	**<0.5**	- - -	Serves 143 Camp Bethel Road
151	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
155	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
156	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**11.0**	- - -	
159	Camp Bethel Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	64 Bridge Road	Served/filtered by 64 Bridge Road.
160	Camp Bethel Road	ND	**6.0**	ND	**<0.5**	ND	ND	ND	**11.0**	ND	ND	ND	**<0.5**	CT DEEP Filter System	19.0 in second filter
163	Camp Bethel Road	**<0.5**	**<0.5**	ND	ND	ND	ND	**5.0**	**5.0**	N/A	N/A	ND	ND	64 Bridge Road	Served/filtered by 64 Bridge Road.
168	Camp Bethel Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	- - -	
180	Camp Bethel Road	ND	ND	ND	ND	ND	**<0.5**	ND	**1.6**	ND	ND	ND	**2.0**	CT DEEP Filter System	0.6 in first filter - 1,1,1 TCA, 0.7 1,1 DCE in first filter
Harper's Landing															
4**	Harper's Landing	ND	ND	ND	ND	ND	**0.1**	ND	**0.1**	ND	ND	ND	**1.2**	- - -	

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Appendix B - Table B2

Study Area Raw Well Water Analytical Results - Historic Concentration Ranges

	COC	1,1-Dichloroethene (µg/L)		Tetrachloroethene (µg/L)		1,1,1-Trichloroethane (µg/L)		Trichloroethene (µg/L)		1,4-Dioxane (µg/L)		Methyl T-Butyl Ether (µg/L)		Current Treatment	Notes
	US EPA MCL	7		5		200		5		---		50,000			
	CT DPH DWAL	7		5		200		1		3		70			
	CT DPH B/SAL	---		---		---		---		50		---			
Street #	**Street Address**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**	**Low**	**High**		
Little Meadow Road															
14	Little Meadow Road	**0.7**	**180.0**	ND	**26.0**	ND	**590.0**	**29.0**	**1,600.0**	**10.0**	**15.0**	ND	**0.58**	- - -	Formerly known as 1 Marina Park
Lot 22-1	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
69	Little Meadow Road	ND	**4.6**	ND	**<0.5**	ND	**9.1**	ND	**40.0**	ND	**1.3**	ND	ND	CT DEEP Filter System	
71	Little Meadow Road	ND	**22.0**	ND	**330.0**	ND	**55.5**	ND	**330.0**	**26.0**	**39.0**	ND	**1.0**	CT DEEP Filter System	
74	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Supply well unknown
75	Little Meadow Road	ND	**10.0**	ND	**<0.5**	ND	**20.0**	ND	**67.0**	**1.4**	**2.7**	ND	**20.0**	CT DEEP Filter System	
76	Little Meadow Road	**0.1**	**7.6**	ND	**<0.5**	ND	**20.0**	ND	**83.0**	**1.8**	**7.0**	ND	**21.0**	CT DEEP Filter System	
77	Little Meadow Road	**0.1**	**72.0**	ND	**1.0**	ND	**54.6**	**2.2**	**350.0**	ND	**62.0**	ND	**<0.5**	CT DEEP Filter System/Bottled Water	
78	Little Meadow Road	ND	**11.0**	ND	**0.5**	ND	**22.0**	ND	**120.0**	ND	**2.2**	ND	**8.5**	CT DEEP Filter System/Bottled Water	
84	Little Meadow Road	ND	**10.0**	ND	**<0.5**	ND	**23.0**	ND	**97.0**	ND	ND	ND	**11.0**	CT DEEP Filter System	1,4 Dioxane detected in filter
88	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	No well
90	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	No well
94	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Well identified at property
98	Little Meadow Road	ND	ND	ND	ND	ND	**0.1**	ND	**2.2**	ND	ND	ND	ND	- - -	
102	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	- - -	
104	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	- - -	
106	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.8**	- - -	
109	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	**<0.5**	ND	ND	ND	ND	- - -	
110	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	**110.0**	ND	ND	ND	ND	CT DEEP Filter System	
116	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.8**	- - -	
120	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	- - -	
124	Little Meadow Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	ND	ND	N/A	N/A	- - -	
128	Little Meadow Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**10.0**	- - -	
130	Little Meadow Road	ND	**6.7**	ND	ND	ND	ND	ND	**19.0**	ND	**11.0**	ND	ND	CT DEEP Filter System	
134	Little Meadow Road	ND	**11.0**	ND	ND	ND	**4.7**	**1.3**	**74.0**	**7.4**	**20.0**	ND	ND	CT DEEP Filter System	
Old Chester Road-N															
0	Old Chester Road-N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Undeveloped, no well
Saybrook Road															
1556	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.5**	- - -	
1557	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.6**	- - -	
1564	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	Served by 1572 Saybrook Road
1565	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
1569	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
1572	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**0.7**	- - -	Serves 1564 Saybrook Road
1573	Saybrook Road	ND	ND	ND	**3.9**	ND	ND	ND	**<0.5**	ND	ND	ND	**1.1**	- - -	
1583	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	ND	- - -	
1584	Saybrook Road	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	- - -	
1586	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	**4.1**	- - -	
1588	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**1.08**	- - -	
1598	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	**0.53**	- - -	
1609	Saybrook Road	ND	**0.7**	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**0.54**	- - -	
1610	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	**108.0**	Bottled Water	Two wells located at this property- two filters will be installed
1617	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	N/A	N/A	ND	ND	- - -	
1618	Saybrook Road	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**3.58**	**900.0**	Filter System	
1640	Saybrook Road	ND	**<0.5**	ND	ND	ND	ND	ND	**2.4**	ND	ND	ND	ND	- - -	
South Side Bluff															
16	South Side Bluff	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.5**	- - -	
22	South Side Bluff	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**<0.5**	- - -	
26	South Side Bluff	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**4.8**	- - -	
30	South Side Bluff	ND	ND	ND	ND	ND	**<0.5**	ND	ND	ND	ND	ND	**<0.5**	- - -	

* 79 Bridge Road is also considered 81 Bridge Rd. (two separate houses served by one well)
** 4 Harpers Landing is also considered 12 Andrews Marina.

Notes:

	Value exceeds both US EPA MCL and CT DPH DWAL
	Value exceeds CT DPH DWAL or CT DPH B/SAL
BOLD	Detected compound
ND	Non detect
N/A	No access, no well present, or constituent not analyzed

Appendix C

Water Supply Evaluation – Insurance Service Office PPC™ Program

ISO's Public Protection Classification (PPC™) Program
Technical Subjects Overview
Needed Fire Flow
Monitoring Emergency Circuits for Integrity
Criteria for Distribution of Companies
Response-Time Considerations
Engine-Company Equipment
Service-Company Equipment
Ladder-Company Equipment
FSRS Equivalency List
Maximum Age for Apparatus
Automatic Aid
Training
Water-Supply Evaluations
Alternative Water Supplies
Relative-Value Tables
Divergence Factors

Water-Supply Evaluations

Forty percent of your community's Public Protection Classification (PPC™) grading is based on your water supply. ISO looks at whether you have sufficient water for fire suppression beyond your community's daily maximum consumption for other purposes.

Minimum criteria
For your community to be eligible for a PPC of Class 8 or better, your water supply system must be able to deliver at least 250 gpm for a period of two hours. That flow is in addition to the community's maximum daily rate of consumption for purposes other than firefighting.

If the fire department delivers the 250 gpm through tanker shuttle, large-diameter hose, or other alternative water supply, the water must be available within five minutes of the arrival of the first-due apparatus, and the department must maintain the flow, without interruption, for the two-hour duration.

Class 8B
If a community has superior fire-protection services and fire-alarm facilities, but lacks the water supply required for a PPC of Class 8 or better, the community may be eligible for a Class 8B rating. For more information, see Minimum Criteria for Class 8B.

Evaluation of systems that exceed the minimum requirement
If your water supply meets the 250-gpm minimum, ISO will evaluate your system — together with factors relating to your fire department and your fire-alarm and communications systems — to determine whether you qualify for a PPC of Class 8 or better.

Within the Fire Suppression Rating Schedule (FSRS), a section called "Needed Fire Flow" outlines the methodology for determining the amount of water necessary for providing fire protection at representative locations throughout the community. To evaluate your community's water supply ISO calculates the needed fire flow for selected locations. We then determine the water-flow capabilities at those locations and calculate a ratio considering the need (needed fire flow) and the availability (water-flow capability). We use that ratio in calculating the credit points identified in the FSRS.

ISO calculates the needed fire flow for an individual building based on the building's area, construction, occupancy, and exposure. To get full credit, the water supply must be able to deliver water, at 20 psi residual pressure and at the specified rate of flow, for a specified period of time. Needed fire flows for individual buildings range from a minimum of 500 gpm to a maximum of 12,000 gpm. For more information, see the Guide for Determination of Needed Fire Flow.

Residential areas
For residential areas with one- and two-family dwellings, ISO determines the needed fire flows by considering the distance between buildings:

Distance	Needed Fire Flow
more than 100 feet	500 gpm
31 to 100 feet	750 gpm
11 to 30 feet	1,000 gpm
10 feet or less	1,500 gpm

Buildings not considered in the community's PPC
For purposes of calculating your community's PPC, ISO does not normally consider the needed fire flow at certain high-demand properties. Those properties include:

- buildings graded and coded by ISO as protected by an automatic sprinkler system meeting applicable National Fire Protection Association standards
- buildings with a needed fire flow in excess of 3,500 gpm

ISO individually grades the protection of buildings with a needed fire flow in excess of 3,500 gpm, and their PPC can differ from that of the community or district that provides their fire protection.

Evaluation method
ISO analyzes three primary factors in the evaluation of the water supply at each representative site in your community:

- capacity of the supply works
- capacity of the water mains or distribution system
- distribution of hydrants

We analyze each of those factors according to applicable standards of the National Fire Protection Association (NFPA) and the American Water Works Association (AWWA).

We determine the capacity of the supply works for each service (pressure) zone through an analysis of such factors as water source (wells, springs, impoundments, stream-flow diversions, and the like); treatment facilities; transmission facilities (suction storage, booster pumps, transmission mains, pressure-reducing valves, and the like); and gravity storage. We calculate the flow — sustainable for the needed duration — from both suction storage tanks and gravity storage tanks, based on the capacity of the tanks at their average daily minimum levels.

We determine supply-works capacity, in gpm, for a duration of 2 hours for needed fire flows less than 3,000 gpm; for a duration of 3 hours for needed fire flows of 3,000 gpm to 3,500 gpm; and for a duration of 4 hours for needed fire flows in excess of 3,500 gpm. We credit only supply-works capacity in excess of the maximum daily consumption rate, based on records for the last 3 years.

We determine capacity of the water mains or distribution system by observing actual hydrant flow tests at each representative location.

