Durham Water System Extension
Feasibility Study Update

Town of Durham
Durham, CT

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Final Update November 2012

FUSS & O'NEILL
Disciplines to Deliver

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1 INTRODUCTION

1.1 Purpose of Study

Persistent contamination of groundwater in several areas of Durham and the need for improved fire protection prompted the Town of Durham to consider the extension of public water supply to areas north of Allyn Brook. The extension of public water to Durham is consistent with the selected remedy for the Durham Meadows Superfund Site. The Durham Center Water System supplies many properties south of Allyn Brook. Capacity of this system, absent a Diversion Permit, would not be adequate to service the entire Superfund Site, not to mention other sections of Town.

The City of Middletown representatives indicated they were prepared to assist the Town of Durham in addressing public health and safety needs for the community. Currently, Middletown has little excess capacity available for the short term planning period but with potential additional water supply sources (to be investigated as part of this study) they may be able to serve Durham's needs in the long term.

The Town of Durham secured funding from the State of Connecticut for updating the 2000 Feasibility Study to extend the existing water system from the City of Middletown to the Superfund Area in Durham as depicted in Figure 8 (See **Attachment "A"**) of the 2005 Environmental Protection Agency's Record of Decision (EPA ROD) for the Durham Meadows Superfund Site and to the other areas in Durham impacted by, or threatened with, groundwater contamination. **Figure 1-1** is a site location map of the approximate limits of the proposed project study area. **Figure 1-2** depicts areas impacted by, or threatened with, groundwater contamination as well as other areas considered for inclusion to a public water system. This updated study addresses the technical feasibility of extending water service for both domestic purposes and fire protection to these areas and updates opinions of costs for extending water to the various areas identified.

1.2 Project Scope

There are several issues that will be addressed in this update to the original water system extension feasibility study. Some of the key elements include:

1. Identify existing and potential areas of Groundwater Contamination in Durham that can be served.

   Update the delineation of chemically polluted areas identified in the "Durham Water Main Extension Feasibility Study" dated May 2000 and delineate other possible affected areas north of Allyn Brook in the Town of Durham. Identify the areas in Durham, and in adjoining sections of Middlefield and those at the border with the City of Middletown.

2. Extent of Proposed Water System - Various Cases

   Establish the limits of the proposed water system for different areas based on system requirements. Assist the Town of Durham with identification of limits of proposed service areas for each scenario and compare the alternatives of providing water to the current Durham Center water system via an extension from Middletown in lieu of continuing current operations of the existing system. All scenarios will include the service to the Superfund Area (the initial service area) to comply with the EPA ROD.

   The chemically polluted areas identified include the following:

   Areas with Contaminated Groundwater
   A. The Superfund area
   B. The MTBE area along Main Street (Gasoline Stations Area)
   C. The 1,1-Dichloroethylene (1,1-DCE) Site
   D. The Parsons Area
   E. Schools Area

   Areas with Impaired Groundwater Quality (hard water, high iron & manganese)
   F. Durham Heights Area
   G. Woodland Drive Area
   H. The Royal Oak Drive Area;
   I. The Durham Center System south of Allyn Brook.

3. Data Collection - Town of Durham

   The Town of Durham's Assessor map information was utilized along with service connection ties already measured in the field for the Durham Center's existing water main layout. System valves and individual services were provided by the Town to portray the existing layout of the Durham Center public water system.

4. Develop projected water demands for the areas of concern

   Water Demands for each area of concern will be developed. The City of Middletown's water system and safe yield will be reviewed to determine its available capacity and if upgrades or modifications to their system are needed to convey water, provide storage and fire protection to the Durham Meadows Superfund Site as well as other proposed areas of concern.

5. Size Important Components of the Proposed Water System Extension

   Identify the best route(s) to extend Middletown's water system into Durham. Preliminary sizing of infrastructure including water mains in Durham, improvements to the City of Middletown's infrastructure (including a storage tank, replacing an existing 8" water main and a booster pumping station) will be completed to supply water to the Town of Durham. Structures will be sized for two conditions; with and without fire protection.

6. Investigate the Sources of Supply for the City of Middletown

   Based on the most up to date Water Supply Plan completed by Middletown, a review of the safe yield/available water analysis was completed for their existing sources of supply and an analysis was done to determine if additional sources of supply for the City of Middletown are necessary to provide water to Durham for the water main extension. The potential sources discussed include the replacement of Well No. 1 and Well No. 3 in Middletown, an interconnection with Cromwell, and the activation of Laurel Brook Reservoir.

7. Complete Environmental Impact Evaluation

   An Environmental Impact Evaluation for the extension of water supply from the City of Middletown to the areas identified in the analysis will be completed and the results of the analysis will be incorporated into a report summarizing the findings.

8. Develop a preliminary opinion of cost for the proposed water system extensions

   Summarize construction costs for each of the areas identified. Construction costs are then developed for each of scenarios evaluated. The costs are broken into alternatives for extending the main to each area for domestic water supply only and for providing water supply that includes fire protection. The costs also include necessary upgrades and modifications to the City of Middletown's infrastructure for providing domestic water supply only or domestic supply plus fire protection for the various scenarios.

9. Develop a schedule for design and construction

   Develop a tentative schedule for the design and construction of the recommended water distribution system including necessary upgrades to the City of Middletown's system. The schedule will take into account design services, bidding for the project, permitting needed for the extension, and the necessary approvals from Connecticut Department of Public Health (CTDPH) and the Connecticut Department of Energy and Environmental Protection (CTDEEP - formerly CTDEP).

1.3 Existing Water Systems

There are several small public water supply systems presently serving areas of Durham. Groundwater is the sole water supply for homes, churches, small communities, schools and businesses in Town. There are also a number of smaller public water supplies including Community Water Systems (a public water system that serves at least twenty-five (25) residents throughout the year, See **Figure 1-3**), Transient Non-Community Water System (a non-community water system that does not meet the definition of a non-transient non-community water system) and Non-Transient Non-Community Water Systems (a public water system that is not a community system and that regularly serves at least twenty-five (25) of the same persons over six (6) months per year). These systems serve small areas or individual lots but do not or cannot serve the areas identified herein. Each water system along with its pertinent details is listed below.

Community Water Systems (CWS):

1. The Durham Center Water System - This system was formerly owned and operated by the Eastern Connecticut Regional Water Company (ECRWC). The Town of Durham obtained the exclusive water service area, and purchased this system from ECRWC in 2002. The system serves approximately 47 customers on Main Street from the intersection of Route 17 and Route 79 northward to Maple Avenue. The system also serves Fowler Avenue, and a part of Cherry Lane. The Durham Center Water Supply is currently operated by Connecticut Water Company (CWC). See **Figure 1-4** for the Durham Center Water System Layout. Currently, the Town is in negotiations with Connecticut Water Company (CWC) to determine if the Utility will take over ownership and operation of the Durham Center Water system.

2. The Durham Lexington Place System - This system, owned by the Town, is located in the southeast corner of Town off of Higganum Road. The system serves 15 units in the Lexington Place Condominium Complex. Water is pumped from two bedrock supply wells. This system meets all drinking water standards without treatment and is operated by CWC.

3. The Durham Elderly Housing System at Mauro Meadows - This system, owned by the Town, is located off Higganum Road. The system is supplied by on-site wells. Water quality meets drinking water standards without treatment. This system serves approximately 24 units, (48 people) and is operated by CWC.

4. The Hill Hollow Condominium Association (formerly Mill Pond Elderly Housing Association) serves 24 units of elderly housing off Mill Pond Lane.

5. The Twin Maples Nursing Home located at 809R New Haven Road (Route 17), serves 44 residents plus staff (not shown in the Figure, off the map).

Transient Non - Community Systems (NTC):

1. 238 Main Street, Tim Mack/Durham Market
2. 325 Main Street, Mark Morrow/TLC Eatery
3. Braga Investments, 459 Madison Road, The Butcher's Wife
4. Camp Farnum, 285R Maiden Lane
5. Citizens Bank, 376 Main Street
6. Commerce Circle Associates, 9 Commerce Circle
7. Dunkin Donuts, 38 Main Street
8. Durham Commons, 360 Main Street
9. Grippo's Mobil Service Center, 349 Main Street, Dunkin Donuts & Subway
10. Hitchin' Post Tavern, 980 New Haven Road
11. Lino's Market, 472 Main Street
12. LNJS Realty Family Partnership, 339 Main Street, Gossip Restaurant and a bank
13. New Haven Raccoon Club, 853R New Haven Road
14. Quick Stop Convenience Store, 1041 New Haven Road
15. The United Churches of Durham, 17 Wallingford Road
16. Time Out Tavern, 100 New Haven Road

Non-Transient, Non-Community Systems (NTNC):

1. Regional School District No. 13 - This water supply system supplies the Coginchaug High School, the Francis Korn Elementary School, and the Frank W. Strong Middle School (Strong School). Water supplies for the schools are provided by three wells. There are two wells adjacent to Coginchaug Regional High School and one well located on the south side of the loading dock of the Korn School. See **Figure 1-3**.
2. Dolphin Days Learning Center, located on 9 Ozick Drive off of Route 68 - This system serves 128 children plus staff and is operated by CWC.
3. Distinctive Building - 45 Ozick Drive
4. Durham Manufacturing Company - 199 & 203R Main Street.
5. Frederick Brewster School - 126 Tuttle Road
6. Hobson Motzer - 30 Airline Drive
7. Morgan AM&T Building 1
8. Stonegate Springs

1.4 Areas Considered for Public Water

Groundwater contamination problems in the areas shown on **Figure 1-5** prevent property owners from obtaining a reliable and safe supply of potable drinking water from their existing individual wells. Remediation measures include the installation of point of entry treatment systems, water quality monitoring, and the maintenance of filters/treatment systems and the use of bottled water.

Properties with documented well contamination problems are shown on **Figure 1-6.**

1.4.1 Areas with Contaminated Groundwater

The following is a brief discussion of each of the contamination areas:

1.4.1.1 Durham Meadows *Superfund Site (Area A)*

The Durham Meadows Superfund Site includes an area of groundwater contamination generally centered on Main Street from both the former Merriam Manufacturing Company, Inc. (MMC) located at 281 Main Street and Durham Manufacturing Company (DMC), a currently operating facility located at 201 Main Street. The site includes historic Main Street in Durham Center and contains industrial and residential properties. The site is generally bounded by Talcott Lane to the North; Brick Lane, Ball Brook and Allyn Brook to the East; Allyn Brook to the south; and wetlands off Maple Avenue to the west.

History of Durham and Merriam Manufacturing Site Activities

Merriam Manufacturing Company, Inc. (MMC) was established in 1851 at the 281 Main Street location in Durham, Connecticut. MMC manufactured metal products, including displays, boxes and cases, by pressing, breaking and welding sheet metal that was then degreased, painted and assembled. Beginning in 1940, the plant used trichloroethene (also known as trichloroethylene, or TCE) to clean boxes prior to painting. In 1953, the plant installed new equipment including a "water-wash degreaser." In 1974, the plant was using TCE, 1,1,1-

trichloroethane (also known as 1,1,1-TCA, or TCA), and methylene chloride in vapor degreasers. A 600-gallon vapor degreaser was used from 1975 to 1986, and a 2,300-gallon vapor degreaser was used from 1978 to 1993.

Floor drains were reportedly located in the vicinity of the degreasers, and various solvents were stored in above-ground storage tanks near the loading dock area. Additionally, MMC used tetrachloroethene (also known as tetrachloroethylene, perchloroethylene, or PCE) as early as the 1940s, and used toluene as a solvent in the painting process as a paint thinner from1940-1993.

Between 1940 and 1973, wastewater from the painting operations drained to the ground along the north side of the building. Beginning in 1953, the wash water from the box cleaning operation drained to an on-site septic system. From 1973 to 1982, paint waste was drained into the two wastewater lagoons constructed at the facility. This wastewater was composed of water and residue from the paint spray operations. After 1982, wastes generated from MMC's operations were either eliminated or collected and stored in drums. These drums were then disposed of off-site.

In addition, a number of leaks and spills occurred during MMC operations, including at the former drum storage area and the loading dock area. In November of 1981, CTDEP discovered violations of the Resource Conservation and Recovery Act (RCRA) at the MMC facility, including mislabeled, leaking waste drums, and storage of drums without proper containment. One hundred improperly labeled containers were stored on asphalt without a berm or drain. Two drums were leaking, and there was evidence of prior spills.

In March 1998, the bulk of the factory was destroyed by fire, leaving only a small warehouse building towards the rear of the property.

After the fire, an old underground storage tank used for heating oil was discovered at the MMC property. MMC hired a contractor to pump out the contents of the tank and in late 1999 and early 2000; MMC removed the tank and associated contaminated soil pursuant to a Connecticut Notice of Violation. This work reportedly resulted in the excavation and off-site disposal of approximately 120 to 130 tons of soil contaminated with oil.

The Durham Manufacturing Company (DMC) was established in 1922 at 201 and 203R Main Street in Durham, Connecticut. Three main buildings including an office building and two manufacturing buildings are currently located on the property. DMC also manufactures metal boxes and displays, and has used various solvents during its operations, including TCE (from the 1940s through the present), 1,1,1-TCA (from 1973-1976), and methylene chloride (used from 1976 through the present).

In 1951, DMC installed a 750-gallon settling tank to receive wastewater and paint sludge from wet paint spray booths and a caustic stripper tank. Approximately 500 gallons per year of sludge were pumped from the tank. Supernatant in the tank was discharged into an on-site "ditch". Approximately 1,200 gallons of water per week moved through the settling tank to the "ditch" as a result of cleaning operations of the wet paint spray booths. In 1974, DMC replaced the 750-gallon tank with a 5,000-gallon tank, which continued to receive wastewater and sludge from the wet paint spray booths and caustic stripper. Water was eventually drained into an on-site leaching field.

From approximately 1974 through 1978, DMC used unlined sludge drying beds in its wastewater treatment operations. Accumulated paint sludge from the settling tank was directed into one of two drying beds approximately twice a year. The sludge was dug out of the drying beds by hand approximately once a year, drummed, and taken to the Durham/Middlefield landfill for disposal. An on-site aeration pond was constructed in 1960 to receive non-contact cooling water from the degreasing and spot-welding operations, and storm water from drains located around the parking lot and roof. In 1982-1983, an aeration system was installed in the pond.

In 1982, solvent usage was approximately 1,000 gallons per month, and the wastewater stream was approximately 4,000 gallons per month.

Based on analytical data from an extraction well "EX-6" on the DMC property, it appears that a methylene chloride spill may have occurred in the area sometime in the mid-1990's. Analytical data provided in a draft work plan for remedial investigation work by DMC's contractor Leggette, Brashears & Graham (LBG) indicates that methylene chloride detections in EX-6 increased from 168 parts per billion (ppb, or ug/L) on May 3, 1995, to 2,977,000 ppb on August 15, 1995."[1]

More detailed information of the site history and background as well as the enforcement activities can be found in the USEPA's Record of Decision.

Action Taken

In 1982, in response to complaints of possible contaminated drinking water, the Connecticut Department of Energy and Environmental Protection (CTDEEP - formerly CTDEP) began testing drinking water wells of residences near MMC and DMC along Main Street. CTDEEP detected VOC's commonly found in solvents, paints and degreasers in a number of wells, including TCE, 1,1,1-TCA, PCE and methylene chloride.

Under CTDEEP Water Supply Consent Orders, MMC and DMC installed carbon filters on impacted residential wells. Since then, the two companies have monitored and maintained up to 38 filter treatment systems and wells on at least a quarterly basis. Currently, DMC is responsible for servicing 14 of these wells. MMC was responsible for servicing 24 of these wells, but ceased this activity and CTDEEP has since taken over monitoring and maintenance of these locations.

The CTDEEP periodically samples wells outside of the contaminated groundwater area to monitor the migration of the plume.

EPA discovered 1, 4 - dioxane in 2003-2004 in wells at MMC, DMC, and at a number of residences. Because this compound is not effectively captured by the current carbon filters, CTDEEP is supplying bottled water for drinking to several affected homes in the northern portion of "Area A". Further, CTDEEP requires monitoring for this compound at a number of residences throughout the Site.

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[1]- Record of Decision, Durham Superfund Site, Durham, Connecticut, Part 2: The Decision Summary, Pages 10-12, September 30, 2005, USEPA, Region 1

The highest concentrations of VOCs have traditionally been detected at MMC, DMC, the Strong School well formerly located at 191 Main Street, and the residences at 168 Main Street and 174 Main Street.

The Superfund Site area (Area A) includes approximately 109 properties (89 are residential, 9 are vacant and the remaining 11 properties include commercial, industrial and municipal facilities) of which approximately 38 wells are contaminated. These values were derived from GIS mapping provided by the Midstate Regional Planning Agency and by a visual count during area evaluations.

USEPA's Record of Decision selected a remedy that includes a water line that would be connected to all homes located within the Technical Impracticability Waiver Zone for the Site wide Groundwater Study Area of the Superfund Site, as outline on Figure 8 within the ROD. This area generally matches "Area A" defined herein (**See Figure 1-5**) with the exception of the Strong School which will be included in the Schools Area described later. The ROD technical impracticability zone encompasses all areas in the overburden and bedrock aquifers that are currently or conceivable could be impacted by contamination emanating from the Superfund Site. The ROD anticipated a water line connection to all occupied lots within this zone, including residences currently affected by groundwater contamination and a buffer zone of residences located near the contaminated area.

1.4.1.2 MTBE Site - Petroleum Pollution on Main Street (Area B)

Three gas stations; FastMart (formerly Dairy Mart) at 384 Main St., the former Shell Station at 336 Main St., and the Grippo's Station at 349 Main St. located on the east and west sides of Main Street between Route 147, Haddam Quarter Road and Talcott Lane have reportedly contributed to groundwater contamination in this area. Numerous leaks and spills have occurred over the years at each of the gas stations as described below.

Source Location	No. of Threatened Locations	No. of Impacted* Locations
Former DairyMart	4	2 (2 with filters)
Former Shell Station	4	3 (4 with filters)
Grippo's Station	4	0 (2 with filters)

* Impacted = above 70 ppb

The CTDEEP has found petroleum related contamination in well water samples in 12 homes and businesses near Main Street. Currently, the CTDEEP requests quarterly sampling of 12 monitoring wells at the former Shell gas station and four potable wells equipped with carbon filter at 336, 328, 316 and 322 Main Street. Three of the wells (336, 328 and 316 Main) often contain MTBE above the 70 ppb state action level. 322 Main's raw water generally has low levels of MTBE, below 70. CTDEEP stated that the concentration have decreased since peak levels were measured in 2000-2001. Three other wells, 14 Talcott Lane and 308 and 312 Main, were sampled once during the peak period and they measured low contaminant levels.

The MTBE site area (Area B) includes 15 properties of which one is residential, one is vacant with the remaining 13 properties being commercial and industrial buildings. Eight (8) properties were identified as having MTBE contamination. These are equipped with filters as shown on

Figure 1-5. Also, three of the wells impacted by MTBE are currently located in Area A as shown in **Figure 1-5.**

1.4.1.3 Dichloroethylene 1,1-DCE & CVOC's (Area C)

The DEP has reported another contaminant from an unknown source near upper Maple Avenue and Middlefield Road. 1,1-Dichloroethylene (1,1-DCE) is an organic liquid with a mild, sweet, chloroform-like odor. Virtually all of it is used in making adhesives, synthetic fibers, refrigerants, food packaging and coating resins. Six wells have shown trace levels of 1,1-DCE (dichloroethylene) that exceed DPH action levels for drinking water (7 parts per billion (ppb). All six wells have carbon filters. There are also approximately 7 locations that contain low levels of CVOC's.

The 1, 1 DCE Site area (Area C) includes approximately 22 properties of which 21 are residential and one is vacant.

1.4.1.4 Parsons (Area D)

This area is north of the 1, 1 - DCE area and lies along the west side of Main Street (Route 17). VOC's have been detected in some of the wells. Not all of the contamination in this area can be attributed to the former Parsons Manufacturing Company. The properties along the east side of Main Street and the northwest corner of this area will remain in the area since they will be included in water demand projections.

The Parsons Area (Area D) includes approximately 37 properties of which 28 are residential, 8 are designated commercial or industrial and one is vacant.

1.4.1.5 Schools Area (Area E)

This area includes the Coginchaug Regional High School, the Korn Elementary School and the Frank W. Strong Middle School. The schools are located on Pickett Lane and lie just to the east of the Durham Manufacturing Facility. The area also includes some private residences along Maiden Lane, a small chicken farm and residence that is to the north of the High School and 3 vacant lots.

The Durham Meadows Superfund Site contamination has been documented to extend to the south along a portion of Pickett Lane, and the Strong School.

In 1970, a drinking water sample taken from the Strong Middle School, located at 191 Main Street, south of and adjacent to the DMC property, was found to contain PCE and chloroform. Wastewater located in an "open pit" at DMC was observed approximately 550 feet north of the school's well location, and samples collected from the DMC pit and from Ball Brook reportedly contained PCE. Chloroform was also detected in an "open seepage area of discharge" at the rear of MMC and in a ditch leading from the rear of the property toward Ball Brook.

Regional School District 13 was maintaining and monitoring filters at the Strong School at 191 Main Street in Durham until August 2004, when the Strong School was connected to a well system that services the Coginchaug Regional High School and Korn Elementary School (not

impacted by Superfund Site Area contamination). The water system at 191 Main Street has been abandoned and is no longer in service.

1.4.2 Areas with Impaired Groundwater Quality

The following is a brief discussion of each of the impaired groundwater areas:

1.4.2.1 Bacteriological Pollution - Durham Heights Area (Area F)

This is a subdivision that lies east of Main Street between Oak Terrace and south of the Haddam Quarter Road. Many homes are on small lots, typically ranging in size from 1/4 to 1/3 of an acre with individual potable water supply wells and on-site septic systems. Bacteria had been detected in some of the wells.

Several factors may have contributed to the high bacteria levels, including:

- poor well construction,
- lack of separation from foundation drains and on-site septic systems,
- high groundwater in the area of on-site septic systems,
- poor soils for on-site septic systems, and
- construction of a stormwater detention pond in a neighboring subdivision.

The Town of Durham Health Department and the CTDEEP have monitored this problem over the years. As many as 63 homes have been identified with bacteriological pollution at one time or another dating back to 1985.

There are not many homes that still have bacteria issues; only two or three that had problems still require bottled water for domestic use. Most of the homeowners still have concerns about aesthetic issues related to hardness, and iron and manganese in their well supplies. Many instances of fixtures being stained and hot water heating systems being damaged have been documented.

There are approximately 15 single family homes on larger lots south of Haddam Quarter Road. These homes show no evidence of bacteria issues but have voiced their concerns regarding aesthetic issues that include hardness and iron and manganese in their well supplies.

The Durham Heights Area (Area F) includes approximately 95 properties of which 92 are residential and the remaining 3 are vacant.

1.4.2.2 Woodland Drive Area (Area G)

This is a subdivision that lies east of Main Street and west of Durham Heights between Oak Terrace and Haddam Quarter Drive. This area was included because it would allow for looping of the proposed water mains and provide for a separate way that water could be conveyed to the south if there are issues along Main Street. There have not been any instances of contamination, but aesthetic issues related to hardness, iron and manganese have been identified. Most of the homes in this area have larger lot sizes with adequate separation between their septic systems and water supply wells.

The Woodland Drive Area (Area G) includes approximately 55 properties of which 50 are residential and the remaining 5 are vacant.

1.4.2.3 Royal Oak Drive (Area H)

This is a subdivision that lies north of Durham Heights, east of Main Street between Oak Terrace in Durham and Acorn Drive in Middletown. There are mostly aesthetic issues related to hardness, iron and manganese in this area. Guy Russo (Director of Middletown's Water and Sewer department) from City of Middletown stated that the vacant lot north of this area may never be built and should not be included in water extension and demand calculations.

The Royal Oak Drive Area (Area H) includes approximately 112 properties of which 109 are residential and the remaining 3 are vacant.

1.4.3 Durham Center (Area I)

The Durham Center area includes a water system that has two wells, disinfection, atmospheric and pressure storage and a distribution system. The Durham Fairground wells 1 and 2 were taken over from the Durham Agricultural Fair Association to provide supply to the Durham Center System. Wells 1 and 2 are both gravel packed wells that produce 78 and 77 gallons per minute, respectively. The system output is limited to a maximum combined withdrawal of 50,000 gallons per day (within 24-hour period) because the system does not have a water diversion permit. The wells pump to the pumphouse where the raw water is injected with sodium hypochlorite for disinfection purposes. The treated water goes to a 15,000-gallons steel atmospheric storage tank. Twin 10 HP booster pumps transfer water to two 6,000-gallon steel hydropneumatic storage tanks. Water is sent out to distribution on demand which serves approximately 47 connections in addition to the Durham Agricultural Fair. There is a 3-inch Watts backflow prevention device installed on the supply line to the fair. (From DPH Sanitary Survey Report, Sept. 2008).

The United State Environmental Protection Agency (USEPA) and CTDEEP are concerned that the Ball Brook Fault runs through the Superfund Area and continues southwest close to the two existing Fairgrounds wells. Pumping of the Fairground wells may promote migration of the VOC plume in the Superfund Area towards the Fairground wells, particularly when the Superfund area is supplied with public water.

There are two monitoring wells near Allyn Brook. Monitoring of these wells would track the extent and possible migration of the contaminant toward the Fairgrounds wells. After the construction of a water supply system to the Superfund Site areas, USEPA will implement a monitoring network in order to monitor plume migration and ensure the plume does not migrate beyond the limits of the Technical Impracticability zone as defined in USEPA's Record of Decision.

The Durham Center service area includes approximately 83 properties of which approximately 59 are residential. Thirty one (31) of the residential properties are connected to the system. There are 17 industrial, commercial and municipal properties in this area and only one in not connected to the existing water supply. The remaining properties are either vacant (7) or not connected to the system.

A complete listing of the number of properties in each area, their landuse designation and summary information is provided in **Table 1-1** "Study Area Lot Distribution".

1.4.4 Middlefield Areas

There were two areas within Middlefield that were previously identified in the Study completed in 2000. They are summarized below:

a) Effluent Plume from Closed Durham Middlefield Landfill

A landfill leachate plume emanating from the closed landfill on the Durham/Middlefield Town line has polluted 9 individual potable water supply wells that serve approximately 34-35 people down gradient of the former Landfill. To provide potable water to these properties, a new small water system (served by one well) was provided by Town of Middlefield and the Town has not had any issues with this system. The system requires some upgrades per the CTDPH drinking water section.

b) High Nitrates in Middlefield

Application of fertilizer and handling of fertilizer has reportedly resulted in high nitrate concentrations in the groundwater. The affected area is at the southern portion of Cherry Hill Road and the eastern section of Miller Road. According to the Town's sanitarian, approximately 18 individual wells are equipped with reverse osmosis treatment units that remove the nitrates found in well supplies. All units are in good working condition with no problems identified.

Fuss & O'Neill contacted Lee Vito (Town of Middlefield Town Sanitarian) on January 26, 2009 regarding the status of these areas and whether the town of Middlefield was interested in participating in the update to the Feasibility Study completed in 2000. After conversation with the First Selectman, Jon A. Brashaw, Mr. Vito stated that both areas previously identified have been addressed and the Town of Middlefield is happy with their present situation. Therefore, based on direction received from Town of Middlefield, the two areas in Middlefield have been eliminated from this study. No further analysis, flow determinations and extension scenarios will be included in the updated study.