Those tests produce results calculated in gpm at a residual pressure of 20 psi. Under certain circumstances, ISO may accept tests witnessed by outside agencies, if conducted according to industry-accepted practices, or flows determined from a valid and balanced computer model.

ISO evaluates hydrant distribution by examining the number and type of hydrants within 1,000 feet of each representative building. We also look at the distance from each such hydrant to the subject building, measured as apparatus can lay hose.

Hydrants with at least one large pumper outlet may receive credit for up to 1,000 gpm. Hydrants with at least two hose outlets, but no pumper outlet, may receive credit for up to 750 gpm. And hydrants with only one hose outlet may receive credit for up to 500 gpm.

Hydrants within 300 feet of the subject building may receive credit for up to 1,000 gpm (but not more than the credit that would apply based on the number and type of outlets). Hydrants from 301 feet to 600 feet from the subject building may receive credit for up to 670 gpm (but not more than the credit that would apply based on the number and type of outlets). And hydrants from 601 feet to 1,000 feet from the subject building receive credit for 250 gpm. Under certain circumstances, when

all fire department pumpers carry sufficient large-diameter hose, ISO may allow maximum credit for hydrants up to 1,000 feet from the subject building.

For each representative location, ISO credits the least of the rates of flow determined for supply-works capacity, water-main or distribution-system capacity, or hydrant distribution. (The credit rate of flow cannot exceed the needed fire flow for that location.)

To determine the grading points that go into the calculation of your community's PPC, ISO considers the percentage of the needed fire flows that the credited rates of flow can provide. You receive that percentage of the available grading points. For example, if your community's credited flow could supply 75 percent of the needed fire flows at the representative locations, you would receive 75 percent of the available credit points.

In addition, ISO evaluates the type and installation of hydrants and/or suction points throughout your community or district, along with any program of hydrant inspections and maintenance. You receive additional credit points based on that evaluation.

For more information . . .
. . . on any topic related to the PPC™ program or the Fire Suppression Rating Schedule, click Talk to ISO Mitigation or call the ISO mitigation specialists at 1-800-444-4554.

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Appendix D

Connection to Connecticut Water Company Water Distribution System Cost Estimates

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Base Layout
Route 154, Chester Section
CWC Connection to Chester/Haddam Line

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	1280	$12,800.00
Removal of Concrete Pavement	$15.00	SY	249	$3,733.33
Cut Bituminous Concrete Pavement	$4.00	LF	1840	$7,360.00
Removal of Bituminous Sidewalk	$4.18	SY	3	$11.15
Removal of Existing Curbing	$2.50	LF	400	$1,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	2748	$82,433.00
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	485	$48,490.00
Processed Aggregate Subbase	$46.00	CY	99	$4,571.60
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	97	$15,226.38
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	194	$18,426.83
Material for Tack Coat	$9.00	Gal	72	$644.00
Mill and Overlay (2.5-inches)	$20.00	SY	1700	$34,000.00
Class "A" Concrete	$300.00	CY	9	$2,820.00
Bedding Material	$30.00	CY	1058	$31,748.89
8" Ductile Iron Pipe	$75.00	LF	4082	$306,150.00
Paved Apron	$60.00	SY	190	$11,400.00
Bituminous Concrete Lip Curbing	$6.50	LF	400	$2,600.00
Rebuild Stone Wall	$125.00	LF	20	$2,500.00
Remove and Reset Metal Beam Rail	$30.00	LF	300	$9,000.00
Bituminous Concrete Sidewalk	$50.00	SY	3	$133.33
Trafficperson (Municipal Police Officer)	$75.00	HR	328	$24,600.00
8" Gate Valve	$2,000.00	EA	4	$8,000.00
Subtotal				$627,648.52
Minor Items (3%)				$18,829.46
Subtotal				$646,477.98
M&P of Traffic (4%)				$25,859.12
Mobilization (7.5%)				$48,485.85
Subtotal				$720,822.95
Incidentals (10%)				$72,082.29
Subtotal				$792,905.24
Contingency (25%)				$198,226.31
Total				$991,131.55
Say				$992,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Base Layout
Route 154, Haddam Section
Chester/Haddam Line to Bridge Road Area

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	9726	$97,262.00
Removal of Concrete Pavement	$15.00	SY	1891	$28,368.08
Cut Bituminous Concrete Pavement	$4.00	LF	9726	$38,904.80
Removal of Existing Curbing	$2.50	LF	1325	$3,312.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	6033	$180,998.15
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	1065	$106,469.50
Processed Aggregate Subbase	$46.00	CY	525	$24,165.40
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	513	$80,486.33
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	1025	$97,403.84
Material for Tack Coat	$9.00	Gal	378	$3,404.17
Mill and Overlay (2.5-inches)	$20.00	SY	8272	$165,436.67
Concrete for Steps and Copings	$1,500.00	CY	1	$1,467.00
Class "A" Concrete	$300.00	CY	19	$5,685.00
Bedding Material	$30.00	CY	2298	$68,935.22
8" Ductile Iron Pipe	$75.00	LF	8863	$664,732.50
Paved Apron	$60.00	SY	165	$9,880.00
Bituminous Concrete Lip Curbing	$6.50	LF	1325	$8,612.50
Remove and Reset Metal Beam Rail	$30.00	LF	1450	$43,500.00
Trafficperson (Municipal Police Officer)	$75.00	HR	712	$53,400.00
8" Gate Valve	$2,000.00	EA	13	$26,000.00
Subtotal				$1,708,423.67
Minor Items (3%)				$51,252.71
Subtotal				$1,759,676.38
M&P of Traffic (4%)				$70,387.06
Mobilization (7.5%)				$131,975.73
Subtotal				$1,962,039.16
Incidentals (10%)				$196,203.92
Subtotal				$2,158,243.08
Contingency (25%)				$539,560.77
Total				$2,697,803.85
Say				$2,698,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Base Layout
Bridge Road (Route 82) Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	5470	$21,880.00
Removal of Existing Curbing	$2.50	LF	185	$462.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	1842	$55,264.17
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	325	$32,508.33
Processed Aggregate Subbase	$46.00	CY	295	$13,590.59
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	288	$45,265.39
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	577	$54,779.77
Material for Tack Coat	$9.00	Gal	213	$1,914.50
Mill and Overlay (2.5-inches)	$20.00	SY	4725	$94,500.00
Class "A" Concrete	$300.00	CY	3	$840.00
Bedding Material	$30.00	CY	709	$21,272.22
8" Ductile Iron Pipe	$75.00	LF	2735	$205,125.00
Bituminous Concrete Lip Curbing	$6.50	LF	185	$1,202.50
Remove and Reset Metal Beam Rail	$30.00	LF	165	$4,950.00
Trafficperson (Municipal Police Officer)	$75.00	HR	224	$16,800.00
8" Gate Valve	$2,000.00	EA	9	$18,000.00
Pipe Jacking	$150,000.00	LS	1	$150,000.00
Subtotal				$738,354.97
Minor Items (3%)				$22,150.65
Subtotal				$760,505.62
M&P of Traffic (4%)				$30,420.22
Mobilization (7.5%)				$57,037.92
Subtotal				$847,963.76
Incidentals (10%)				$84,796.38
Subtotal				$932,760.14
Contingency (25%)				$233,190.04
Total				$1,165,950.18
Say				$1,166,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Base Layout
Bridge Lane Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	298	$7,437.50
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	53	$5,250.00
Processed Aggregate Subbase	$46.00	CY	158	$7,283.33
Bedding Material	$30.00	CY	117	$3,500.00
8" Ductile Iron Pipe	$75.00	LF	450	$33,750.00
Trafficperson (Municipal Police Officer)	$75.00	HR	40	$3,000.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$62,220.83
Minor Items (3%)				$1,866.63
Subtotal				$64,087.46
M&P of Traffic (4%)				$2,563.50
Mobilization (7.5%)				$4,806.56
Subtotal				$71,457.52
Incidentals (10%)				$7,145.75
Subtotal				$78,603.27
Contingency (25%)				$19,650.82
Total				$98,254.08
Say				$99,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Base Layout
Little Meadow Road Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	660	$2,640.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	2620	$65,496.67
Processed Aggregate Subbase	$46.00	CY	917	$42,162.07
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	17	$2,730.82
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	29	$2,754.01
Material for Tack Coat	$9.00	Gal	26	$231.00
Class "A" Concrete	$300.00	CY	1	$150.00
Bedding Material	$30.00	CY	873	$26,198.67
8" Ductile Iron Pipe	$75.00	LF	3368	$252,630.00
Remove and Reset Metal Beam Rail	$30.00	LF	260	$7,800.00
Trafficperson (Municipal Police Officer)	$75.00	HR	272	$20,400.00
8" Gate Valve	$2,000.00	EA	5	$10,000.00
Encasing Water Line to Cross Septic Field	$20,000.00	EA	5	$100,000.00
Subtotal				$533,193.23
Minor Items (3%)				$15,995.80
Subtotal				$549,189.03
M&P of Traffic (4%)				$21,967.56
Mobilization (7.5%)				$41,189.18
Subtotal				$612,345.76
Incidentals (10%)				$61,234.58
Subtotal				$673,580.34
Contingency (25%)				$168,395.09
Total				$841,975.43
Say				$842,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Base Layout
Camp Bethel Road Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	1500	$6,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	661	$19,833.33
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	117	$11,666.67
Processed Aggregate Subbase	$46.00	CY	97	$4,472.22
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	40	$6,206.41
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	66	$6,259.11
Material for Tack Coat	$9.00	Gal	58	$525.00
Class "A" Concrete	$300.00	CY	1	$225.00
Bedding Material	$30.00	CY	259	$7,777.78
8" Ductile Iron Pipe	$75.00	LF	1000	$75,000.00
Trafficperson (Municipal Police Officer)	$75.00	HR	80	$6,000.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$145,965.52
Minor Items (3%)				$4,378.97
Subtotal				$150,344.49
M&P of Traffic (4%)				$6,013.78
Mobilization (7.5%)				$11,275.84
Subtotal				$167,634.10
Incidentals (10%)				$16,763.41
Subtotal				$184,397.51
Contingency (25%)				$46,099.38
Total				$230,496.89
Say				$231,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Base Layout
South Side Bluff Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	100	$400.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	583	$14,583.33
Processed Aggregate Subbase	$46.00	CY	253	$11,627.78
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	3	$413.76
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	4	$417.27
Material for Tack Coat	$9.00	Gal	4	$35.00
Class "A" Concrete	$300.00	CY	0.25	$75.00
Bedding Material	$30.00	CY	194	$5,833.33
8" Ductile Iron Pipe	$75.00	LF	750	$56,250.00
Trafficperson (Municipal Police Officer)	$75.00	HR	64	$4,800.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$96,435.48
Minor Items (3%)				$2,893.06
Subtotal				$99,328.54
M&P of Traffic (4%)				$3,973.14
Mobilization (7.5%)				$7,449.64
Subtotal				$110,751.33
Incidentals (10%)				$11,075.13
Subtotal				$121,826.46
Contingency (25%)				$30,456.61
Total				$152,283.07
Say				$153,000.00