2 WATER SERVICE AREAS

2.1 Scenarios Developed

A technical review committee (TRC) was formed to review the boundaries of the areas discussed above and determine the scenarios that should be used for calculating water demands, detailing system improvements and providing opinions of cost. The TRC was comprised of representatives from the CTDEEP, CTDPH, USEPA, the City of Middletown, the Town of Durham and Fuss & O'Neill.

The initial scenario (Area A) and various other scenarios for the water service areas were collectively determined by the TRC based on available information evaluated at several

meetings, and finalized at a workshop held on February 18, 2009 at CTDEEP's offices in Hartford. A consensus approach was utilized by the TRC in determining the service areas. **Figure 1-5** shows the boundaries of each area that will be incorporated into the various scenarios.

The initial service area would service properties that are within the Superfund area as outlined in the USEPA's Record of Decision. Subsequent case studies incorporate the Superfund Area and one or more of the other areas. Where practical, mains are routed so that water can circulate from the central main on Main Street and return to the central main. Such looping provides best conditions to maintain water quality and pressure.

Service connections would be installed all the way into the buildings in Superfund Site Area "A". Services would only be brought to the property line for the other lots within any area. Service connection would not be provided for vacant lots.

2.2 Superfund Site - "Area A"

In order to supply public water from Middletown to the Superfund area, a transmission main would logically be extended south on Route 17 from the Talcott Ridge Drive area where the new Cherry Hill Storage Tank was proposed. The transmission route south along Main Street (Route 17) would form the backbone of all the cases studied. Based on EPA's Record of Decision a service connection from the main to the building would be provided within the technical impracticability zone, including residences currently affected by groundwater contamination (approximately 38 homes) and a buffer zone of residences located near the contaminated area. This would include 100 properties (the developed lots in Area "A).

2.3 Core Area - (Superfund Site + Areas B + C + D)

The majority of the Durham Meadows Superfund site (Area A), MTBE site (Area B), 1,1 DCE site (Area C) and Parsons area (Area D) are formed by the blocks consisting of Main Street, Maple Avenue, Middlefield Road, Talcott Lane, Wallingford Road, Parson's Lane, Winsome Road and a private road (Marina Place) near Talcott Lane. These roads will become the Core Area. The water main proposed for Talcott Lane, Maple Avenue and Middlefield Road, not only provides water to lots with contaminated wells but it also would enhance the layout of the water system and add to the overall reliability of the system.

Service connections all the way into the buildings for the properties with well contamination (other than Superfund Site) may be provided depending on funding obtained. Services would only be brought to the property line for the other lots within the area and service connections would not be provided for vacant lots.

2.4 Core Area + Area E (Schools Area)

In this scenario, water main would be installed on Pickett Lane for all three schools as well as the private residences and chicken farm. The water main would then loop and be installed on Maiden Lane coming back to Main Street. Service connections for un-developed lots would not be provided.

2.5 Core Area + Area I (Durham Center Area)

A transmission main from Middletown would be extended south on Route 17 and would be connected to the stub from the existing Durham Center Water System that is capped on the north side of the bridge traversing Allyn Brook. Analysis of this area will only utilize typical average and maximum day demands from the system. The Peak flows seen during the Fair will not be used for sizing the water main. It is assumed the existing Fairground Wells will be used to meet Peak Demands during the Fair.

2.6 Core Area + Area F (Durham Heights Area)

Homes on Oak Terrace, Wilcox Drive, Edwards Road, Austin Road and Partridge Lane would be included in this scenario. The water main should be looped back to Main Street via Haddam Quarter Road if possible. Easements from existing property owners would need to be obtained for looping to occur.

Since there are not many homes that still have bacteria issues; service connections for these homes would be provided to the property line. Service connection would not be provided for vacant lots.

2.7 Core Area +Areas F + G + H

Most of the homeowners in the Royal Oak Drive, Woodland Drive and the Durham Heights Areas have concerns about aesthetic issues related to their well supplies including hardness, iron and manganese. These areas were included together because of their proximity to each other, the ability to loop the proposed water mains for better water quality and consistent pressures and in order to provide a separate way that water could be conveyed to the south if there are issues along Main Street.

2.8 Core Area +Areas E + F + G + H + I (All Areas)

This scenario includes all the areas described above and is shown on **Figure 1-5**. Water service will be provided into the buildings for the Superfund site area only. For other lots, a water service stub will be provided to the property line. If contamination is present (MTBE and 1, 1 - DCE areas), these may have services provided to the buildings depending on funding obtained. Vacant lots will not have service connections.

3 WATER DEMANDS

3.1 Areas A to H

Water demand assumptions for all developed properties in each area were discussed at one of the TRC workshop meetings and projections calculated here are based on the CTDPH recommendations for average, maximum and peak hour demands. For residential consumption, 75 gallons per capita per day was used for water demand projections).

The following is summary of criteria used in developing residential demands:

a. Single family - 4 person x 75 gpcd = 300 gpd
b. Two Family - 2 - Two bedrooms units (2 x 3 x 75 gpcd = 450 gpd
c. Multi Family - 3 - Two bedrooms units (3 x 3 x 75 gpcd = 675gpd)

Water demand from the various types of non-residential property uses or zoning designations can vary considerably. For Commercial/ Industrial buildings, the Connecticut Public Health Code (PHC Table 4) was used (ex: Large retail/Commercial building - 0.1 gpd/sq. ft. of gross area). The average daily demand (ADD) also includes an allowance of 10 percent for unaccounted for water.

An important planning component in sizing water mains and appurtenances is projecting future water demands for those properties that have not yet been developed. For those properties not yet developed, 300 gpd per vacant residential lots was estimated and 1,500 gpd for each vacant commercial/Industrial lot was assumed.

Maximum Day Demand (MDD) was estimated using a factor of 1.5 as recommended by CTDPH. These peaking factors are typical for mostly residential and low density service areas. To calculate the MDD, the average daily demand was multiplied by 1.5.

$$MDD = ADD \times 1.5$$

Peak Hourly Demand (PHD) was calculated based on DPUC recommendations as follows;

$$PHD = ADD \times 1/3$$

One important note to highlight with the water demand projections developed here; the gallons per minutes (gpm) for the average day and maximum day demands were based on 16 hours per day of operation. This is calculated as the amount of water demand in gallons per day (gpd) divided by 960.

For example, based on the assumptions and criteria listed above, an average daily demand (ADD) of 57,593 gpd (60 gpm, assumed 16 hour per day) was calculated for the Superfund Site Area (Area A). This translates into 86,390 gpd (90 gpm, assumed 16 hour per day) for the maximum day demand and 320 gpm for the Peak hour Demand. **Table 3-1** identifies the total number of building designation for each area included herein. **Table 3-2** calculates the water demands for each area based on the residential buildings, lots and zoning designations include in **Table 3-1**. Details of how the calculations for water consumption for specific properties are summarized at the bottom of **Table 3-2**.

Table 3-3 summarizes the water demands for each area as well as for the seven scenarios analyzed herein. Without fire protection, the estimated water demand ranges from 172,780 gpd (Superfund Area only) to 667,997 gpd (all areas). With fire protection the estimated water demand ranges from 716,390 gpd to 963,998 gpd. The Core area's estimated demand is 315,636 gpd without fire protection and 787,818 gpd with fire protection.

The provision of fire flow for scenarios was also included as a sub-option. For the proposed water main extension to serve the areas of Durham, the system must be able to meet maximum daily demands for the scenario in question in addition to providing the required fire flow for the

specified duration. The flow and duration of the required fire flow are dependent upon the type of development in the area.

Table 3-3 also includes a fire flow rate in gallons per minute for each scenario. The Durham flow rate was based on a fire flow required for the largest building within the service area or scenario. Specific fire flow rates for Durham Manufacturing and the School Area is calculated in Section 5.

3.2 Durham Center & Fairground (Area I)

The existing Durham Center Water System demand data shows an average daily usage of 6,000 gpd. This is based on approximately 32 residential and 16 commercial services. Peak usage is estimated to be approximately 90,000 gpd during the annual Durham Agricultural Fair held the last week in September. For this study, it was agreed by the TRC that the Fairground wells would be used for meeting peak demands during the Fair and that an interconnection between the proposed water main extension and the existing Durham Center System would only allow water to go into the Durham Center area and not allow water to flow to the north.

The Durham Center Area I include approximately 38 properties that are not connected to the existing water system. They include 29 residential lots, 8 vacant lots and 1 property that is zoned commercial.

Water demand projections for this area includes the existing average daily demand of 6,000 gpd plus the expected demands from the 38 properties not currently connected to the system. The residential properties were assumed to be single family residences (300 gpd average daily demand) and the commercial property was assigned a flow of 1,500 gpd. There was also an allowance of 10 percent for unaccounted for water.

4 Middletown Water System

A review of the City of Middletown's latest Water Supply Plan (submitted in December 2011 with a revision in May of 2012) was completed to determine whether the City has excess water available to potentially service the contaminated areas in the Town of Durham. Further, a workshop and multiple conference calls were completed to review the summary tables produced to fully understand the City's plans for long term supply and how the potential additional sources of water should be planned for. The Water Supply Plan is set to be approved in late 2012.

4.1 Middletown Sources of Supply

The City of Middletown receives its water from two distinct sources, an aquifer along the Connecticut River and a reservoir system located mostly in Middletown and partially in Middlefield with an emergency reservoir located in Middlefield.

4.1.1 Groundwater Supplies

The River Road Wellfield consists of approximately 7.6 acres of city owned land adjacent to the Connecticut River on River Road between Eastern Drive and Silver Street. See **Figure 4-1**.

The wellfield began use in 1965 with Well No. 1 and Well No.2 being placed on-line. Development continued in 1971 with the construction of Well No. 3 and Well No. 4. Well No. 5 and Well No. 6 were constructed in 1980; Well No. 7 and Well No. 8 in 1983. Well No. 2A and Well No. 4A replaced the existing wells in 1992 and Well No. 9 and Well No. 10 were constructed in 1995. Well No. 1 and Well No. 3 are presently inactive and can only be used in an emergency.

These 10 wells all pump to the John S Roth Water Treatment Plant for iron and manganese removal by pre-oxidation, the addition of a coagulant, filtration through ferrosand filters and post chemical addition including sodium hydroxide for pH adjustment, fluoride for dental prophylaxis, polyphosphate for corrosion control and chlorine for disinfection.

The wellfield is covered under a diversion permit that restricts flow from the wellfield to 9.0 MGD but at present the approved safe yield (defined as the maximum dependable quantity of water per unit of time which may flow or be pumped continuously from a source of supply during a critical dry period without consideration of available water limitations) for the wellfield as per the CTDPH is limited to 6.03 MGD. This value includes Well No. 1 and Well No. 3. Middletown has completed a simultaneous pump test of all wells within the wellfield to determine the overall safe yield and available supply (defined as the maximum amount of water that can be dependably supplied taking into account reductions applied to the safe yield including limitations based on hydraulics, treatment, pump capacities, reductions in well yield, transmission mains, permit conditions, source construction limitations, approval limitations or operational considerations) from this wellfield. The results of this test are presented in **Table 4-1**. The table includes the safe yield of the supplies as well as the available water for the system.

4.1.2 Surface Water Supplies

The surface water supplies consist of the Higby Reservoir complex that includes three interconnected reservoirs located in the City as well as the Town of Middlefield. Water flows by gravity from Higby Reservoir No. 3 into Higby Reservoir No. 2 and then into Higby Reservoir No. 1. See **Figure 4-1** for an overall location map.

A separate surface water supply, the Adder Reservoir, is also included in the surface water supplies. This is located north of Higby Reservoir No. 1 (See **Figure 4-1**) and is an impoundment of Roaring Brook. Water from the Adder Reservoir flows by gravity through a 20 inch concrete pipe to Higby Reservoir No. 1.

The surface water supplies have a registered withdrawal of 3.24 MGD but the safe yield, as approved by the CTDPH, for these supplies is 1.22 MGD.

Water from the surface water supplies is treated at the Charles B. Bacon Water Treatment Plant. This plant is a conventional filtration plant that includes aeration, coagulation, flocculation, sedimentation, filtration (with sand/anthracite) and disinfection with chlorine.

A third potential surface water supply, the Laurel Brook Reservoir, is located in the City of Middletown and is categorized as an inactive, emergency supply. It could only be used as a continuous source of potable water if treatment facilities including filtration are added. The

approved safe yield for this supply is 0.73 MGD and the approved registered diversion is 0.75 MGD.

4.2 Current Water Demands in Middletown

Table 4-1 summarizes the existing demands on the system, the existing available supplies and the surplus water available based on actual data from 2004 through 2011. The average daily demands (4.14 in 2010) and maximum month average daily demands (4.79 in 2010) have remained fairly constant throughout the last 8 years. There has been a slight decrease in maximum month average daily demands and peak day demands. These actual values are much lower than those predicted in the last Water Supply Plan due to lower growth in water usage than predicted in the City.

4.3 Future Water Demands in Middletown

The projected demands for the City increase slightly for the 2016, 2030 and 2060 planning periods (5.13 MGD, 5.53 MGD and 5.79MGD respectively) for the maximum month average daily demand. The 2016 demands are approximately the midpoint of the existing demands seen from 2010 and those projected for 2030. The projected demands for 2030 and 2060 are taken from the City's latest Water Supply Plan and were based on predictions of population and expected growth in Middletown's system.