Appendix D
Tylerville Center Water Supply Estimate
Service Connections and Well Abandonment Costs

Item Description	Unit	Quantity	Unit Cost	Total
1" Copper Water Service Connection*	EA	57	$1,000.00	$57,000
2" Copper Water Service Connection	EA	33	$1,400.00	$46,200
1" Supply from Property Line to House	LF	2500	$32.00	$80,000
2" Supply from Property Line to House	LF	1750	$35.00	$61,250
1" Water Meter	EA	50	$350.00	$17,500
2" Water Meter	EA	35	$1,400.00	$49,000
Individual System Removal	EA	24	$1,200.00	$28,800
Well Abandonment	EA	65	$2,000.00	$130,000
Total				$469,750

Note:
*79/81 Bridge Road will receive two water service connections

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Alternate Layout
Route 154, Chester Section
CWC Connection to Chester/Haddam Line

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	1280	$12,800.00
Removal of Concrete Pavement	$15.00	SY	249	$3,733.33
Cut Bituminous Concrete Pavement	$4.00	LF	1840	$7,360.00
Removal of Bituminous Sidewalk	$4.18	SY	3	$11.15
Removal of Existing Curbing	$2.50	LF	400	$1,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	2748	$82,433.00
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	485	$48,490.00
Processed Aggregate Subbase	$46.00	CY	99	$4,571.60
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	97	$15,226.38
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	194	$18,426.83
Material for Tack Coat	$9.00	Gal	72	$644.00
Mill and Overlay (2.5-inches)	$20.00	SY	1700	$34,000.00
Class "A" Concrete	$300.00	CY	9	$2,820.00
Bedding Material	$30.00	CY	1058	$31,748.89
8" Ductile Iron Pipe	$75.00	LF	4082	$306,150.00
Paved Apron	$60.00	SY	190	$11,400.00
Bituminous Concrete Lip Curbing	$6.50	LF	400	$2,600.00
Rebuild Stone Wall	$125.00	LF	20	$2,500.00
Remove and Reset Metal Beam Rail	$30.00	LF	300	$9,000.00
Bituminous Concrete Sidewalk	$50.00	SY	3	$133.33
Trafficperson (Municipal Police Officer)	$75.00	HR	328	$24,600.00
8" Gate Valve	$2,000.00	EA	4	$8,000.00
Subtotal				$627,648.52
Minor Items (3%)				$18,829.46
Subtotal				$646,477.98
M&P of Traffic (4%)				$25,859.12
Mobilization (7.5%)				$48,485.85
Subtotal				$720,822.95
Incidentals (10%)				$72,082.29
Subtotal				$792,905.24
Contingency (25%)				$198,226.31
Total				$991,131.55
Say				$992,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Alternate Layout
Route 154, Haddam Section
Chester/Haddam Line to Little Meadow Road Connector & Route 154 Section within Water Supply Area

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	6506	$65,060.00
Removal of Concrete Pavement	$15.00	SY	1265	$18,975.83
Cut Bituminous Concrete Pavement	$4.00	LF	6506	$26,024.00
Removal of Existing Curbing	$2.50	LF	855	$2,137.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	3801	$114,030.33
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	671	$67,076.67
Processed Aggregate Subbase	$46.00	CY	351	$16,164.60
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	343	$53,838.51
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	686	$65,154.88
Material for Tack Coat	$9.00	Gal	253	$2,277.10
Mill and Overlay (2.5-inches)	$20.00	SY	5588	$111,766.67
Class "A" Concrete	$300.00	CY	10	$3,015.00
Bedding Material	$30.00	CY	1457	$43,695.56
8" Ductile Iron Pipe	$75.00	LF	5618	$421,350.00
Paved Apron	$60.00	SY	41	$2,440.00
Bituminous Concrete Lip Curbing	$6.50	LF	855	$5,557.50
Remove and Reset Metal Beam Rail	$30.00	LF	335	$10,050.00
Trafficperson (Municipal Police Officer)	$75.00	HR	456	$34,200.00
8" Gate Valve	$2,000.00	EA	7	$14,000.00
Subtotal				$1,076,814.14
Minor Items (3%)				$32,304.42
Subtotal				$1,109,118.56
M&P of Traffic (4%)				$44,364.74
Mobilization (7.5%)				$83,183.89
Subtotal				$1,236,667.20
Incidentals (10%)				$123,666.72
Subtotal				$1,360,333.92
Contingency (25%)				$340,083.48
Total				$1,700,417.40
Say				$1,701,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Alternate Layout
Bridge Road (Route 82) Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	5470	$21,880.00
Removal of Existing Curbing	$2.50	LF	185	$462.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	1842	$55,264.17
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	325	$32,508.33
Processed Aggregate Subbase	$46.00	CY	295	$13,590.59
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	288	$45,265.39
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	577	$54,779.77
Material for Tack Coat	$9.00	Gal	213	$1,914.50
Mill and Overlay (2.5-inches)	$20.00	SY	4725	$94,500.00
Class "A" Concrete	$300.00	CY	3	$840.00
Bedding Material	$30.00	CY	709	$21,272.22
8" Ductile Iron Pipe	$75.00	LF	2735	$205,125.00
Bituminous Concrete Lip Curbing	$6.50	LF	185	$1,202.50
Remove and Reset Metal Beam Rail	$30.00	LF	165	$4,950.00
Trafficperson (Municipal Police Officer)	$75.00	HR	224	$16,800.00
8" Gate Valve	$2,000.00	EA	9	$18,000.00
Pipe Jacking	$150,000.00	LS	1	$150,000.00
Subtotal				$738,354.97
Minor Items (3%)				$22,150.65
Subtotal				$760,505.62
M&P of Traffic (4%)				$30,420.22
Mobilization (7.5%)				$57,037.92
Subtotal				$847,963.76
Incidentals (10%)				$84,796.38
Subtotal				$932,760.14
Contingency (25%)				$233,190.04
Total				$1,165,950.18
Say				$1,166,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Alternate Layout
Bridge Lane Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	298	$7,437.50
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	53	$5,250.00
Processed Aggregate Subbase	$46.00	CY	158	$7,283.33
Bedding Material	$30.00	CY	117	$3,500.00
8" Ductile Iron Pipe	$75.00	LF	450	$33,750.00
Trafficperson (Municipal Police Officer)	$75.00	HR	40	$3,000.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$62,220.83
Minor Items (3%)				$1,866.63
Subtotal				$64,087.46
M&P of Traffic (4%)				$2,563.50
Mobilization (7.5%)				$4,806.56
Subtotal				$71,457.52
Incidentals (10%)				$7,145.75
Subtotal				$78,603.27
Contingency (25%)				$19,650.82
Total				$98,254.08
Say				$99,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Alternate Layout
Little Meadow Road Section & Route 154 Connector

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	660	$2,640.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	3631	$90,774.44
Processed Aggregate Subbase	$46.00	CY	909	$41,834.10
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	35	$5,461.64
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	70	$6,609.63
Material for Tack Coat	$9.00	Gal	26	$231.00
Class "A" Concrete	$300.00	CY	1	$375.00
Bedding Material	$30.00	CY	1210	$36,309.78
8" Ductile Iron Pipe	$75.00	LF	4668	$350,130.00
Remove and Reset Metal Beam Rail	$30.00	LF	260	$7,800.00
Trafficperson (Municipal Police Officer)	$75.00	HR	376	$28,200.00
8" Gate Valve	$2,000.00	EA	5	$10,000.00
Encasing Water Line to Cross Septic Field	$20,000.00	EA	5	$100,000.00
Pipe Jacking	$150,000.00	LS	1	$150,000.00
Subtotal				$830,365.59
Minor Items (3%)				$24,910.97
Subtotal				$855,276.56
M&P of Traffic (4%)				$34,211.06
Mobilization (7.5%)				$64,145.74
Subtotal				$953,633.36
Incidentals (10%)				$95,363.34
Subtotal				$1,048,996.70
Contingency (25%)				$262,249.17
Total				$1,311,245.87
Say				$1,312,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Alternate Layout
Camp Bethel Road Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	1500	$6,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	661	$19,833.33
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	117	$11,666.67
Processed Aggregate Subbase	$46.00	CY	97	$4,472.22
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	40	$6,206.41
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	66	$6,259.11
Material for Tack Coat	$9.00	Gal	58	$525.00
Class "A" Concrete	$300.00	CY	1	$225.00
Bedding Material	$30.00	CY	259	$7,777.78
8" Ductile Iron Pipe	$75.00	LF	1000	$75,000.00
Trafficperson (Municipal Police Officer)	$75.00	HR	80	$6,000.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$145,965.52
Minor Items (3%)				$4,378.97
Subtotal				$150,344.49
M&P of Traffic (4%)				$6,013.78
Mobilization (7.5%)				$11,275.84
Subtotal				$167,634.10
Incidentals (10%)				$16,763.41
Subtotal				$184,397.51
Contingency (25%)				$46,099.38
Total				$230,496.89
Say				$231,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (8-Inch) Alternate Layout
South Side Bluff Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	100	$400.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	583	$14,583.33
Processed Aggregate Subbase	$46.00	CY	253	$11,627.78
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	3	$413.76
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	4	$417.27
Material for Tack Coat	$9.00	Gal	4	$35.00
Class "A" Concrete	$300.00	CY	0.25	$75.00
Bedding Material	$30.00	CY	194	$5,833.33
8" Ductile Iron Pipe	$75.00	LF	750	$56,250.00
Trafficperson (Municipal Police Officer)	$75.00	HR	64	$4,800.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$96,435.48
Minor Items (3%)				$2,893.06
Subtotal				$99,328.54
M&P of Traffic (4%)				$3,973.14
Mobilization (7.5%)				$7,449.64
Subtotal				$110,751.33
Incidentals (10%)				$11,075.13
Subtotal				$121,826.46
Contingency (25%)				$30,456.61
Total				$152,283.07
Say				$153,000.00

Appendix D
Tylerville Center Water Supply Estimate
Service Connections and Well Abandonment Costs

Item Description	Unit	Quantity	Unit Cost	Total
1" Copper Water Service Connection*	EA	57	$1,000.00	$57,000
2" Copper Water Service Connection	EA	33	$1,400.00	$46,200
1" Supply from Property Line to House	LF	2500	$32.00	$80,000
2" Supply from Property Line to House	LF	1750	$35.00	$61,250
1" Water Meter	EA	50	$350.00	$17,500
2" Water Meter	EA	35	$1,400.00	$49,000
Individual System Removal	EA	24	$1,200.00	$28,800
Well Abandonment	EA	65	$2,000.00	$130,000
Total				$469,750