4.4 Existing Available Water Supply in Middletown

The first two columns in **Table 4-1** summarize the existing available supply in the City of Middletown's system. Column 1 shows the average over the last 8 years. Column 2 shows the demands for 2010, the year accepted for available supply analyses. The total available supply for Middletown's system including all active groundwater and surface water supplies is 5.94MGD under average day demands. This available supply results in surplus water (1.80 MGD) being available when comparing total available water to the average day demands being experienced in the system. With this surplus, the margin of safety (the ratio of available supplies to system demands) is well above the minimum threshold recommended by the CTDPH meaning there is excess supply (> 1 MGD) available to serve Durham's needs if the minimum recommended margin of safety (1.15) is maintained.

4.5 Potential Sources of Supply included in 2016, 2030 and 2060 Projections

Table 4-1 also summarizes the City's plans for additional supplies that include the addition of Well No. 1 and Well No.3 to the other supplies already included in the planning periods. This will be described in more detail below.

4.5.1 Well No. 1 and Well No. 3 Improvements

The replacement of these inactive wells is scheduled in the upcoming short term planning period. The projected available supply expected from these two wells is based on safe yields determined for these wells during the simultaneous pump tests completed. The available supply

for these potential sources is 1.01 MGD. When added to the other available supplies, the total available supply increases to 6.95 MGD.

The Replacement of Well No. 1 and Well No. 3 allows the City to maintain overall system supplies and meet projected demands in Middletown throughout the planning periods (2016, 2030 and 2060).

4.6 Other Potential Sources of Supply not Included in Analysis

There are other potential sources of supply that have not been included in the available supply summary table **(Table 4-1)** but will be mentioned and discussed in some detail here. They include an existing emergency interconnection with Berlin, the Laurel Brook Reservoir and the interconnection with the Cromwell Fire District. These potential sources of supply could be used if demands increase significantly and Middletown is unable to meet their overall demands that would include Durham.

4.6.1 Berlin Interconnection

An emergency interconnection with the Town of Berlin could be converted to a sale of excess water on a continuous basis. This amount would be obtained by Berlin from an interconnection with the City of New Britain. Presently, the City is permitted to withdraw 1.44 MGD on an emergency basis from the Berlin Water Department and the interconnection would be near the intersection of Middle Street and Division Street. The interconnection would require the installation of water main and the design and construction of a booster pumping station to pump water up to meet Middletown's hydraulic grade line in the area. Meter pits and valve vaults would also be necessary to measure flow and regulate pressure in the area.

Permits assumed for the pipe extension and booster pumping station installation include the CTDPH capital improvement permit for the facility and water main, local permits for planning/zoning and inland wetlands, possibly road opening permits for work on Town roads, possibly a CTDEEP inland wetland permit and the existing CTDEEP diversion permit will need to be modified for the continuous use of water.

4.6.2 Laurel Brook Reservoir

The City has not used this dormant source of supply since 1991. The former supply source included a treatment and pumping facility at the base of the reservoir but the system was abandoned and disconnected from the overall distribution system. This source is reportedly available for emergency use only, but it would need the prior consent of the CTDPH and would require treatment and disinfection before being connected back to the system. The source is unfiltered and the water quality does not meet Federal and State standards.

If the Laurel Brook Reservoir source needs to be reactivated, a new treatment facility with filtration will need to be constructed at the reservoir. In the previous study completed in 2000, two water treatment systems, ultrafiltration and conventional filtration, were evaluated to preliminarily assess the type, size and cost of treatment plant alternatives to be utilized in the future. Ultrafiltration will only be discussed in this update since it is a best available technology

for the level of treatment needed, requires a smaller footprint than conventional filtration, results in less backwash wastewater and requires less equipment and maintenance.

Design Criteria

Current water quality data for the Laurel Brook Reservoir is not available. We have assumed that no out of the ordinary water quality conditions exist in the reservoir that would require a higher degree of treatment than that provided with an utlrafiltration plant. A pilot test should be conducted in the future to evaluate the water quality conditions at the reservoir and determine if the treatment system proposed is viable. The Department of Public Health requires a 4 season pilot test be conducted for a new treatment facility.

The City's latest approved Water Supply Plan reports a safe yield for the reservoir at 0.73 million gallons per day (MGD). The registered diversion and therefore the required design capacity for the needed treatment plant is 0.75 MGD. This value was used to size the necessary equipment and estimate costs for the proposed treatment plant.

Ultrafiltration Treatment Facility

This treatment process utilizes membranes to remove particles from the water. A properly sized membrane type filtration process has the ability to separate any solids larger than the effective pore size of the membrane. It is considered by the USEPA to be a "best available technology" due to the physical barrier that they present in the removal of microorganisms and contaminants.

Figure 4-2 is a preliminary schematic of the components necessary for ultrafiltration. The ultrafiltration process is described in more detail below.

The raw water pumped from the reservoir is fed through a pressure reducing valve (PRV) and a prefilter. The PRV is used to maintain a designated pressure within the treatment system required by the membranes while the prefilter removes large particles from the water. The water is then fed through the ultrafiltration treatment system where solids and microorganisms are captured and the filtered water (permeate) passes through the wall of the membrane.

The filtered water is then conveyed to an underground, baffled clearwell. Prior to entering the clearwell, the water is treated with sodium hypochlorite for disinfection. The size of the clearwell is based on the maximum flow rate of 0.75 MGD and a 4-log removal of Giardia, Cryptosporidium, and viruses. Assuming the membrane filters provide a 2-log removal, the clearwell was sized to provide an additional 2-log removal for an overall 4-log removal. Baffling was also used to size the clearwell. Based on this criteria, the approximate size of the clearwell is 0.27 million gallons.

The ultrafiltration system is designed to provide pH adjustment and disinfection prior to distribution. The pH adjustment may be necessary to render the water less corrosive. The ultrafiltration membranes remove viruses and bacteria but post-treatment disinfection provides further protection against these microorganisms as well as additional residual chlorine in the distribution system.

The membranes require periodic backflushing and chemical cleaning in order to maintain the design filtration rate. By reversing the flow, the collected solids are discharged to an underground backwash tank. The membranes are then thoroughly cleaned with a citric acid. After the cleaning, the solution can be stored and treated on site or trucked off site for disposal.

Based on the above treatment process, the estimated building size was approximately 2,600 square feet. The proposed facility would house a raw water pump, prefilter, two racks of ultrafiltration membranes, an overall control panel, cleaning solution and backwash tank, two chemical tanks and pumps, effluent pumps and miscellaneous piping. The size and dimensions of the building are dependent on any additional treatment processes that may be necessary after a pilot test is conducted.

Permits that will be needed for Laurel Brook Reservoir include CTDEEP permits for Diversion (assumed to be an upgrade of the source to an active supply, diversion already in place), CTDPH permits for capital improvements for the new treatment facility and distribution system improvements, water quality sampling and pilot study for ultrafiltration treatment system and local permits for planning and zoning, inland wetlands and road opening.

Another potential permit and concern with this potential source of supply is the impending streamflow regulations that are being finalized and could be implemented in the coming years. This requirement could reduce the safe yield and available supply from this and other surface water supplies in the City.

4.6.3 Cromwell Fire District (Shunpike) Interconnection

Another potential source of supply is an interconnection with the Cromwell Fire District. Based on their latest approved Water Supply Plan, Cromwell shows they have excess supply in their system (See **Tables 4-2** and **4-3** from Cromwell's latest approved Water Supply Plan). Based on the Water Supply Plan, a flow of 0.50 MGD for continuous use is available. This amount is presented because of the limited long term excess supplies projected for Cromwell's system. If more flow is necessary (at present, there is an emergency water supply interconnection permit in place for up to 3.0 MGD), significant improvements would be required to maintain Cromwell's supply so they can meet their obligations for projected demands in their system.

The Cromwell improvements required would depend on the amount of water requested in the interconnection. If only 0.5 MGD was requested, the construction of the interconnection including a booster pump station would be required. If a larger amount of flow was requested, the interconnection and booster station would be necessary but there would also be improvements at the Gardiner Wellfield. These have already been completed.

The interconnection improvements would require 12 inch ductile iron piping and a booster pumping station to deliver flow from Cromwell to Middletown in order to meet the City of Middletown's existing hydraulic grade line in the area. The water main would extend from the intersection of Berlin Road and Newfield Street heading south on Newfield Street (Route 3), crossing the Mattabassett River and ending at a parcel just north of Tuttle Road and Middletown's Sanitary Pump Station.

The Booster Pumping Station would house pump control valves, gate valves and pumps needed to lift Cromwell's water into Middletown's system. The pump station would also allow for gravity flow of water from Middletown to Cromwell, if necessary. The station would also include valve meter pits outside the facility to measure the flow, regulate the pressure and filter the water, if necessary.

Permits assumed for the pipe extension and booster pumping station installation include CTDPH capital improvement permit for the facility and water main, local permits for planning/zoning and inland wetlands, possibly a CTDOT permit for work on State Route 3 and modification of the CTDEEP diversion permit to allow for the continuous flow of water through the interconnection. The pipe extension assumes the pipe will be mounted to the existing bridge that crosses the Mattabassett River; therefore a permit is not anticipated.
If a larger flow request is made, wellfield improvements are also necessary. They would include getting Gardiner Well No. 4 on line and operational in their system. The efforts required for this include infrastructure improvements in the wellfield, local and state permitting and engineering. This work has been completed by Cromwell and the wellfield is operational.

There could also be distribution system improvements needed. If the flow from Cromwell to Middletown matches the emergency interconnection flowrate (3.0 MGD), it would be necessary for approximately 1,500 LF of 8 inch main to be replaced from State Route 72 up to the interconnection at Berlin Road and Newfield Street. If less flow is used (0.5 MGD), there will not be a need to make these system improvements.

4.7 Discussion of Available Supplies for Planning Periods

The projected available water supplies in Middletown during the planning periods of 2016, 2030 and 2060 are also presented in **Table 4-1.** The table calculates the total surplus water available for the various demand scenarios (average day, maximum month average day and peak day), the excess supply available for Durham while maintaining the recommended margin of safety (1.15) and the margin of safety for the various available water scenarios and demands presented. Each planning period will be discussed in more detail below.

4.7.1 Discussion of 2016 Projections

The expected demands and the total available supply for the system are projected to increase during this planning period. Specifically, replacement Well No. 1 and Well No. 3 (1.01. MGD) are now included in the available supplies. These sources increase the available supply to 6.95 MGD. This results in an increase in the excess supply available and also increases the margin of safety for Middletown's system. If Durham's demands (the Core Service Area at approximately 0.8 MGD) are included, the City's margin of safety remains well above the 1.15 threshold under maximum month average day demands. If all the areas are serviced and fire protection is included, Durham's demands can also be met and the margin of safety is still above the 1.15 threshold.

4.7.2 Discussion of 2030 Projections

In 2030, demands increase in Middletown but the increase is not significant (15%). This increase does affect the available supply and excess water available to potentially serve Durham.

When the available supplies are compared to the projected demands (excluding Durham), the margin of safety is well above 1.40. This would allow the City to serve the recommended Core Service Area in Durham as well as the other areas investigated, with fire protection, and still maintain the necessary excess supply and margin of safety under all demand scenarios. There is a caveat to this. The margin of safety gets close to the threshold of 1.15 leaving little additional supply for other potential developments in Middletown.

4.7.3 Discussion of 2060 Projections

In 2060, demands increase further (just over 20 %) when compared to the demands for 2010. This increase does not significantly affect the overall margin of safety for the average, maximum month, and peak day demands. Further, the City would be able to serve the recommended Core Service Area as well as the other areas investigated, with fire protection, and still maintain the necessary margin of safety (just above 1.15). There would however be little excess supply available (approximately 0.23 MGD) under average day demands.

If additional demands in the City of Middletown or in Durham are necessary, there may be a need for an additional source of supply to meet the additional demands and maintain the necessary margin of safety.

4.8 Recommendations

The City of Middletown will be able to service the recommended Core Service Area with fire protection in the Town of Durham in the long term planning periods based on the revised available supplies presented in **Table 4-1**. As the replacement of Well No. 1 and Well No. 3 are completed and added to Middletown's system, the excess available supply increases and more areas in Durham may be able to be serviced. The remaining sections will be developed and completed knowing Middletown will have the available supply to serve the Town of Durham.

5 DISTRIBUTION SYSTEM

5.1 Pipe Sizing Assumptions

The following assumptions were made in completing the pipe sizing of the water main in each of the areas and under the various scenarios investigated. They include:

1. Existing and projected water demand and safe yield for the Middletown system were taken from the latest Water Supply Plan submitted to the CTDPH.

2. Projected demands for each area in Durham were developed based on property information and typical water demand values provided by CTDPH as guidelines. These demands were developed under two different options, without fire protection and providing fire flows.

3. The hydraulic grade line for the proposed Cherry Hill water storage tank on Talcott Ridge Drive was set at 495 feet which is ten feet below the proposed overflow elevation of 505 feet. For purposes of this study, the Cherry Hill tank was assumed to be filled

using an existing booster pump station adjacent to Middletown's existing Long Hill Storage Tank.

4. The City of Middletown plans to add the Gleason Road Storage Tank to the existing Long Hill Storage Tank after the Cherry Hill tank is completed. The new Gleason Road tank would primarily service existing customers in the Long Hill area. The Cherry Hill tank would be for the areas south of the Long Hill booster pump station including the proposed system extension into Durham.

5.2 Pipe Sizing Criteria

The proposed water mains for various scenarios will be sized to meet two demand conditions:

1. Peak hour demands, without fire flow

   Without fire flow, projected demands in the system were calculated as the average daily demands multiplied by a factor of three to provide additional supply for potential demands in Middletown and Durham that were not captured in the areas and scenarios described and to include some additional storage for potential emergencies (See **Table 3-3**).

   These flows were then used to size the proposed Storage Tank and determine pipe size. Typically, pipe size is selected based on velocities expected in the main at the flow demand projected. It also takes into account friction losses. Once main sizes were selected, the size of the storage tank was determined.

2. Maximum daily demands plus coincident fire flow

   When fire flow was included in the demand projections, the maximum daily demand in addition to the required fire flow for the area was used to determine pipe sizes. These sizes were also based on velocities expected and estimated friction losses. The size of the storage tank required increased significantly since the need for 3,500 gallons per minute for a 3 hour duration, the worst case scenario, results in 630,000 gallons per day of storage in addition to the maximum daily demands (Average daily demands multiplied by 1.5 based on CTDPH recommendations).

5.3 Flow Pressure

CTDPH regulations require all service connections have a minimum water pressure at the main of 25 psi, although 35 psi is the recommended minimum under normal operating conditions (which include normal peak demands but exclude fire flow demands). Positive pressure (20 psi minimum recommended) is to be maintained under all flow conditions, including fire flows, at all points in the distribution system.

Pressures in excess of 125 psi are undesirable and may cause faucets to leak, valve seats to wear out quickly or hot water heater pressure relief valves to discharge. The CTDPH requires a pressure reducing device to be provided where static pressures exceed 125 psi in the distribution main.

5.4 Fire Protection

To calculate the fire flow rates for buildings in the service area, the Insurance Service Office (ISO) method was used. Durham Manufacturing Company, the largest commercial building in the Superfund Site and Base Case scenarios was used.

The ISO method considers building construction, occupancy, adjacent exposed buildings, and communication paths between the buildings. The basic formula in the schedule is:

NFF = (C)(O)(X+P)
NFF =needed fire flow in gallons per minute
C) =18 F $\sqrt{A_i}$ (A construction factor)
F = Coefficient related to the class of construction (0.8 for masonry, noncombustible)
A = effective building area (25,508 sq. ft. for Durham Mfg.)
(O) = an occupancy factor (0.85 for limited combustible, schools, metal industries)
(X+P) = an exposure factor (a maximum value of 1.75 used here)

NFF = (18 x 0.8 x $\sqrt{25,508}$) x (0.85) x (1.75)
NFF = 3,421 gpm **SAY 3,500 gpm**
(because it is greater than 2,500, ISO rounds the NFF to the nearest 500 gpm)

The same formula is used to determine fire flow for the following buildings:

School Scenario (largest Area = 29,705 Sq. ft.):

NFF = (18 x 0.6 x $\sqrt{29,705}$) x (0.85) x (1.75)
NFF = 2,769 gpm **SAY 3,000 gpm**

Durham Center (Library is the largest building in the service area = 5,531 sq. ft.).

NFF = (18 x 0.8 x $\sqrt{5,531}$) x (1.00) x (1.75)
NFF = 1,874 gpm **SAY 2,000 gpm**
(O) = an occupancy factor of 1.00 for combustible bldg. used

For single and two family residential areas not exceeding 2 stories in height, ISO recommends the following needed fire flows:

Distance Between Buildings	Needed Fire Flow	Required Duration (hrs)
More than 100'	500 gpm	2
31' - 100'	500 gpm	2
11 - 30'	1,000 gpm	2
10' or less	1,500 gpm	2
For other types of habitational building Maximum needed fire flow	3,500 gpm	3

For this study, the residential fire flow needed was assumed to be 1,000 gpm. The existing Durham Center Water System does not provide fire flows.

The following estimated fire flow requirements are used in sizing piping for the different areas and the various scenarios:

1.	3,500 gpm	-Durham Manufacturing, Main Street, Durham
2.	3,000 gpm	Durham Schools
3.	1,000 gpm	-Residential areas

5.5 Pipe Sizes Selected

Based on the projected demands for each of the areas defined and for the various scenarios investigated, pipe sizing was completed for each of the areas. Pipe sizes varied for portions of the system based on the two options of providing or not providing fire flow to the areas. As a result the following sizes were selected for the areas:

5.5.1 With Fire Protection

The "spine" of the system would extend south of Allyn Brook if Area "I" is included in the water system. Route 17 or Main /Street would require a 16 inch water main from the new storage tank all the way to Allyn Brook. The water main south of Allyn Brook would be 12 inches. This would extend to Higganum Road and the end of the Durham Center System.

The School Area would also require 12 inch water main to allow for fire protection flows needed (3,000 gpm). The remaining areas and Town roads would all have 8 inch water main to meet projected demands and allow for fire protection flows.

See **Table 5-1** for pipe sizes included in each area and scenario.

5.5.2 Without Fire Protection

The system needed, if fire protection were not provided, would be different along Main Street, the School Area and Durham Center. The water main that extends from the new storage tank would be 12 inches down to Allyn Brook before connecting to the Durham Center System. The water main in the Durham Center System would remain unchanged. The reason for the 12 inch main is the expectation that much of the areas included herein would eventually be connected to the system and when the flows for all the remaining areas are included in demand projections, the pipe size necessary is 12 inches.

The remaining areas and the School Area would only require 8 inch mains to meet projected demands under all scenarios.

See **Table 5-2** for pipe sizes included in each area and scenario.

5.6 System Layout

The layout of the water distribution system for the initial scenarios (Superfund Area only) and all other scenarios under both sub options (without fire protection and including fire flows) are shown on **Figure 5-1 and 5-2**. The following assumptions and criteria were made in establishing the distribution system layout:

1. On State roads, road pavement repair and maintenance and protection of traffic will be minimized to reduce project costs. On Main Street, Wallingford Road and Middlefield Road (State Routes 17, 68, and 147), the water main is proposed to be installed on the road shoulder and off the pavement. Where crossing of the road is necessary, the water main will be installed by open cut construction methods. Service connections on the opposite side of these roads will be directionally drilled.

2. The water main will be routed so that impacts to the specimen trees along Main Street will be minimized. In some areas the water main will be installed near or under the existing concrete sidewalk. The sidewalks will be removed and replaced where required.

3. On Town roads in Durham, the proposed water main will be installed in the pavement due to the relatively narrow right-of-ways and shoulders.

4. Service connections will be furnished and installed all the way into the buildings for each of the 100 properties within the Durham Meadows Superfund Site Area "A". For all other properties, the service connections will be installed to the property line. Vacant lots will not have service connections installed.

5. In areas other than Superfund site, service connections may be provided to the buildings that have had documented potable water well contamination depending on funding obtained and available.

6. Gate valves shall be installed at street lines of intersecting streets. Each intersection would be triple gated. Valves will also be installed approximately every 800 feet to allow for isolating parts of the system for maintenance needs.

7. Fire hydrants will be installed approximately every 500 feet along the proposed water main route if fire protection is provided.

8. Hydrants shall have a 6" branch pipe with a 6" gate valve controlling each hydrant.

9. Hydrants shall be installed on the side of the street closest to the water main, behind the curb or pavement line, normally 2 feet from face of curb to center line of hydrant

10. All water mains that will supply hydrants must be at least 8" in diameter.

11. The water mains were looped wherever practical for water quality and pressure considerations.

12. Water mains would generally be installed with approximately 4.5 feet of cover unless other utilities dictate that the main be installed deeper in specified areas.

13. All water main material and products shall be capable of withstanding internal and external forces.

14. All water main material and products shall be protected against internal and external corrosion.

15. Flushing devices shall be installed at intervals for adequate flushing of the entire water main.

16. Blow-off assemblies shall be installed at all dead ends of water main.

17. After construction is completed, all new water pipe and appurtenances shall be subjected to hydrostatic pressure and leakage testing.

18. After construction is completed all new water pipe and appurtenances shall be disinfected and flushed in accordance with AWWA standards.

5.7 Pressure Reducing Valves / Booster Pump Station

The Hydraulic Grade Line for the proposed system will be set by the proposed Cherry Hill Storage Tank's ground elevation (430 feet) and overflow elevation (505 feet). Elevations within the Durham service areas range from 150 to 480 feet. Using this elevation differential, static pressures would range from approximately **11 psi** at the higher elevations along Acorn Drive to **154 psi** at the lower elevations in the vicinity of Maple Avenue, Main Street and Old Cemetery Road. The following additional infrastructure is necessary in areas to account for elevations and system pressures expected:

1. A pressure reducing valve (PRV) in an underground vault chamber is recommended along Main Street just north of Middlefield Road to reduce static pressures along Main Street, Maiden Lane and Maple Avenue to a range of 50 to 80 psi regardless of whether fire protection is provided: See **Figure 5-1** and **Figure 5-2.**

2. A booster pump station is recommended along Main Street just north of Acorn Drive for Area "H". The ground elevation ranges from approximately 400' to 480' feet. This matches or is higher than the ground elevation of the Cherry Hill Storage Tank (430 feet). This is shown in both **Figure 5-1** and **Figure 5-2.**

6 CHERRY HILL STORAGE TANK

6.1 Storage Tank Sizing Criteria

Based upon "Guidelines for the Design and Operation of Public Water System, Treatment, Works, and Sources" developed by the State on Connecticut Department of Public Health (CTDPH) and the Recommended Standards for Water Works (Ten State Standards), storage

facilities should have sufficient capacity to meet domestic demands and fire protection, (fire flow requirement based on ISO).

The minimum storage capacity for a system not providing fire protection shall be at least 200 gallons per residential customer (184,000 gallons for all areas scenario) or equal to the average daily demand of the system (218,000 gallons for all areas scenario), whichever is greater. If commercial or industrial customers are included, additional storage shall be provided based on reasonable average day estimated water usage thereof. Storage requirements should also take into account potential demands in the system that were not included in the areas and scenarios discussed (potential development in Middletown) while also including an additional buffer for emergency supplies during an outage or a main break. Because of these potential additional demands, the average daily demand was multiplied by a factor of 3 to size the proposed Storage Tank when no fire protection was included.

6.1.1 Fire Flow Storage

Fire flow storage depends on the fire flow rate used and the duration of the fire demand. The American Water Works Association (AWWA) has guidelines when sizing storage tanks for fire protection. These guidelines are based on a basic fire flow as established by the Insurance Service Office (ISO). For this study, the basic fire flow is defined as a fire flow whose quantity is needed for handling fires in important districts or buildings. A fire flow of 3,500 gpm was used based on calculations developed in Section 4.4 for the Durham Manufacturing Facility in the Base Scenario and for the Schools in the School Scenario. A fire flow of 2,000 gpm was used for the Durham Center area

Because the 3,500 gpm fire flow is the largest for all the scenarios investigated, 630,000 gallons of storage (3,500 gpm for 3 hours of duration) are necessary when fire protection is included.

The size of the Cherry Hill Tank, if fire flow is included, will be the addition of the fire flows required for the areas included within the scenario and the Maximum Daily demand for the scenario. Since the scenarios all include the Superfund site, the fire flow that is used to size the tank is 3,500 pm. This equates to 630,000 gallons per day of storage needed.

Tank sizing and fire flows assumes the following:

1. ADD, MDD & Peak Hour minimum pressure in the system are recommended at 35 psi.
2. The minimum pressure required in the distribution system during MDD with coincident fire flows is 20 psi.

6.1.2 Emergency Supply

Emergency supply can be met either by having a standby power source at a booster pump station or by providing additional storage tank capacity. The emergency capacity is typically equal to the average day demand. The estimated average day demand for the all scenarios options is 220,000 gallons.

Any storage provided within the tank below the elevation required to maintain 20 psi within the distribution system is considered emergency storage, and would be available during pipeline

breaks, treatment plant breakdown, natural disasters, power outages or equipment failures. The volume to be provided is a function of risk with respect to an interruption of supply and, typically, we recommend the Town provide at least one day of the average day water demand. For this study, we recommend emergency storage equal to an average day's demand or 218,000 gallons.

6.2 Tank Storage Capacity

Based on the above, the estimated capacity of the proposed Cherry Hill Storage Tank is summarized below. The size is based on the area(s) included, the scenarios discussed and whether fire protection is included. They are:

Scenario	Without Fire Protection (gal)	With Fire Protection (gal)
A (Superfund Site only)	250,000	750,000
A+B+C+D (Core Service Area)	350,000	800,000
(Core Service Area)+I	400,000	820,000
(Core Service Area)+E	370,000	820,000
(Core Service Area)+F	420,000	850,000
(Core Service Area)+F+G+H	600,000	950,000
All Areas	700,000	1,000,000

In order to provide a minimum pressure of 20 psi everywhere in the system, the overflow elevation of the tank must be approximately at elevation 503 feet. The existing tank site elevation is approximately elevation 430 feet. Therefore, to provide 960,000 gallons of useable storage and have the overflow at elevation 503 feet, a tank 75 feet in height and 50 feet in diameter is required. The actual capacity of the tank would thus be just over 1,000,000 gallons.

6.3 Tank Supply and Elevation

The proposed Cherry Hill storage tank will be serviced through the existing booster pump station located near the intersection of Brush Hill Road and Long Hill Road. The existing Long Hill booster pump station would upgraded to include an additional pump, an additional variable frequency drive, new electric service, building modifications and a new emergency generator to increase the facility's emergency pumping capacity.

Assuming the proposed Cherry Hill storage tank was sized at 1,000,000 gallons and that the water level was 10 feet below the overflow elevation, and 3-4 hours were required to fill the tank, a pumping rate of 750 gpm will be required. The available pressure on the suction side of the existing booster pump station would be approximately 10-15 psi depending on the Long Hill Tank elevation. If the existing Long Hill pump station were to be used to fill the Cherry Hill storage tank, the available pressure on the suction side must be maintained otherwise the system pressures will fall below the minimum 20 psi. It is recommended that the City of Middletown run their computer model to determine of the existing pump station needs to be modified or a new station needs to be provided to fill the proposed Cherry Hill Storage Tank.

The proposed storage tank would be isolated from the remaining part of the Middletown water distribution system and would not be required to fill and draw at the same rate as Middletown's

other storage facilities. Therefore the overflow elevation of the Cherry Hill Storage Tank is based on the pressure requirements stated above.