Note:
*79/81 Bridge Road will receive two water service connections

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Base Layout
Route 154, Chester Section
CWC Connection to Chester/Haddam Line

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	1280	$12,800.00
Removal of Concrete Pavement	$15.00	SY	249	$3,733.33
Cut Bituminous Concrete Pavement	$4.00	LF	1840	$7,360.00
Removal of Bituminous Sidewalk	$4.18	SY	3	$11.15
Removal of Existing Curbing	$2.50	LF	400	$1,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	2748	$82,433.00
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	485	$48,490.00
Processed Aggregate Subbase	$46.00	CY	99	$4,571.60
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	97	$15,226.38
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	194	$18,426.83
Material for Tack Coat	$9.00	Gal	72	$644.00
Mill and Overlay (2.5-inches)	$20.00	SY	1700	$34,000.00
Class "A" Concrete	$300.00	CY	9	$2,820.00
Bedding Material	$30.00	CY	1058	$31,748.89
12" Ductile Iron Pipe	$95.00	LF	4082	$387,790.00
Paved Apron	$60.00	SY	190	$11,400.00
Bituminous Concrete Lip Curbing	$6.50	LF	400	$2,600.00
Rebuild Stone Wall	$125.00	LF	20	$2,500.00
Remove and Reset Metal Beam Rail	$30.00	LF	300	$9,000.00
Bituminous Concrete Sidewalk	$50.00	SY	3	$133.33
Trafficperson (Municipal Police Officer)	$75.00	HR	328	$24,600.00
12" Gate Valve	$2,800.00	EA	4	$11,200.00
Subtotal				$712,488.52
Minor Items (3%)				$21,374.66
Subtotal				$733,863.18
M&P of Traffic (4%)				$29,354.53
Mobilization (7.5%)				$55,039.74
Subtotal				$818,257.45
Incidentals (10%)				$81,825.74
Subtotal				$900,083.19
Contingency (25%)				$225,020.80
Total				$1,125,103.99
Say				$1,126,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Base Layout
Route 154, Haddam Section
Chester/Haddam Line to Bridge Road Area

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	9726	$97,262.00
Removal of Concrete Pavement	$15.00	SY	1891	$28,368.08
Cut Bituminous Concrete Pavement	$4.00	LF	9726	$38,904.80
Removal of Existing Curbing	$2.50	LF	1325	$3,312.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	6033	$180,998.15
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	1065	$106,469.50
Processed Aggregate Subbase	$46.00	CY	525	$24,165.40
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	513	$80,486.33
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	1025	$97,403.84
Material for Tack Coat	$9.00	Gal	378	$3,404.17
Mill and Overlay (2.5-inches)	$20.00	SY	8272	$165,436.67
Concrete for Steps and Copings	$1,500.00	CY	1	$1,467.00
Class "A" Concrete	$300.00	CY	19	$5,685.00
Bedding Material	$30.00	CY	2298	$68,935.22
12" Ductile Iron Pipe	$95.00	LF	8863	$841,994.50
Paved Apron	$60.00	SY	165	$9,880.00
Bituminous Concrete Lip Curbing	$6.50	LF	1325	$8,612.50
Remove and Reset Metal Beam Rail	$30.00	LF	1450	$43,500.00
Trafficperson (Municipal Police Officer)	$75.00	HR	712	$53,400.00
12" Gate Valve	$2,800.00	EA	13	$36,400.00
Subtotal				$1,896,085.67
Minor Items (3%)				$56,882.57
Subtotal				$1,952,968.24
M&P of Traffic (4%)				$78,118.73
Mobilization (7.5%)				$146,472.62
Subtotal				$2,177,559.59
Incidentals (10%)				$217,755.96
Subtotal				$2,395,315.54
Contingency (25%)				$598,828.89
Total				$2,994,144.43
Say				$2,995,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Base Layout
Bridge Road (Route 82) Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	5470	$21,880.00
Removal of Existing Curbing	$2.50	LF	185	$462.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	1842	$55,264.17
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	325	$32,508.33
Processed Aggregate Subbase	$46.00	CY	295	$13,590.59
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	288	$45,265.39
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	577	$54,779.77
Material for Tack Coat	$9.00	Gal	213	$1,914.50
Mill and Overlay (2.5-inches)	$20.00	SY	4725	$94,500.00
Class "A" Concrete	$300.00	CY	3	$840.00
Bedding Material	$30.00	CY	709	$21,272.22
12" Ductile Iron Pipe	$95.00	LF	2735	$259,825.00
Bituminous Concrete Lip Curbing	$6.50	LF	185	$1,202.50
Remove and Reset Metal Beam Rail	$30.00	LF	165	$4,950.00
Trafficperson (Municipal Police Officer)	$75.00	HR	224	$16,800.00
12" Gate Valve	$2,800.00	EA	9	$25,200.00
Pipe Jacking	$170,000.00	LS	1	$170,000.00
Subtotal				$820,254.97
Minor Items (3%)				$24,607.65
Subtotal				$844,862.62
M&P of Traffic (4%)				$33,794.50
Mobilization (7.5%)				$63,364.70
Subtotal				$942,021.82
Incidentals (10%)				$94,202.18
Subtotal				$1,036,224.00
Contingency (25%)				$259,056.00
Total				$1,295,280.00
Say				$1,296,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Base Layout
Bridge Lane Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	298	$7,437.50
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	53	$5,250.00
Processed Aggregate Subbase	$46.00	CY	158	$7,283.33
Bedding Material	$30.00	CY	117	$3,500.00
8" Ductile Iron Pipe	$75.00	LF	450	$33,750.00
Trafficperson (Municipal Police Officer)	$75.00	HR	40	$3,000.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$62,220.83
Minor Items (3%)				$1,866.63
Subtotal				$64,087.46
M&P of Traffic (4%)				$2,563.50
Mobilization (7.5%)				$4,806.56
Subtotal				$71,457.52
Incidentals (10%)				$7,145.75
Subtotal				$78,603.27
Contingency (25%)				$19,650.82
Total				$98,254.08
Say				$99,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Base Layout
Little Meadow Road Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	660	$2,640.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	2620	$65,496.67
Processed Aggregate Subbase	$46.00	CY	917	$42,162.07
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	17	$2,730.82
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	29	$2,754.01
Material for Tack Coat	$9.00	Gal	26	$231.00
Class "A" Concrete	$300.00	CY	1	$150.00
Bedding Material	$30.00	CY	873	$26,198.67
8" Ductile Iron Pipe	$75.00	LF	3368	$252,630.00
Remove and Reset Metal Beam Rail	$30.00	LF	260	$7,800.00
Trafficperson (Municipal Police Officer)	$75.00	HR	272	$20,400.00
8" Gate Valve	$2,000.00	EA	5	$10,000.00
Encasing Water Line to Cross Septic Field	$20,000.00	EA	5	$100,000.00
Subtotal				$533,193.23
Minor Items (3%)				$15,995.80
Subtotal				$549,189.03
M&P of Traffic (4%)				$21,967.56
Mobilization (7.5%)				$41,189.18
Subtotal				$612,345.76
Incidentals (10%)				$61,234.58
Subtotal				$673,580.34
Contingency (25%)				$168,395.09
Total				$841,975.43
Say				$842,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Base Layout
Camp Bethel Road Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	1500	$6,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	496	$14,875.00
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	88	$8,750.00
Processed Aggregate Subbase	$46.00	CY	97	$4,472.22
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	40	$6,206.41
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	66	$6,259.11
Material for Tack Coat	$9.00	Gal	58	$525.00
Class "A" Concrete	$300.00	CY	1	$225.00
Bedding Material	$30.00	CY	194	$5,833.33
8" Ductile Iron Pipe	$75.00	LF	750	$56,250.00
Trafficperson (Municipal Police Officer)	$75.00	HR	64	$4,800.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$116,196.08
Minor Items (3%)				$3,485.88
Subtotal				$119,681.96
M&P of Traffic (4%)				$4,787.28
Mobilization (7.5%)				$8,976.15
Subtotal				$133,445.38
Incidentals (10%)				$13,344.54
Subtotal				$146,789.92
Contingency (25%)				$36,697.48
Total				$183,487.40
Say				$184,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Base Layout
South Side Bluff Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	100	$400.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	583	$14,583.33
Processed Aggregate Subbase	$46.00	CY	253	$11,627.78
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	3	$413.76
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	4	$417.27
Material for Tack Coat	$9.00	Gal	4	$35.00
Class "A" Concrete	$300.00	CY	0	$75.00
Bedding Material	$30.00	CY	194	$5,833.33
8" Ductile Iron Pipe	$75.00	LF	750	$56,250.00
Trafficperson (Municipal Police Officer)	$75.00	HR	64	$4,800.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$96,435.48
Minor Items (3%)				$2,893.06
Subtotal				$99,328.54
M&P of Traffic (4%)				$3,973.14
Mobilization (7.5%)				$7,449.64
Subtotal				$110,751.33
Incidentals (10%)				$11,075.13
Subtotal				$121,826.46
Contingency (25%)				$30,456.61
Total				$152,283.07
Say				$153,000.00

Appendix D
Tylerville Center Water Supply Estimate
Service Connections and Well Abandonment Costs

Item Description	Unit	Quantity	Unit Cost	Total
1" Copper Water Service Connection*	EA	57	$1,000.00	$57,000
2" Copper Water Service Connection	EA	33	$1,400.00	$46,200
1" Supply from Property Line to House	LF	2500	$32.00	$80,000
2" Supply from Property Line to House	LF	1750	$35.00	$61,250
1" Water Meter	EA	50	$350.00	$17,500
2" Water Meter	EA	35	$1,400.00	$49,000
Individual System Removal	EA	24	$1,200.00	$28,800
Well Abandonment	EA	65	$2,000.00	$130,000
Total				$469,750

Note:
*79/81 Bridge Road will receive two water service connections

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Alternate Layout
Route 154, Chester Section
CWC Connection to Chester/Haddam Line