The elevations on Talcott Ridge Drive near the proposed tank site are the highest in the proposed service area. Ground elevations at the highest lot range from approximately elevation 410 feet near the road to approximately 440 feet at the rear of the lot. The design of the tank has proceeded with the assumption a house would be built in the middle of the lot at approximate elevation 420 feet. In order to provide a minimum pressure of 35 psi during peak hour demands, the estimated overflow elevation of the proposed Cherry Hill storage tank is 505 feet.

7 PROJECT COSTS

7.1 Distribution System

Preliminary opinions of cost of several distribution system alternatives were prepared. See **Table 7 - 1a & 1b** to **Table 7 - 9a & 9b**. These alternatives include the cost of water main construction for each proposed service area with and without fire protection:

- The Superfund Site
- The MTBE Site
- The 1,1- DCE Site
- The Parsons Area
- Schools Area and Private Properties
- The Durham Heights Area
- Woodland Drive
- The Royal Oak Area;
- The Durham Center
- All Areas

7.1.1 Assumptions

Several assumptions were established, in addition to the assumptions listed in Section 4.6, System Layout, to determine the opinion of capital cost for the distribution system.

1. Costs for water main and service connections were taken from previous bids obtained for similar work within the last year. These costs were utilized along with Fuss & O'Neill experience to develop estimates included herein.

2. Uniformed officers would be required for construction work on all state roads.

3. An allowance was included for maintenance and protection of traffic on both State and Town roads.

4. An allowance was included for overall sidewalk repair on Main Street where the water main is proposed to be installed off the road. There are concrete, bituminous, stone

dust and slate sidewalks in the project area. The assumption was made that each sidewalk type would be replaced with the same kind where disturbed.

5. Pavement repair on town roads would consist of a temporary trench repair followed by a permanent trench patch.

6. An allowance for rock excavation was included. Ten percent (10%) of the total linear feet of trench was assumed because there were no subsurface investigations completed. The quantity may vary during the design phase of the project once borings are completed along the proposed route. Trench dimensions were assumed to be 4 feet wide by 5 feet deep. Lateral trenches were assumed to be 2 feet wide by 5 feet deep.

7. A total of 98 existing potable water supply wells in the Superfund site area would be permanently abandoned (two properties in this area share well water with other wells), and new water service would be connected to all the buildings within this area. The 38 existing water filter systems installed would be removed.

8. All wells in other areas outside the Superfund site that are serviced by the proposed extension from Middletown should have their existing potable water wells permanently abandoned. The estimated $142,000 cost for the abandoning of the existing wells in Area "B", "C", and "D" have not been included in the estimates provided. If funding becomes available, the costs for well abandonment in these areas could be included.

9. Service connections all the way to the building for the properties with well contamination not related to the Superfund Site were not provided. They may be included at a later date, depending on funding obtained.

10. Upgrade to the Long Hill Pump Station, replacement of the 8 inch water main in Talcott Ridge Drive and the proposed Cherry Hill Water Storage Tank would be required for all scenarios with or without fire protection. The tank size varies for each scenario investigated. The tank material assumed was precast pre-stressed concrete.

11. Pressure reducing valves are required with all systems.

12. The planned relocation of overhead utilities lines concurrent with the water main project was considered. Although there may be some economy of scale, cost reductions were not included at this point.

7.2 Cherry Hill Storage Tank & Water Main Replacement

The tank shall be designed and constructed in accordance with AWWA standard D110, Type III, precast concrete walls with steel diaphragm, wire pre-stressing, and freestanding concrete dome roof, concrete floor and foundation, roof access hatch, vent, inlet/outlet pipe, and overflow pipe. The upsizing of approximately 1,400 linear feet of existing 8 inch diameter ductile iron pipe to 12 inch from Talcott Ridge Drive to the tank is required under all scenarios and the cost is estimated at $182,000.

As shown on **Table 7-10** and **Table 7-11**, the approximate opinion of capital cost for the Cherry Hill Water Storage Tank varies from $400,000 to $1,265,000 depending on whether fire protection is included. This cost includes:

1. Design and construction of water storage tank
2. Tank foundation and interior piping
3. Altitude control valve and chamber, including miscellaneous piping, valves and fittings.
4. An allowance of 10% of the base tank costs was included for general site work and piping connections.

7.3 Upgrade of Existing Long Hill Pump Station

As shown on **Table 7-10** and **Table 7-11**, the approximate opinion of capital cost for the upgrade to the existing Long Hill Booster Pumping Station is estimated at $600,000. These upgrades are required for the extension of water into the Town of Durham. This cost includes:

1. A new pump with VFD,
2. Building expansion
3. Generator upgrade
4. Electrical Service & Instrumentation/Control upgrades

7.4 Basis of Opinions of Cost

Opinions of capital cost were generated for the seven scenarios developed for the study update as described in Section 2 to assist in determining if the project is feasible from a financial perspective, as well as addressing the groundwater contamination concerns. The costs were based on the assumptions presented above and unit prices obtained from recently bid projects as well as information obtained from construction industry cost publications, such as Means.

A 15 percent allowance was added to each alternative's opinion of capital cost for engineering and administrative costs to design the system, prepare construction bid documents and administer the project construction. A 25 percent contingency was added to each opinion of cost.

7.4.1 Opinions of Capital Cost

Opinions of capital cost were prepared for each of the scenarios investigated. These are summarized in **Table 7-10** (without fire protection) and **Table 7-11** (with fire protection). The Tables also include costs for upgrading Middletown's system. This includes water main replacement costs, pump station upgrade costs, and Storage Tank costs. The costs assume Well No. 1 and Well No. 3 will be replaced by Middletown and these costs will not be included in this estimate.

One of the areas and one of the scenarios will be discussed in detail below to explain the costs presented.

1. Superfund Area

a. Without Fire Protection:

The Superfund Site Area's distribution system without fire protection is shown on **Figure 7-1**. The system extension consists of the proposed Cherry Hill Water Storage Tank, water main upgrades on Talcott Ridge Drive, Long Hill Pump station upgrades in Middletown, and 12-inch water main from the tank through the center of Durham off the pavement on Route 17. All other water mains in Durham off Route 17 would be 8-inch. Fire hydrants would be provided for water main flushing only.

The water distribution system would be installed to serve only the properties in the Durham Meadows Superfund site that presently have or have had in the past groundwater contamination as shown on **Figure 1-5**. Complete water service connections to the buildings would be provided for the 100 properties within Superfund Site Area. Water service connections would not be provided for vacant lots.

The opinion of capital cost for Superfund Site Area distribution system without fire protection is approximately $8,540,000 (See **Table 7-10**, top chart). This amount was derived from adding the Durham construction cost (app. $4,900,000) to the cost of Middletown upgrades, including the proposed Cherry Hill Water Storage Tank ($412,500), water main upgrades on Talcott Ridge Drive ($182,000), and the Long Hill Pump station upgrades ($600,000). These costs then included a contingency and engineering/administration fees.

b. With Fire Protection:

The Superfund Site Area's distribution system is shown on **Figure 7-2** with fire protection. The system extension consists of the proposed Cherry Hill Water Storage Tank, water main upgrade on Talcott Ridge Drive, the Long Hill Pump station upgrades in Middletown, and a 16-inch water main from the tank through the center of Durham off the pavement on Route 17. All other water mains in Durham off Route 17 would be 8-inch. Fire hydrants would be provided approximately every 500 linear feet.

Service connections would be provided in the same manner as discussed above without fire protection. The opinion of capital cost for this distribution system is approximately $10,010,000 (See **Table 7-11**, top chart). This amount was derived from adding the Durham construction cost (app. $5,420,000) to the cost of Middletown upgrades, including the proposed Cherry Hill Water Storage Tank ($948,750), water main upgrades on Talcott Ridge Drive ($182,000) and the Long Hill Pump station upgrades ($600,000)). These costs then included a contingency and engineering/administration fees.

2. Core Service Area

a. Without Fire Protection:

The Core Service Area distribution system would include the Superfund Area plus Areas B, C and D depicted in **Figure 1-5**. The improvements would still include items discussed for just the Superfund site, but the Tank size would increase and there would be additional water main (8 inch diameter) to serve the other areas now included in the analysis. There would also be an additional source of supply provided to serve the additional areas included under this scenario (Cromwell Interconnection with wellfield expansion). All service connections in Areas B, C

and D would be extended to the property line. As shown on **Table 7-10**, the opinion of cost for Core Service Area distribution system without fire protection is approximately $10,640,000.

b. With Fire Protection:

With Fire Protection the system's required improvements would be the same, but the water main size from Middletown would be larger and the Storage Tank would also be larger. The remaining water mains not in Route 17 all would be 8 inch in diameter and additional fire hydrants would be incorporated into the system. The opinion of cost for this system is approximately $12,010,000 as shown on **Table 7-11**.

3. Other Scenarios

The opinion of cost for the other five scenarios included the improvements previously described for the Superfund and Core Service Areas but also included other areas that could potentially be served. The costs identified for these study areas ranged from $11,500,000 to $20,050,000 without fire protection. Costs for the same scenarios with fire protection ranged from $12,050,000 to $22,440,000. **Table 7-12** summarizes the costs for each of the scenarios.

Table 7-12
Budgetary Opinion of Capital Cost with and without Fire Protection
Summary Table

No.	Scenarios	Cost Without Fire Protection	Cost With Fire Protection
1	A (Superfund Site)	$8,540,000	$10,010,000
2	A+B+C+D (Core Service Area)	$10,640,000	$12,010,000
3	(Core Service Area)+I	$11,500,000	$12,050,000
4	(Core Service Area)+E	$12,180,000	$12,050,000
5	(Core Service Area)+F	$12,790,000	$12,100,000
6	(Core Service Area)+F+G+H	$17,640,000	$18,980,000
7	All Areas	$20,050,000	$22,440,000

8 IMPLEMENTATION

Several components need to be in place before construction can begin on the proposed water main extension. These components include funding, permit acquisition, and resolution of service area rights in the proposed service areas.

8.1 Funding

The Town of Durham will need to obtain funding for engineering, administration and construction for proposed water main extension (Core Service Areas) as a minimum. Since there will likely be several sources of funding, the timing for obtaining the funding will be critical as well as the available window for use of the funds.

As noted above in Section 7, once the proposed water system extension project is viable, the Town of Durham will need complete various funding applications along with some preliminary engineering.

8.2 Permits

Several permits and approvals will need to be in place before construction begins:

- The CTDPH will need to approve of the water main extension to ensure that proposed facilities will be in accordance with standard water works practice.
- The CTDEEP would need to provide a diversion permit for the transfer of water from Middletown to Durham. Depending on the amount needed, a general permit may be used. If Durham were to transfer its service area to Middletown, no diversion would be necessary since it would be simply be an expansion of Middletown's system.
- The CTDOT. will need to approve the plans for construction and pavement repair in State roads, such as Route 17 and Route 68.
- The local Planning & Zoning Commission(s) will need to be notified of the proposed infrastructure improvements as a part of Chapter 8-24 requirements.
- Local wetlands permits will be required for installation of the proposed water main near wetlands and watercourses.
- The City of Middletown Water & Sewer Department will need to approve the extension of their water system into an adjacent community. Execution of inter-municipal agreements will be required between Middletown and Durham.

During construction, contaminated soil will likely be encountered in the areas of the petroleum contamination and the Durham Meadows Superfund Site near Main Street. An action plan should be approved by the DEP before construction to establish sampling requirements, maximum allowable contaminant levels, and soil and groundwater disposal methods.

9 SUMMARY AND RECOMMENDED PLAN

Persistent and widespread groundwater contamination and other water quality issues have prompted the Town of Durham to consider the extension of Middletown's public water supply into the Durham Area. Carbon filters at more than fifty properties continue to require maintenance and monitoring to provide safe potable water. Groundwater contaminations (solvent and petroleum products) persist in the following areas:

- VOC contamination from the Durham Meadows Superfund Site
- Petroleum product pollution (including MTBE) from 3 gasoline stations on Route 17
- Dichloroethylene (1,1-DCE) from an unknown source
- VOC contamination at a few wells in the Parsons Area

- Supply of public water to the areas listed above is a safer and more reliable than carbon filtration at individual properties presently employed.
- Other known water quality problems exist in the following areas:
- Bacteria, hardness, iron and manganese in Durham Heights area
- Hardness, iron and manganese in Woodland Drive and Royal Oak area

Except for bacteria that persist at a few properties, these water quality problems do not present a public health threat.

As a result of the groundwater contamination problems, the recommended water distribution system that should be implemented is the Core Service Area Scenario as shown on **Figure 9-1**. The Core Service Area water distribution system provides potable water to the Durham Meadows Superfund site and other areas with documented groundwater pollution problems (Areas B, C, and D). The Town of Durham has also recognized a need for improved fire protection, therefore, fire protection should be provided as part of the initial water distribution system. The total budgetary opinion of capital cost for the Core Service Area distribution system with fire protection (See **Table 7-11**) is approximately $12,010,000. The estimated cost has a range of +30% to -15% of the estimated cost. This results in a range from $10,208,500 to $15,613,000.

Service connections from the water main to each building in the Superfund Site Area are included in the cost estimates developed. Service connections all the way to the buildings for the properties with well contamination not related to the Superfund Site were not included in costs but may be provided later depending on funding obtained and monies available. Services would only be brought to the property line for the other lots within the areas investigated and service connections would not be provided for vacant lots.

Funding for the project may be obtained from various state and federal agencies. One hundred (100) percent grant money is not available from most federal and state agencies. The only agency that would provide 100 percent grant money is the CTDEEP's Potable Water Program if there were no responsible parties identified. However, there have been responsible polluters identified in this project. None of the agencies will commit to any funding until a viable project is submitted and funding is formally applied for.

If funding is not available to construct the water distribution system, the USEPA would first negotiate with Superfund Site responsible parties to finance this effort. If the responsible parties are unable to participate in funding this work, the USEPA Region I may request Superfund financing for this work.

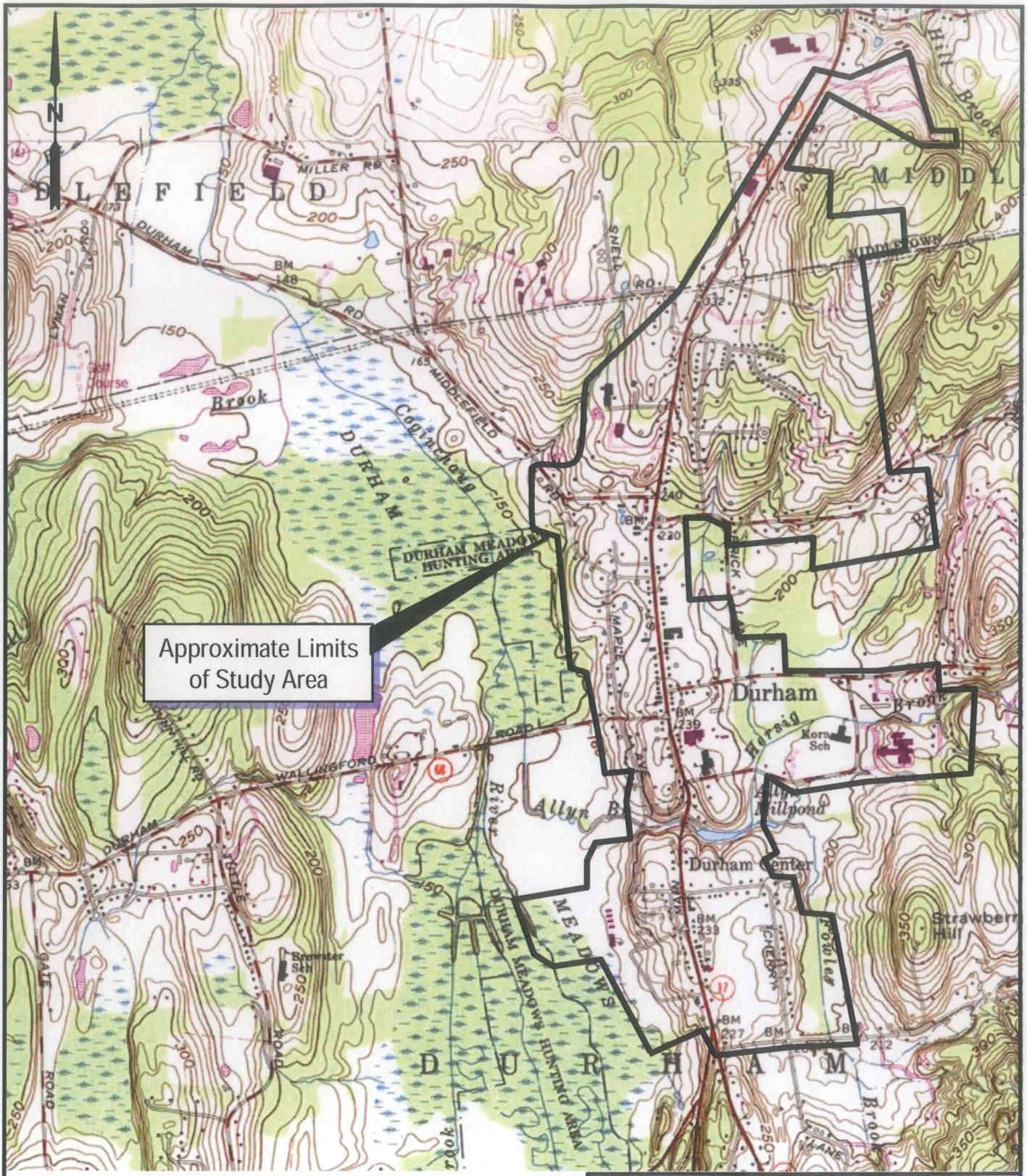
If the Town cannot obtain enough funding to implement the complete water distribution system with fire protection to the Core Service Area as recommended in this study, then the project could be constructed in phases as funding and monies become available.

Phase 1 would extend the water system from Middletown down Route 17 to the Durham Area to supply potable water to the properties in the Superfund site as recommended. Service connections into the buildings would be provided only for the developed properties in the Superfund Site Area. The water mains would be sized for fire protection, and the tank would be provided. Middletown improvements would also be completed.

After more money and supply became available, the remaining Areas (B, C, and D) could be serviced and a determination on how service connections would be installed would be determined.

Figures

FIGURES



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DURHAM, CONN. 1964 PHOTOREVISED 1984

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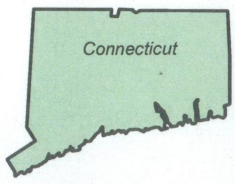
FIGURE 1-1



Quadrangle Location

FUSS & O'NEILL
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TOWN OF DURHAM

SITE LOCATION MAP

WATER SYSTEM EXTENSION FEASIBILITY STUDY UPDATE

DURHAM CONNECTICUT

PROJ. NO. 1998.823.B20 DATED : MAY 2009 SCALE: 1"= 2000'

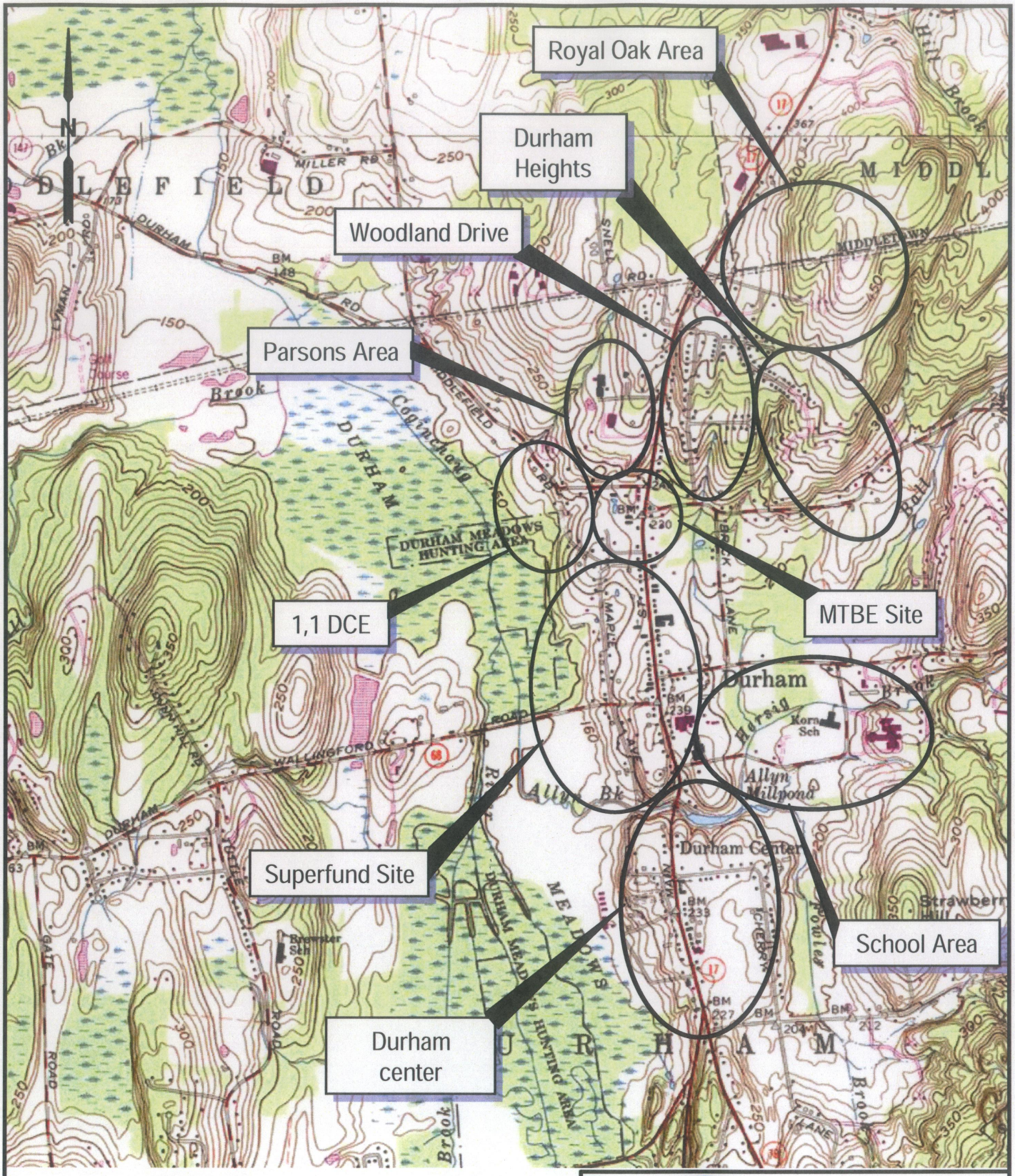

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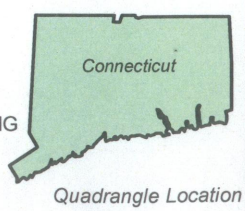
FIGURE 1-2



Quadrangle Location

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TOWN OF DURHAM

AREAS OF CONCERN

WATER SYSTEM EXTENSION FEASIBILITY STUDY UPDATE

DURHAM CONNECTICUT

PROJ. NO. 1998.823.B20 DATED : August 2010 SCALE: 1"= 2000'

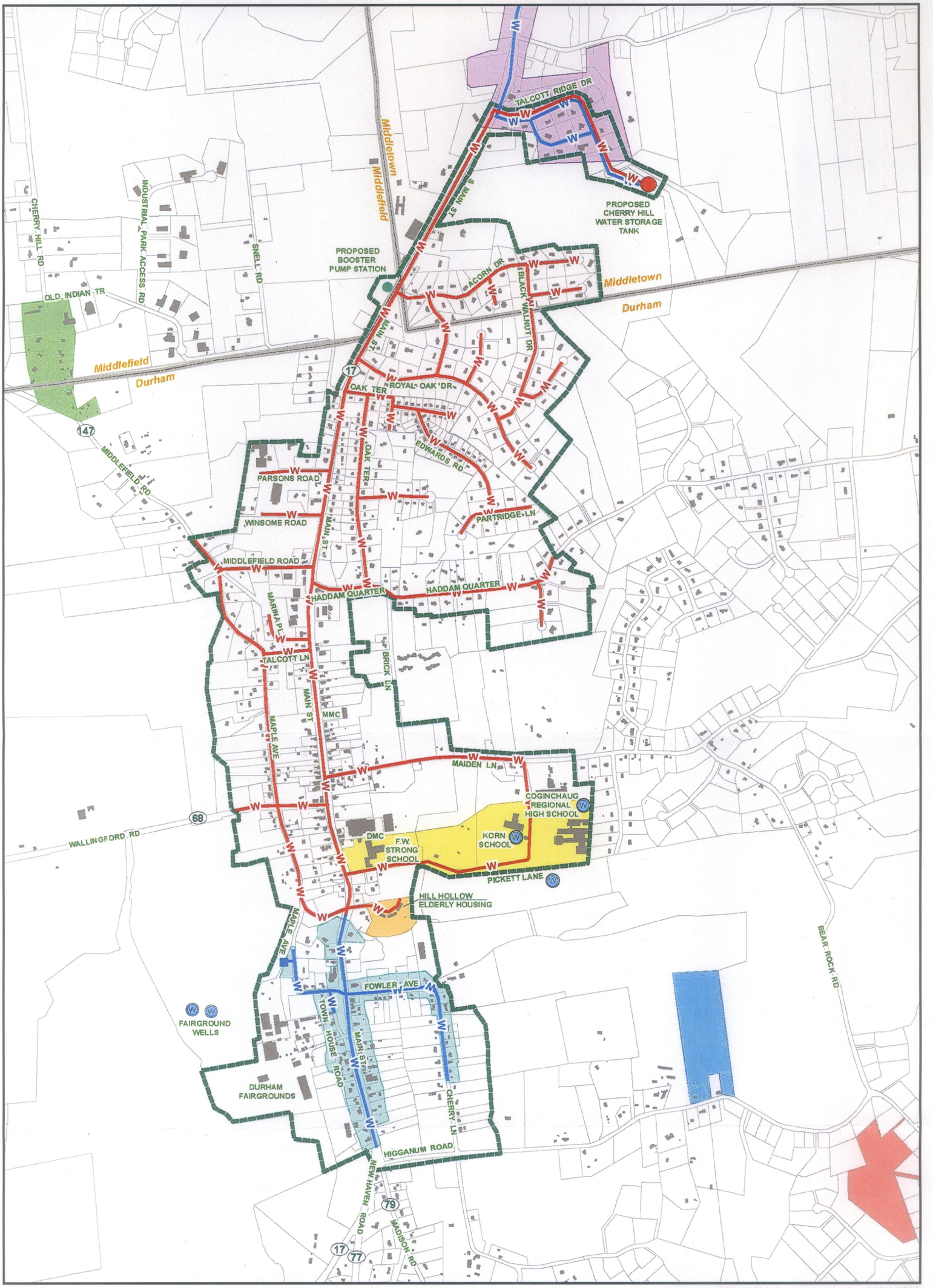

FIGURE 1-3 MAY 2009

- Durham Center Water System
- Durham Elderly Housing
- Hill Hollow Association
- Middletown Water Department
- Old Indian Trail
- Regional School District 13
- Lexington Place
- Existing Water Main
- Proposed Water Main
- Study Area