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	1280	$12,800.00
Removal of Concrete Pavement	$15.00	SY	249	$3,733.33
Cut Bituminous Concrete Pavement	$4.00	LF	1840	$7,360.00
Removal of Bituminous Sidewalk	$4.18	SY	3	$11.15
Removal of Existing Curbing	$2.50	LF	400	$1,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	2748	$82,433.00
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	485	$48,490.00
Processed Aggregate Subbase	$46.00	CY	99	$4,571.60
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	97	$15,226.38
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	194	$18,426.83
Material for Tack Coat	$9.00	Gal	72	$644.00
Mill and Overlay (2.5-inches)	$20.00	SY	1700	$34,000.00
Class "A" Concrete	$300.00	CY	9	$2,820.00
Bedding Material	$30.00	CY	1058	$31,748.89
12" Ductile Iron Pipe	$95.00	LF	4082	$387,790.00
Paved Apron	$60.00	SY	190	$11,400.00
Bituminous Concrete Lip Curbing	$6.50	LF	400	$2,600.00
Rebuild Stone Wall	$125.00	LF	20	$2,500.00
Remove and Reset Metal Beam Rail	$30.00	LF	300	$9,000.00
Bituminous Concrete Sidewalk	$50.00	SY	3	$133.33
Trafficperson (Municipal Police Officer)	$75.00	HR	328	$24,600.00
12" Gate Valve	$2,800.00	EA	4	$11,200.00
Subtotal				$712,488.52
Minor Items (3%)				$21,374.66
Subtotal				$733,863.18
M&P of Traffic (4%)				$29,354.53
Mobilization (7.5%)				$55,039.74
Subtotal				$818,257.45
Incidentals (10%)				$81,825.74
Subtotal				$900,083.19
Contingency (25%)				$225,020.80
Total				$1,125,103.99
Say				$1,126,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-Inch) Alternate Layout
Route 154, Haddam Section
Chester/Haddam Line to Little Meadow Road Connector & Route 154 Section within Water Supply Area

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Concrete Pavement	$10.00	LF	6506	$65,060.00
Removal of Concrete Pavement	$15.00	SY	1265	$18,975.83
Cut Bituminous Concrete Pavement	$4.00	LF	6506	$26,024.00
Removal of Existing Curbing	$2.50	LF	855	$2,137.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	3801	$114,030.33
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	671	$67,076.67
Processed Aggregate Subbase	$46.00	CY	351	$16,164.60
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	343	$53,838.51
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	686	$65,154.88
Material for Tack Coat	$9.00	Gal	253	$2,277.10
Mill and Overlay (2.5-inches)	$20.00	SY	5588	$111,766.67
Class "A" Concrete	$300.00	CY	10	$3,015.00
Bedding Material	$30.00	CY	1457	$43,695.56
12" Ductile Iron Pipe	$95.00	LF	5618	$533,710.00
Paved Apron	$60.00	SY	41	$2,440.00
Bituminous Concrete Lip Curbing	$6.50	LF	855	$5,557.50
Remove and Reset Metal Beam Rail	$30.00	LF	335	$10,050.00
Trafficperson (Municipal Police Officer)	$75.00	HR	456	$34,200.00
12" Gate Valve	$2,800.00	EA	7	$19,600.00
Subtotal				$1,194,774.14
Minor Items (3%)				$35,843.22
Subtotal				$1,230,617.36
M&P of Traffic (4%)				$49,224.69
Mobilization (7.5%)				$92,296.30
Subtotal				$1,372,138.36
Incidentals (10%)				$137,213.84
Subtotal				$1,509,352.20
Contingency (25%)				$377,338.05
Total				$1,886,690.24
Say				$1,887,000.00

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Appendix D
Tylerville Center Water Supply Estimate - (12-inch) Alternate Layout
Bridge Road (Route 82) Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	5470	$21,880.00
Removal of Existing Curbing	$2.50	LF	185	$462.50
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	1842	$55,264.17
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	325	$32,508.33
Processed Aggregate Subbase	$46.00	CY	295	$13,590.59
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	288	$45,265.39
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	577	$54,779.77
Material for Tack Coat	$9.00	Gal	213	$1,914.50
Mill and Overlay (2.5-inches)	$20.00	SY	4725	$94,500.00
Class "A" Concrete	$300.00	CY	3	$840.00
Bedding Material	$30.00	CY	709	$21,272.22
12" Ductile Iron Pipe	$95.00	LF	2735	$259,825.00
Bituminous Concrete Lip Curbing	$6.50	LF	185	$1,202.50
Remove and Reset Metal Beam Rail	$30.00	LF	165	$4,950.00
Trafficperson (Municipal Police Officer)	$75.00	HR	224	$16,800.00
12" Gate Valve	$2,800.00	EA	9	$25,200.00
Pipe Jacking	$170,000.00	LS	1	$170,000.00
Subtotal				$820,254.97
Minor Items (3%)				$24,607.65
Subtotal				$844,862.62
M&P of Traffic (4%)				$33,794.50
Mobilization (7.5%)				$63,364.70
Subtotal				$942,021.82
Incidentals (10%)				$94,202.18
Subtotal				$1,036,224.00
Contingency (25%)				$259,056.00
Total				$1,295,280.00
Say				$1,296,000.00

AECOM

Appendix D
Tylerville Center Water Supply Estimate - (12-inch) Alternate Layout
Bridge Lane Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	298	$7,437.50
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	53	$5,250.00
Processed Aggregate Subbase	$46.00	CY	158	$7,283.33
Bedding Material	$30.00	CY	117	$3,500.00
8" Ductile Iron Pipe	$75.00	LF	450	$33,750.00
Trafficperson (Municipal Police Officer)	$75.00	HR	40	$3,000.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$62,220.83
Minor Items (3%)				$1,866.63
Subtotal				$64,087.46
M&P of Traffic (4%)				$2,563.50
Mobilization (7.5%)				$4,806.56
Subtotal				$71,457.52
Incidentals (10%)				$7,145.75
Subtotal				$78,603.27
Contingency (25%)				$19,650.82
Total				$98,254.08
Say				$99,000.00

AECOM

Appendix D

Tylerville Center Water Supply Estimate - (12-inch) Alternate Layout

Little Meadow Road Section & Route 154 Connector

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	660	$2,640.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	3631	$90,774.44
Processed Aggregate Subbase	$46.00	CY	917	$42,162.07
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	17	$2,730.82
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	29	$2,754.01
Material for Tack Coat	$9.00	Gal	26	$231.00
Class "A" Concrete	$300.00	CY	1	$375.00
Bedding Material	$30.00	CY	1210	$36,309.78
12" Ductile Iron Pipe	$95.00	LF	4668	$443,498.00
Remove and Reset Metal Beam Rail	$30.00	LF	260	$7,800.00
Trafficperson (Municipal Police Officer)	$75.00	HR	376	$28,200.00
12" Gate Valve	$2,800.00	EA	5	$14,000.00
Encasing Water Line to Cross Septic Field	$20,000.00	EA	5	$100,000.00
Pipe Jacking	$170,000.00	LS	1	$170,000.00
Subtotal				$941,475.12
Minor Items (3%)				$28,244.25
Subtotal				$969,719.37
M&P of Traffic (4%)				$38,788.77
Mobilization (7.5%)				$72,728.95
Subtotal				$1,081,237.10
Incidentals (10%)				$108,123.71
Subtotal				$1,189,360.81
Contingency (25%)				$297,340.20
Total				$1,486,701.01
Say				$1,487,000.00

AECOM

Appendix D
Tylerville Center Water Supply Estimate - (12-inch) Alternate Layout
Camp Bethel Road Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	1500	$6,000.00
Trench Excavation 0-10' Deep (No Bedrock)	$30.00	CY	496	$14,875.00
Trench Excavation 0-10' Deep (Bedrock)	$100.00	CY	88	$8,750.00
Processed Aggregate Subbase	$46.00	CY	97	$4,472.22
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	40	$6,206.41
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	66	$6,259.11
Material for Tack Coat	$9.00	Gal	58	$525.00
Class "A" Concrete	$300.00	CY	1	$225.00
Bedding Material	$30.00	CY	194	$5,833.33
8" Ductile Iron Pipe	$75.00	LF	750	$56,250.00
Trafficperson (Municipal Police Officer)	$75.00	HR	64	$4,800.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$116,196.08
Minor Items (3%)				$3,485.88
Subtotal				$119,681.96
M&P of Traffic (4%)				$4,787.28
Mobilization (7.5%)				$8,976.15
Subtotal				$133,445.38
Incidentals (10%)				$13,344.54
Subtotal				$146,789.92
Contingency (25%)				$36,697.48
Total				$183,487.40
Say				$184,000.00

AECOM

Appendix D
Tylerville Center Water Supply Estimate - (12-inch) Alternate Layout
South Side Bluff Section

	Estimated By:		PHG	2/4/2013
	Checked By:		WAB	2/25/2013
Description	Unit Cost	Unit	Quantity	Cost
Cut Bituminous Concrete Pavement	$4.00	LF	100	$400.00
Trench Excavation 0-10' Deep (No Bedrock)	$25.00	CY	583	$14,583.33
Processed Aggregate Subbase	$46.00	CY	253	$11,627.78
Bituminous Concrete, Class 1 0 to 249	$157.00	Ton	3	$413.76
Bituminous Concrete, Class 4 250 to 499	$95.00	Ton	4	$417.27
Material for Tack Coat	$9.00	Gal	4	$35.00
Class "A" Concrete	$300.00	CY	0	$75.00
Bedding Material	$30.00	CY	194	$5,833.33
8" Ductile Iron Pipe	$75.00	LF	750	$56,250.00
Trafficperson (Municipal Police Officer)	$75.00	HR	64	$4,800.00
8" Gate Valve	$2,000.00	EA	1	$2,000.00
Subtotal				$96,435.48
Minor Items (3%)				$2,893.06
Subtotal				$99,328.54
M&P of Traffic (4%)				$3,973.14
Mobilization (7.5%)				$7,449.64
Subtotal				$110,751.33
Incidentals (10%)				$11,075.13
Subtotal				$121,826.46
Contingency (25%)				$30,456.61
Total				$152,283.07
Say				$153,000.00

Appendix D
Tylerville Center Water Supply Estimate
Service Connections and Well Abandonment Costs

Item Description	Unit	Quantity	Unit Cost	Total
1" Copper Water Service Connection*	EA	57	$1,000.00	$57,000
2" Copper Water Service Connection	EA	33	$1,400.00	$46,200
1" Supply from Property Line to House	LF	2500	$32.00	$80,000
2" Supply from Property Line to House	LF	1750	$35.00	$61,250
1" Water Meter	EA	50	$350.00	$17,500
2" Water Meter	EA	35	$1,400.00	$49,000
Individual System Removal	EA	24	$1,200.00	$28,800
Well Abandonment	EA	65	$2,000.00	$130,000
Total				$469,750

Note:
*79/81 Bridge Road will receive two water service connections

Appendix E

CWC Rate Tables

ConnecticutWater

Fact Sheet

Pay your bill online by check or credit card at www.ctwater.com

Schedule of Approved Rates

Rates for water service for Connecticut Water Company were approved by the Department of Public Utility Control (DPUC) in Docket 09-12-11 effective July 14, 2010.

The charges for all customers include a **Basic Service Charge** and a **Commodity Charge**. The Basic Service Charge is applied each billing period to help cover certain fixed costs such as meter reading, testing and replacement, bill preparation and processing, etc. *These Basic Service Charges are applied even if there is no consumption at a premise during a particular billing period.* The Commodity Charge is determined by the amount of water used during the billing period. The commodity charge shows on the bill in units of gallons or cubic feet depending on how the meter installed at your premises records the usage.

Most customer bills are issued once per quarter, though larger volume users including commercial and industrial customers are generally billed once per month. The number of days in a billing cycle may vary slightly, but your service charge and consumption reflect the usage and billing period for your account. Your bill is the combination of the Basic Service Charge for the meter size at your account, the amount of water used during the billing period times the Commodity Charge for your customer class, as well as any other special charges or interest due on your account.

Year Round Basic Service Charges

Meter Size	Quarterly	Monthly	Daily Rate
5/8”	$28.83	$ 9.61	$0.316
3/4”	$43.24	$14.41	$0.474
1”	$72.06	$24.02	$0.790
1-1/2”	$144.15	$48.05	$1.580
2”	$230.64	$76.88	$2.528
3”	$432.44	$144.15	$4.739
4”	$720.73	$240.24	$7.898
6”	$1,441.46	$480.49	$15.797
8”	$2,306.34	$768.78	$25.275
10”	$3,460.05	$1,153.35	$37.918

Year Round Commodity Charges All Consumption

	Connecticut Water	
Customer Class	Per 1,000 gallons	Per 100 cubic feet
Residential	$7.340	$5.491
Commercial	$6.424	$4.806
Industrial	$5.464	$4.087
Public Authority	$6.025	$4.507

Seasonal Service Charges

Meter Size	Connecticut Water	Masons Island
5/8”	$ 115.38	$229.57
3/4”	$172.94	---
1”	$288.32	$535.40
1-1/2”	$576.65	
2”	$922.27	
3”	$1,730.80	
4”	$2,884.67	

Seasonal Commodity Charges

Customers	Per 1,000 gallons	Per 100 cubic feet
Connecticut Water	$7.340	$5.491
Masons Island	$6.588	$4.927

Seasonal Flat Rate Charges Soundview, Point O’Woods & White Sands Systems

Unit Type	Rate Per Season
Single	$375.00

Schedule of Special Charges

The DPUC Decision authorizes separate Fire Protection Charges as well as a number of Special Charges for various non-routine services.

Service Turn On / Off & Meter Charges	
Service Turn Off – Normal Hours	$40
Service Turn On – Normal Hours	$40
Service Turn Off – After Hours	$60
Service Turn On – After Hours	$60
Service Turn On – Large Meter ≥ 2" – Normal Hours	$40
Service Turn On – Large Meter ≥ 2" – After Hours	$60
Service Turn On at Curb – Normal Hours	$40
Service Turn On at Curb – After Hours	$60
Frozen Meter Charge – Normal Hours	$50
Frozen Meter – After Hours	$75

Miscellaneous Fees & Charges	
Bulk Water Account Activation	$50
Bulk Water Commodity Charge	Commercial Meter Rate
Unauthorized Hydrant Use	$200
Unauthorized Water Use	$200
Curb Box Repairs – Equipment Required	$300
Curb Box Repairs – Hand Dug	$100
Cross Connection Notice Fee	$40

Collection Fees	
Returned Check Fee	$30
Late Payment Fee*	1.5% per month

*Note: Late payment/interest charges are applied to amounts past due 30 days or more at a rate of 1.5 percent per month. Interest charges will appear on customer notices and subsequent bills based on the amount outstanding and time past due.

Private Fire Protection Charges	
Service Connection Size	**Per Quarter Per Connection**
2" Service Connection	$41.89 each
3" Service Connection	$94.45 each
4" Service Connection	$131.36 each
6" Service Connection	$308.33 each
8" Service Connection	$544.96 each
10" Service Connection	$841.23 each
12" Service Connection	$1,197.16 each
Bradley Field	
60% of Regular Connecticut Water Division Rates	

Public Fire Protection Charges	
Hydrant Charge (per month)	$17.45 each
Linear Foot Charge (per month)	$0.08840
Private Right of Way - Linear Foot Charge (per month)	$0.07072
Bradley Field	
Hydrant Charge (per month)	$10.47 each
Linear Foot Charge - Bradley (per month)	$0.05304

If you need additional information on this topic or have specific questions, please feel free to contact Connecticut Water Company customer service staff at 1.800.286.5700.

Connecticut Water Company
93 West Main Street
Clinton, CT 06413-1600

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Appendix F

Fire Suppression Cost Estimates

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Appendix F
Tylerville Center Water Supply Estimate
Fire Hydrants

ESTIMATE FOR 8 INCH MAIN

Item Description	Unit	Quantity	Unit Cost	Total
6" CL 52 Cement Lined Ductile Iron Pipe	LF	15	$20.00	$300
Fire Hydrant (includes 6" gate valve and valve box w/ accessories)	EA	1	$3,199.17	$3,199
8" x 6" Tee (Cement Lined Ductile Iron w/ accessories)	EA	1	$336.18	$336
Pipe Bedding	CY	1.5	$25.00	$38
Installation Labor - 2 Laborers	Hrs	16	$70.00	$1,120
Installation Labor - Equipment Operator	Hrs	8	$100.00	$800
Installation Equipment	Days	1	$800.00	$800
Police Detail	Hrs	8	$75.00	$600
Surface Restoration (Estimated average for pavement and grass)	EA	1	$500.00	$500
Total per hydrant				$7,693
Subtotal	EA	20	$7,693	$153,857
Contingency (10%)				$15,386
Total				$169,243

ESTIMATE FOR 12 INCH MAIN

Item Description	Unit	Quantity	Unit Cost	Total
6" CL 52 Cement Lined Ductile Iron Pipe	LF	15	$20.00	$300
Fire Hydrant (includes 6" gate valve and valve box w/ accessories)	EA	1	$3,199.17	$3,199
12" x 6" Tee (Cement Lined Ductile Iron w/ accessories)	EA	1	$608.68	$609
Pipe Bedding	CY	1.5	$25.00	$38
Installation Labor - 2 Laborers	Hrs	16	$70.00	$1,120
Installation Labor - Equipment Operator	Hrs	8	$100.00	$800
Installation Equipment	Days	1	$800.00	$800
Police Detail	Hrs	8	$75.00	$600
Surface Restoration (Estimated average for pavement and grass)	EA	1	$500.00	$500
Total per hydrant				$7,965
Subtotal	EA	20	$7,965	$159,307
Contingency (10%)				$15,931
Total				$175,238

Note: The number of hydrants is based on the Insurance Service Office's Public Protection Classification (PPCTM) Program and the current CWC July 2010 Plans.

Appendix G

Connecticut Department of Health and Connecticut Water Company Correspondence Regarding Additional Capacity in the Chester Water System to Serve Tylerville

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STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel P. Malloy
Governor
Nancy Wyman
Lt. Governor

Drinking Water Section

June 7, 2012

Mr. Pat Bowe, Director
Remediation Division
CT Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106

RE: Technical Supply Adequacy Review Comments-Draft Tylerville Water Supply Alternatives Evaluation

Dear Mr. Bowe:

The Department of Public Health (DPH) Drinking Water Section (DWS) has completed a technical supply adequacy review of the Connecticut Water Company (CWC) - Chester System to determine its current and future ability to provide safe and adequate public water supply to Tylerville Center and the Route 154 corridor. A CWC water main extension was a primary water supply option evaluated in the draft preliminary Tylerville Center Water Supply Alternatives Evaluation engineering report prepared by AECOM for DEEP's Water Protection and Land Reuse Remediation Division pursuant to CGS Section 22a-471. The attached review, conducted by Steve Messer of my staff, is provided to enhance, update, and supplement previous DPH comments for the Chester System. The review indicates a continuing marginalization of available supply over time as CWC projected system demands increase in conjunction with distribution system deficiencies that may be exacerbated by adding demand. An executive summary is provided below that highlights key regulatory conclusions of the completed technical review:

I) **Regulatory Requirement:** RCSA 19-13-B102(o) requires the "supply capacity of each community water system shall be maintained in excess of the demand of the system, with sufficient margin of safety (MOS) to properly allow for: (1) Sudden increases in consumption which may occur during a dry period; (2) The time required to bring new sources of supply on line; and (3) Increases or growth in the service area which may be reasonably expected."

Status: CWC Chester Division currently has the ability to safely and adequately serve existing customers, the Tylerville Water Study Area (WSA), and the Route 154 corridor. By calendar year 2020, due to CWC's projected growth in system demand, the CWC Chester System is projected to fall short of meeting this regulatory requirement for certain system demand conditions.

Action Item: The 2010 CWC Shoreline Region water supply plan states an interconnection of CWC's Chester and Guilford systems will be completed by the company during calendar years 2011-2012. CWC's Guilford System has an existing interconnection, with all requisite regulatory permits, with the Regional Water Authority which has considerable available excess supply. The Chester System requires additional supply by calendar year 2020 for certain demand conditions; CWC's planned interconnection of their Chester and Guilford systems is the most effective available short term supply. This planned project should be required to be completed by CWC if a

Keeping Connecticut Healthy
DPH
Connecticut Department of Public Health

Phone: (860) 509-7333 • Fax: (860) 509-7359 • VP: (860) 899-1611
410 Capitol Avenue, MS#51WAT, P.O. Box 340308
Hartford, Connecticut 06134-0308
www.ct.gov/dph
Affirmative Action/Equal Opportunity Employer

State regulatory decision is made to select CWC's water main extension option as the preferred long term Tylerville water supply solution. Completion of the planned interconnection would eliminate any possible concerns over current or future CWC - Chester System supply adequacy. Company officials informed DPH at an April 19, 2012 meeting that the interconnection planned for construction in 2011-2012 has not yet been initiated or budgeted to date. ***Tylerville added demands would result in a projected CWC-Chester System regulatory non-compliance status by calendar year2020 for RSCA Section 19-13-B102(o)(1-3).***

II) **Regulatory Requirement**: RCSA section 19-13-B102(p) requires "sources of supply, treatment, pumping, transmission, and storage facilities of sufficient capacity be maintained to provide flows in excess of maximum flows experienced in the CWS, and in individual service zones in integrated systems. When peak period consumption interrupts service to consumers under normal conditions, conservation measures to effectively reduce consumption shall be promptly instituted for the CWS, and a program to provide sufficient supply, treatment, pumping, transmission and storage capacity to meet existing and projected peak period consumption shall be implemented."

Status: The 2010 CWC Shoreline Region water supply plan states additional distribution system capacity is needed in the Chester system which can be accomplished by paralleling or replacing existing Middlesex Turnpike water mains; CWC's water supply plan system "Improvement Schedule" states the Middlesex Turnpike water main replacement project is to be completed in the 20 year planning period (by 2020). CWC's plan further states in Table 2.4.2 that the Middlesex Turnpike water main replacement project will be completed by December 2011 as part of the company's Water Main Replacement Program already approved by CT's Public Utility Regulatory Authority (PURA) through the Water Infrastructure Conservation Act (WICA) which funds critical infrastructure projects via approved surcharges to customer bills. The plan also states potential for situations that may occur during heavy CWC - Chester System demand periods when excessive head losses in existing 10" mains prevent CWC's Essex tank from refilling; such situations require set up of a portable pump with hydrant to hydrant fire hose connections in a "secure" location near Route 9. Company officials informed DPH at the above April 19, 2012 meeting that completion of the PURA approved WICA project would successfully resolve both identified existing distribution system deficiencies.

Action Item: CWC officials have stated that identified existing CWC - Chester System distribution system deficiencies would be successfully resolved by CWC's completion of their PURA approved Water Main Replacement Program WICA project. The project entails installation of 10,500' of new 16" diameter water main to replace existing CWC Middlesex Turnpike mains. The approved WICA Water Main Replacement Program project slated for Middlesex Turnpike should be required to be completed by the company if a State regulatory decision is made to select the CWC water main extension option as the preferred Tylerville long term water supply solution. It is our understanding that the project has yet to be initiated by the company.

It is my understanding that a final draft report will be completed which encompasses our comments and that a public hearing will be scheduled shortly thereafter. Thank you and if you have any questions or comments, please do not hesitate to contact me direct at (860) 509-7343.

Sincerely,

Lori Mathieu
Public Health Section Chief
Drinking Water Section

Cc: Steve Messer, DWS Statewide Planning Unit
Cam Walden, DWSRF/Capacity Development Unit
David Cooley, DWS Compliance Unit

CWC Shoreline Region/Chester Division Supply Adequacy Evaluation

I) Sources of Supply/Safe Yield:

A) Surface Water:

Source	Status	Usable Storage (MG)	Safe Yield (MGD)	DEEP Diversion (MGD)	Available Supply (MGD)	Intake Size/Elev. (USGS)	WTP Capacity Firm/Nominal (MGD)
Turkey Hill	Active	136.0	*	*	*	10"/302.9'	
Wilcox	Active	65.0	*	*	*	12"/209.9'	
Dueses Pond	Active	1.3	*	1.3	*	16"/151.5'	
U. Chester	Active	5.8	*	*	*	14"/292.0	
L. Chester	Active	108.0	1.2	2.0	1.2	16"/283.0'	
Total:		316.1 MG	1.2 MGD	2.0 MGD	1.2 MGD		**1.0 MGD/1.5 MGD***

*best determined from all available DWS reference sources

1) Available Surface Water Supply: Average Day Demand (ADD) = **1.0 MGD**: DPH approved safe yield of a reservoir system is a typical limiting factor; however, Williams WTP firm capacity of 1.0 MGD is more restrictive than the 1.0 MGD total approved safe yield of the Chester Reservoir system.
2) Available Surface Water Supply: Max. Month Average Day Demand (MMADD) = **1.0 MGD**: Firm WTP capacity (one filter train removed: Williams WTP = 1.0 MGD) can be used to meet MMADD.
3) Available Surface Water Supply: Maximum Day Demand (MDD) = **1.5 MGD**: Nominal treatment plant capacity (maximum; all filters operating) is allowed; Williams WTP nominal treatment capacity = 1.5 MGD.
4) Surface Water Supply System Restrictions/Limitations: **ADD** - Firm treatment capacity = **1.0 MGD; MMADD** - Firm treatment capacity = **1.0 MGD; MDD**- Nominal treatment capacity = **1.5 MGD**

B) Ground Water:

Source	Status	Const. Date	Type	Depth	Diameter	Safe Yield (MGD)	DEEP Div. (MGD)	Pump Cap. (MGD)	ADD/ MMADD Supply (MGD)	MDD Supply (MGD)
Dennison	Active	July '62	GP	51'	24" x 18"	***0.14*** **	0.25	0.25*	0.167	0.223
Total:						0.14 MGD**			**0.14 MGD**	**0.19 MGD**

* = installed pump capacity exceeds estimated safe yield; ** = CWC data; 1981 seven hour yield test at 155 gpm

1) Available Ground Water Supply: Average Day Demand (ADD)/ Maximum Month Average Day Demand (MMADD) = 0.14** MGD: Total *estimated* safe yield after 75% critical dry period adjustment (18 hour pumping day). ** Not properly yield tested per RCSA Section 25-32d-4.
2) Available Ground Water Supply: Maximum Day Demand (MDD) = 0.19 MGD: Total *estimated* safe yield of a ground water supply = a 24 hour pumping day. (One calendar day per year)
3) Ground Water Supply System Restrictions/Limitations: **ADD** – *estimated* safe yield after 75% critical dry period adjustment (18 hour pumping day); **MMADD** - *estimated* safe yield after 75% critical dry period adjustment (18 hour pumping day); **MDD**- *estimated* total safe yield (24 hour pumping day)

II) Total Available Water (AW): AW = Maximum water dependably supplied after limitations/restrictions (system hydraulics, treatment/pumping capacities, permit/legal restrictions, bulk sales) applied to safe yield.

A) Total Available Water: Average Day Demand (ADD) = 1.0 MGD (Available Surface Supply) + 0.14 MGD (Available Ground Water Supply) = **1.14 MGD**
B) Total Available Water: Maximum Month Average Day Demand (MMADD) = 1.0 MGD (Available Surface Supply) + 0.14 MGD (Available Ground Water Supply) = **1.14 MGD**
C) Total Available Water: Maximum Day Demand (MDD) = 1.5 MGD (Available Surface Supply) + 0.19 MGD (Available Ground Water Supply) = **1.69 MGD**

III) Tylerville Center Study Area Projected Demands: *Demands* taken from March 2012 AECOM "Tylerville Center Water Supply Alternatives Evaluation" final draft report.* ***(The 10% contingency factor added by AECOM to Tylerville demands is not utilized within this supply adequacy evaluation.)***

Study Area	Average Day Demand (ADD)	Maximum Month Average Day Demand (MMADD)	Maximum Day Demand (MDD)
Water Supply Area (WSA)	0.07 MGD	0.09 MGD*	0.11 MGD
WSA & Rt. 154 Corridor	0.09 MGD	0.12 MGD*	0.13 MGD

* = MMADD demands for Tylerville not provided in AECOM report; estimated by 1.3 x AECOM report ADD.

IV) CWC Shoreline Region/Chester Division Projected Demands and Margin of Safety (MOS): MOS is Available Water/System Demand; DPH recommends minimum adequate 15 % MOS for all demands.

SCENARIO I: CWC Chester Division Historic/Projected Demands Only (2010 CWC water supply plan)

Year	Average Day Demand (ADD)	ADD MOS	Maximum Month Average Day Demand (MMADD)	MMADD MOS	Maximum Day Demand (MDD)	MDD MOS
2005 (CWC)	0.62 MGD	1.84	0.91 MGD	1.25	1.02 MGD	1.66
2006 (CWC)	0.45 MGD	2.53	0.74 MGD	1.54	1.02 MGD	1.66
2007 (CWC)	0.59 MGD	1.93	0.73 MGD	1.56	0.97 MGD	1.74
2008 (CWC)	0.56 MGD	2.04	0.78 MGD	1.46	1.01 MGD	1.67
2009 (CWC)	0.55 MGD	2.07	0.69 MGD	1.65	0.83 MGD	2.04
2014 (CWC)	0.58 MGD	1.97	0.80 MGD	1.43	1.02 MGD	1.66
2020 (CWC)	0.66 MGD	1.72	0.92 MGD	1.24	1.17 MGD	1.44
2050 (CWC)	0.79 MGD	1.44	1.10 MGD	1.04	1.40 MGD	1.21

ORANGE = BELOW DPH RECOMMENDED 15% MOS; **RED = MARGIN OF SAFETY BELOW 1.0**

SCENARIO II: CWC Chester Division Demands with added Tylerville WSA Projected Demands

Year	Average Day Demand (ADD)	ADD MOS	Maximum Month Average Day Demand (MMADD)	MMADD MOS	Maximum Day Demand (MDD)	MDD MOS
2005 (CWC)	0.62 MGD	1.84	0.91 MGD	1.25	1.02 MGD	1.66
2006 (CWC)	0.45 MGD	2.53	0.74 MGD	1.54	1.02 MGD	1.66
2007 (CWC)	0.59 MGD	1.93	0.73 MGD	1.56	0.97 MGD	1.74
2008 (CWC)	0.56 MGD	2.04	0.78 MGD	1.46	1.01 MGD	1.67
2009 (CWC)	0.55 MGD	2.07	0.69 MGD	1.65	0.83 MGD	2.04
2014 (CWC)	0.65 MGD	1.75	0.89 MGD	1.28*	1.13 MGD	1.50
2020 (CWC)	0.73 MGD	1.56	1.01 MGD	1.13*	1.28 MGD	1.32
2050 (CWC)	0.86 MGD	1.33	1.19 MGD	**0.96 ***	1.51 MGD	**1.12**

ORANGE = BELOW DPH RECOMMENDED 15% MOS; **RED = MARGIN OF SAFETY BELOW 1.0**

SCENARIO III: CWC Shoreline Region/Chester Div. & Tylerville WSA/Rt. 154 Projected Demands

Year	Average Day Demand (ADD)	ADD MOS	Maximum Month Average Day Demand (MMADD)	MMADD MOS	Maximum Day Demand (MDD)	MDD MOS
2005 (CWC)	0.62 MGD	1.84	0.91 MGD	1.25	1.02 MGD	1.66
2006 (CWC)	0.45 MGD	2.53	0.74 MGD	1.54	1.02 MGD	1.66
2007 (CWC)	0.59 MGD	1.93	0.73 MGD	1.56	0.97 MGD	1.74
2008 (CWC)	0.56 MGD	2.04	0.78 MGD	1.46	1.01 MGD	1.67
2009 (CWC)	0.55 MGD	2.07	0.69 MGD	1.65	0.83 MGD	2.04
2014 (CWC)	0.67 MGD	1.70	0.92 MGD	1.24*	1.15 MGD	1.47
2020 (CWC)	0.75 MGD	1.52	1.05 MGD	1.09*	1.30 MGD	1.30
2050 (CWC)	0.88 MGD	1.30	1.23 MGD	**0.93***	1.53 MGD	**1.10**

ORANGE = BELOW DPH RECOMMENDED 15% MOS; **RED = MARGIN OF SAFETY BELOW 1.0**

V) Technical Conclusions:

A. Dennison Well was not yield tested per specified requirements of RCSA Section 25-32d-4(b); data provided for safe yield verification was 155 gpm for 7 hours falling well short of 72 hour requirement.

B. CWC states Dennison Well has 0.140 MGD safe yield (SY) without technical substantiation and credits AW of 0.140/0.190 MGD for ADD/MMADD and MDD, respectively. A minimum 72 hour yield test at sustained pumping rates with stabilized drawdown meeting RCSA Section 25-32d-4(b) requirements typically required to obtain a DPH approved safe yield. Given the stated safe yield/AW is slightly lower than 155 gpm (1981 short test) pumping rate results; the plan's 0.140 stated safe yield is used herein.

C. Level A Aquifer Mapping is slated for the Dennison Well in the Short Term Improvement plan; CWC should ensure minimum yield test requirements are met at this time. Dennison Well pumping capacity is stated to be 0.250 MGD which is considerably oversized regardless of stated safe yield. The same pattern of oversized pumps was evident during CWC's Western Region/Northern Division supply adequacy evaluation. Such practices are not sound water supply engineering or environmentally friendly.

D. Chester System demand projections provided in the plan appear to be reasonably determined in accordance with standard water supply planning practices based upon historic observed system demands.

E. AECOM's report provided a second parallel demand set for Average Day Demand (ADD) and Maximum Day Demand (MDD) with a 10% contingency factor; however, did not provide Maximum Month Average Day Demand (MMADD) projections which are critical here. This review used the standard demand sets without a 10% contingency which could skew MOS results and be subject to criticism. MMADD demands were observed to be critical so MMADD was calculated by applying a 1.30 multiplication factor to AECOM's standard ADD set which is reasonable based on observed statewide data and may be low due to larger rural lots and associated lawn/gardening activities.

VI) Results/Final Recommendations:

A. CWC Shoreline Region Chester Division has the current ability to safely and adequately serve existing customers, Tylerville "water service area", and the Route 154 corridor.

B. CWC Chester Division currently does not have short and long term future ability to safely and adequately serve existing customers, Tylerville "water service area", and the Route 154 corridor. In both the Tylerville WSA and the Tylerville WSA/Route 154 corridor scenarios, MMADD MOS dips below minimum 1.15 by calendar year 2020 and falls below 1.0 in the long term planning period.

C. Additional supply is required to safely and adequately provide future water service.

D. The plan states Short Term Improvements include Level A mapping for Dennison Well (proper yield testing should be conducted at this time) and completion of an interconnection with CWC's Guilford System along Route 153 which has an existing interconnection with Regional Water Authority complete with all requisite permitting requirements. This interconnection appears the most reasonable and available supply in a short term period and should be made a requirement of any State regulatory determination made to resolve Tylerville contamination areas.

E. CWC Shoreline Region plan also states additional distribution capacity is needed from Chester down through Deep River which can be accomplished by paralleling and/or replacing the existing Middlesex Turnpike water main. The plan also indicates potential for disconcerting situations during Chester System heavy demand periods; full technical details of this existing deficiency are found in Section 2 - Existing Sources/System Operation, page 22 in the plan. It is stated heavy demand can cause excessive head loss in existing 10" mains preventing Essex tank from completely filling requiring a portable pump with hydrant to hydrant fire hose connections to be set up in a "secure" location near Route 9.

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September 10, 2012

Ms. Lori Mathieu
Public Health Section Chief
Dept. of Public Health
410 Capitol Avenue
Hartford, CT 06134-0308

Mr. Patrick Bowe, Director
Remediation Division
CT Dept. of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

Re: Tylerville (Haddam, CT) Water Supply Alternative

Dear Ms. Mathieu and Mr. Bowe:

I write to make sure that all stakeholders are working from the same set of facts concerning Connecticut Water's interest and ability to provide drinking water and fire protection services to the Tylerville area of Haddam, CT. In so doing, I also wish to correct certain errors contained in the Department of Public Health's Technical Supply Adequacy Review letter dated June 7, 2012, a copy of which was obtained by the Company in early August (the "Technical Review").

The Company has long viewed the extension of water service to Tylerville as a practical, permanent solution to localized contamination issues and identified the same in our October 2004 individual water supply plan and July 2010 plan update. We have similarly identified a connection of the Chester and Guilford distribution systems as likely occurring within the near-term planning period. However, an interconnection of the two distribution systems is not, and never has been, a prerequisite to our ability to provide water to Tylerville. A brief discussion of system available supply, demand and margin of safety is attached.

Upon review of the accompanying data and analysis it is clear the Chester System currently has sufficient capacity to safely and adequately serve Tylerville. This fact is noted by DPH in the Technical Review. However, by discounting available supply and inflating demand, the Technical Review erroneously concludes that "*Tylerville added demands would result in a projected CWC-Chester System regulatory non-compliance status by calendar year 2020.*"

To address this perceived shortfall, the Technical Review advocates that a connection of the Guilford and Chester distribution systems "*should be required to be completed by CWC if a State regulatory decision is made to select CWC's water main extension option as the preferred long term Tylerville water supply solution*." This is needlessly prescriptive.

As noted, a connection between the Guilford and Chester systems is planned by the Company. However, such a project should not be speculatively mandated, but undertaken at the appropriate time, for the appropriate reason, and for the benefit of our customers. Moreover, the use of extraordinary contracts or orders to effect such a connection is not necessary or warranted; in the unlikely event that the Company does not move quickly enough to bring needed supplies to our customers, the Departments (DPH and PURA) have adequate legal and regulatory tools to remedy the situation.

Any concern regarding the future failure on the part of the Company to meet its water service obligation would have no grounding in the facts that make up the long history of our Company. We have never failed to meet our obligations as a public service company. We understand and embrace our responsibility to provide an adequate supply of water to all customers – now and in the future. If additional supply is needed in the Chester System, we will undertake a connection between systems at the appropriate time, or pursue some other viable alternative to ensure our continued ability to provide service.

Very truly yours,

David L. Radka
Director of Water Resources

Cc: E. Blaschinski, DPH
T. Caruso, PURA
P. DeStefano, Haddam
E. Thornburg, CWC

Review of Available Supply and Margin of Safety for CT Water Company's Chester System

Available Supply: In the Chester System, peak available supply is 1.69 million gallons per day (mgd), with the bulk of this (1.5 mgd) coming from the Williams surface water treatment plant and the remaining 0.19 mgd from groundwater. Average day available water is naturally somewhat less; Williams water treatment plant yield is considered equal to the supply available during a critical dry period, while groundwater is discounted by an 18-hour pumping day. For the Chester System, this equals 1.34 mgd.

Maximum month average day available supply is somewhat less than peak day and can be computed as either the reservoir safe yield multiplied by the maximum monthly peaking factor used in the safe yield analysis, or using full treatment plant capacity while adjusting for volume lost when a filter is out of service for backwashing and the amount used to backwash. For the Williams WTP, both methodologies result in an available supply of some 1.4 mgd. The addition of groundwater brings the maximum month available supply to 1.54 mgd.[1]

The Technical Review makes use of a so-called "firm" water treatment plant capacity value and assumes a filter is completely off line when evaluating available supply for average day and maximum month average day purposes, respectively. This approach, which does not appear supported by water supply planning regulation, results in a surface water available supply that is 0.2 mgd less than the department has historically acknowledged through the water supply planning process.

Demand and Margin of Safety: Water supply demands associated with the Tylerville area and water main extension along CT Route 154 were projected in the Company's 2010 water supply plan update. Demands were calculated using historic per capita, commercial and industrial customer demand for the system, and multiplied by the anticipated service area. The Technical Review appears to have ignored these projections and layered additional demand associated with the Tylerville project over them. Such an error inflates system demand above reasonably expected levels.

For the Chester System, recent demand, as expressed by surface water treatment plant and well production, is as follows:

	CHESTER SYSTEM					
	2011	MOS	2010	MOS	2009	MOS
ADD	535,342	2.50	547,411	2.45	536,463	2.50
MMADD	716,252	2.15	752,548	2.05	693,083	2.22
MDD	883,000	1.91	1,016,148	1.66	829,700	2.04

These data indicate an excess system capacity more than adequate to serve the Tylerville area. In fact, even during a hot, dry year such as 2010, the Chester System maintained an available supply of at least 0.5 mgd above demand, including a 15 percent margin of safety.

[1] In the past, Connecticut Water has also used the reservoir system safe yield of 1.2 mgd as a limiting factor when computing available supply for maximum month planning purposes. This results in a somewhat more conservative system-wide available supply of 1.34 mgd.

STATE OF CONNECTICUT

DEPARTMENT OF PUBLIC HEALTH

Jewell Mullen, M.D., M.P.H., M.P.A.
Commissioner

Dannel Malloy
Governor

October 12, 2012

Mr. David L. Radka, Director of Water Resources
Connecticut Water Company
93 West Main Street
Clinton, CT 06413-1600

Re: DPH Technical Review - Connecticut Water Company (CWC) Tylerville Supply Alternative

Dear Mr. Radka:

Thank you for your September 10, 2012 correspondence. The Department of Public Health Drinking Water Section (DWS) has reviewed your clarifying information on available water supply and finds that the CWC Chester System has sufficient supply to serve the Tylerville area. Your commitment to serve the Tylerville area is consistent with the CWC Shoreline Region individual water supply plan and the South Central Connecticut Water Utility Coordinating Committee (WUCC) plan dated April 1990 which identifies the entire town of Haddam as the exclusive service area (ESA) of CWC and with the individual Water Supply Plan for the Connecticut Water Company Shoreline system.

In order to facilitate public water service to Tylerville, the DWS suggests that you supply all relevant water supply data to the Department of Energy and Environmental Protection (DEEP) directly so that your technical data and level of commitment can be incorporated into the AECOM engineering study. Further we offer the more detailed comments on your correspondence for your consideration.

- The Tylerville and Route 154 corridor demand in the June 2012 DPH adequacy review was derived from AECOM's Tylerville engineering study. DWS notes that a 'non-specific' Tylerville area demand was included in CWC water supply plan demand projections. We recommend that you provide specific detailed projections for the service areas to DEEP for inclusion in AECOM's Tylerville study. We agree with CWC's comment that one set of consistent technical data is critical in supply evaluations.

- Using CWC's technical data provided in the September 10, 2012 correspondence, DWS staff updated our supply adequacy technical review. Results indicate you have sufficient supply to serve existing customers and the Tylerville/Route 154 corridor for all system demand conditions through the 2020 planning period.

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Ample supply and system redundancy are key components of DPH public drinking water supply planning. With CWC's commitments expressed in your September 10 , 2012 correspondence, the DWS finds CWC's plan to serve the Tylerville area consistent with long standing water supply planning documents and that CWC is well positioned and committed to assuring a safe and adequate supply for the existing and expanded Chester System.

If you have further questions or concerns, please do not hesitate to contact me direct at (860) 509-7343.

Sincerely,

Lori Mathieu
Public Health Section Chief
Drinking Water Section

Cc: Paul DeStefano, Honorable First Selectman - Town Of Haddam
Ellen Blaschinski, Branch Chief of Regulatory Services – DPH
Patrick Bowe, Director, DEEP Remediation Division
Eric Thornburg, CEO – Connecticut Water Company
Thomas Caruso, PURA
Liz Glidden, Town Planner – Town of Haddam
Thad King, Health Director – Chatham Health District