N W E S

0 500 1,000 2,000 Feet

EXISTING WATER SYSTEMS
WATER SYSTEM EXTENSION
TOWN OF DURHAM

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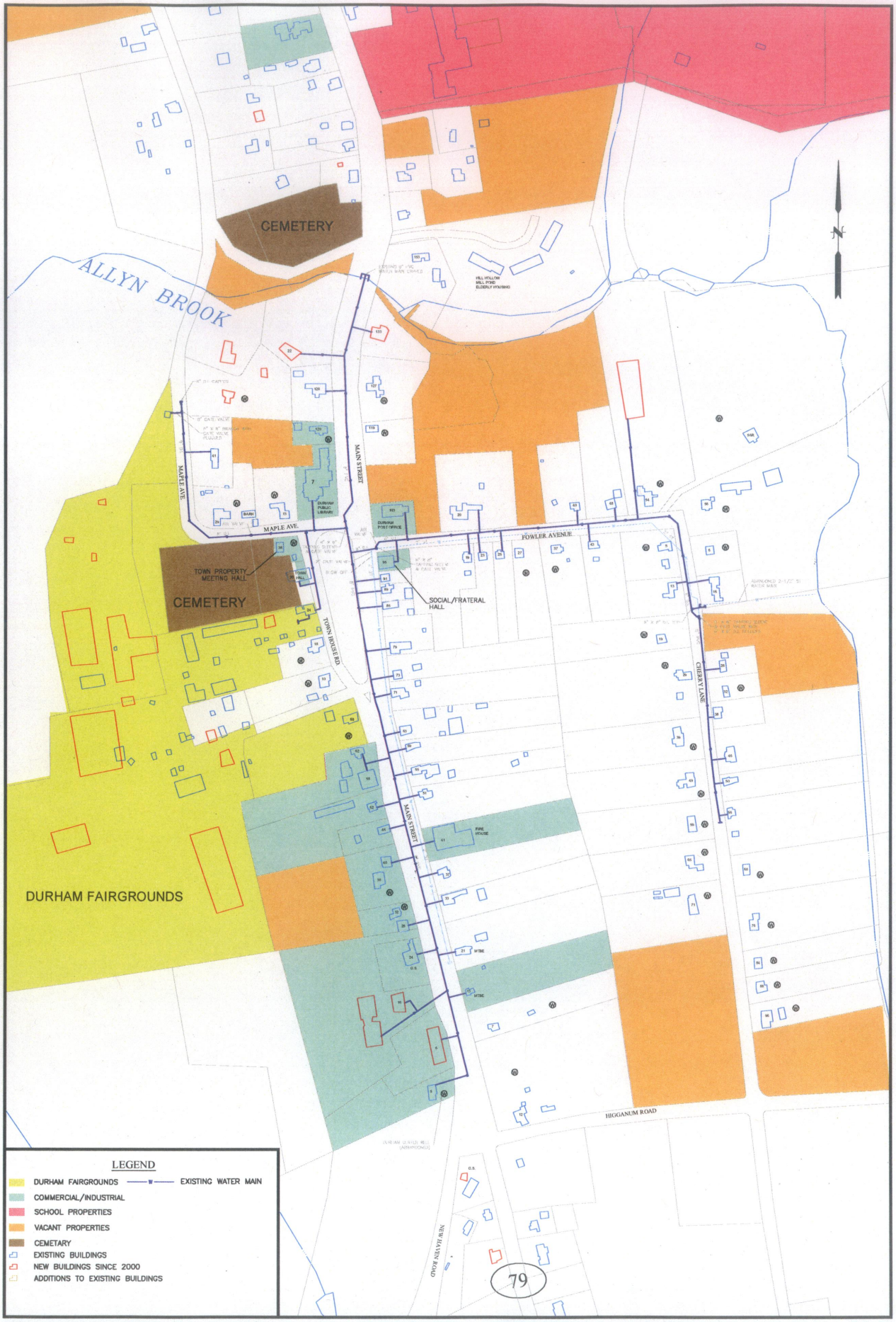

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PROJ. No.: 1998823.B20 DATE: JUNE 2009	DURHAM CENTER SUPPLY (DCS) WATER SYSTEM EXTENSION FEASIBILITY STUDY UPDATE	WWW.FandO.COM FUSS & O'NEILL *Disciplines to Deliver*	SCALE: HORZ.: N.T.S. VERT.: DATUM: HORZ.: VERT.:
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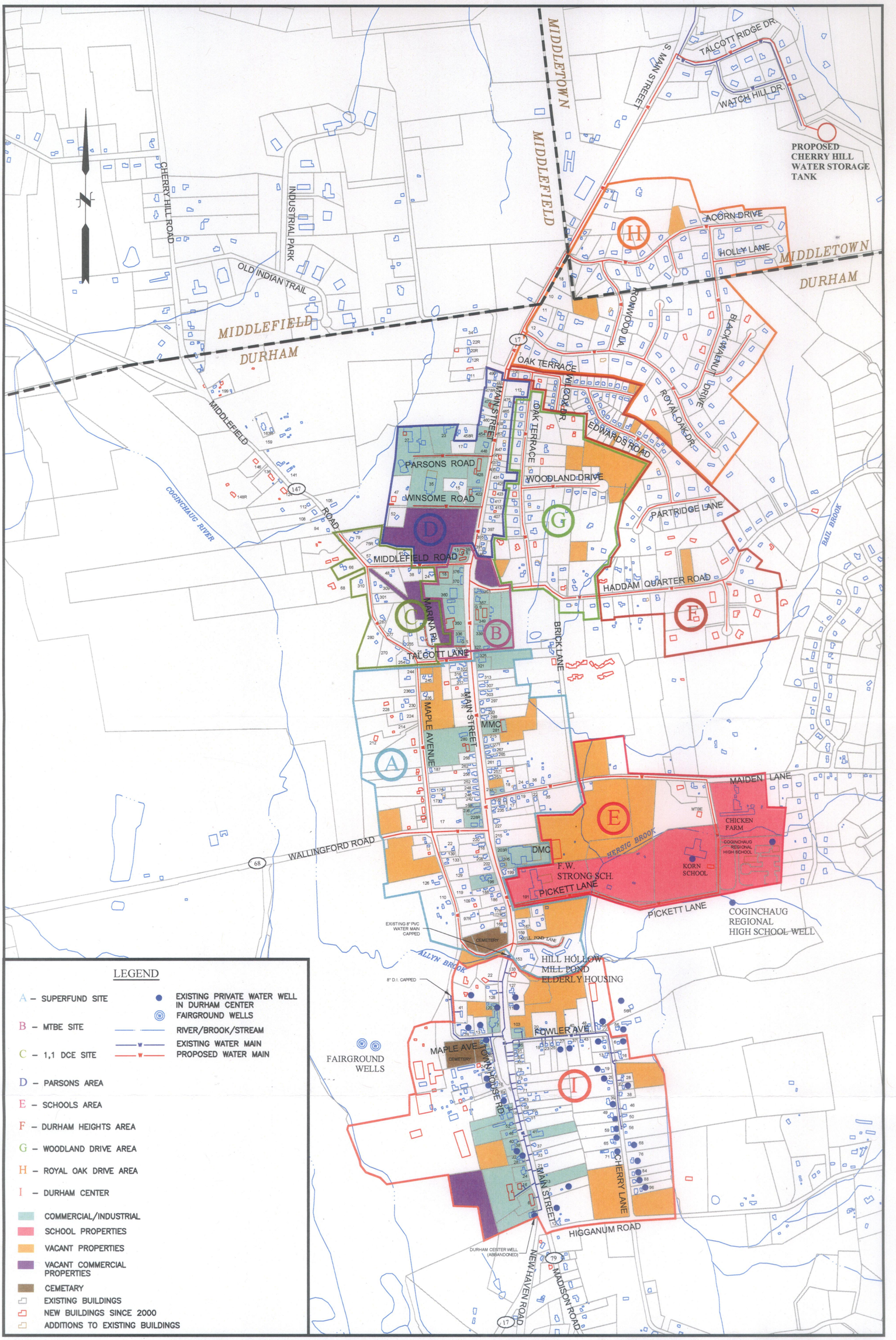

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STUDY AREAS
WATER SYSTEM EXTENSION FEASIBILITY STUDY
DURHAM CONNECTICUT

PROJ. No.: 98823.B20
DATE: AUGUST 2010
FIG.1-5

File Path: J:\DWG\P\98988231B20\Plan\98823B2NWTR001.dwg, Layout: FIG 1-5-11X17 Tue, Dec 14, 2010 - 4:59 PM User: jchrung
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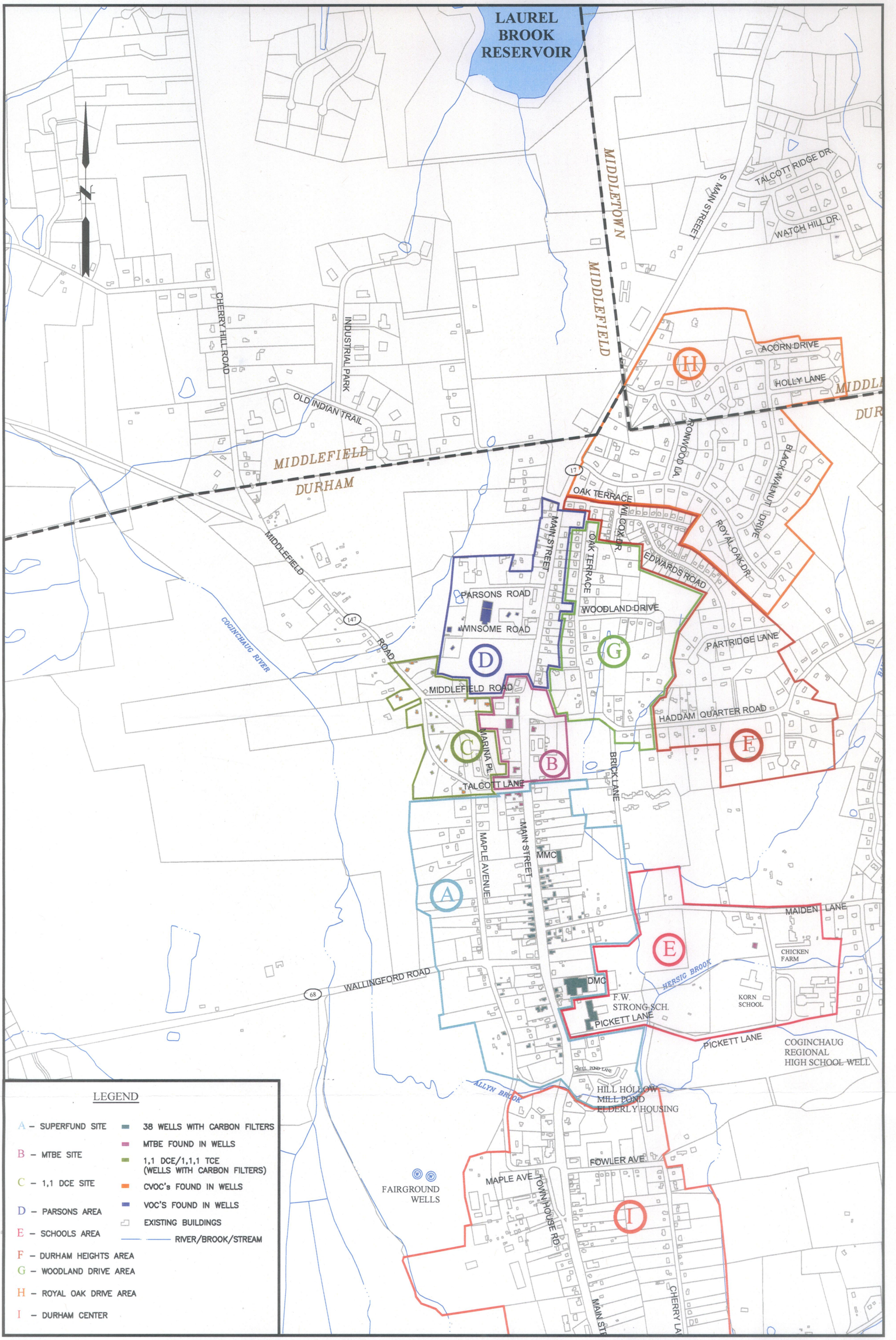

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PROPERTIES WITH WELL CONTAMINATION
WATER SYSTEM EXTENSION
FEASIBILITY STUDY UPDATE
DURHAM CONNECTICUT

PROJ. No.: 98823.B20
DATE: AUGUST 2010

FIG.1-6

File Path: J:\DWG\P\98\98823\B20\Plan\98823B2NWTR001.dwg Layout: FIG.1-6-11x17 Tue, Dec 14, 2010 - 4:59 PM User: jcheung
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ROCKY HILL

BERLIN

PROPOSED BERLIN INTERCONNECTION

PROPOSED CROMWELL FIRE DISTRICT SHUNPIKE INTERCONNECTION

CROMWELL

MATTABASSET

PORTLAND

EXISTING CROMWELL FIRE DISTRICT MATTABASSET INTERCONNECTION

RIVER

JOHN S. ROTH WATER TREATMENT PLANT

RIVER ROAD WELL FIELD

MERIDEN

ROARING BROOK CANAL DRAINAGE BASIN

ADDER RESERVOIR

CHARLES B. BACON WATER TREATMENT PLANT

CONNECTICUT

EXISTING CVH INTERCONNECTION

ADDER RESERVOIR DRAINAGE BASIN

COGINCHAUG

MIDDLETOWN

MOUNT HIGBY RESERVOIR

EAST HAMPTON

MT HIGBY RESERVOIR DRAINAGE BASIN

LAUREL BROOK RESERVOIR

MIDDLEFIELD

LAUREL BROOK DRAINAGE BASIN

HADDAM

DURHAM

DRAWING REFERENCE

"2004 WATER SUPPLY PLAN UPDATE".
MIDDLETOWN, CONNECTICUT, MGI#16980.
DATED SEPTEMBER 7, 2004

No.	DATE	DESCRIPTION	BY
1.			

REVISIONS

PROJ. MANAGER:
CHIEF DESIGNER:
REVIEWED BY: DATE

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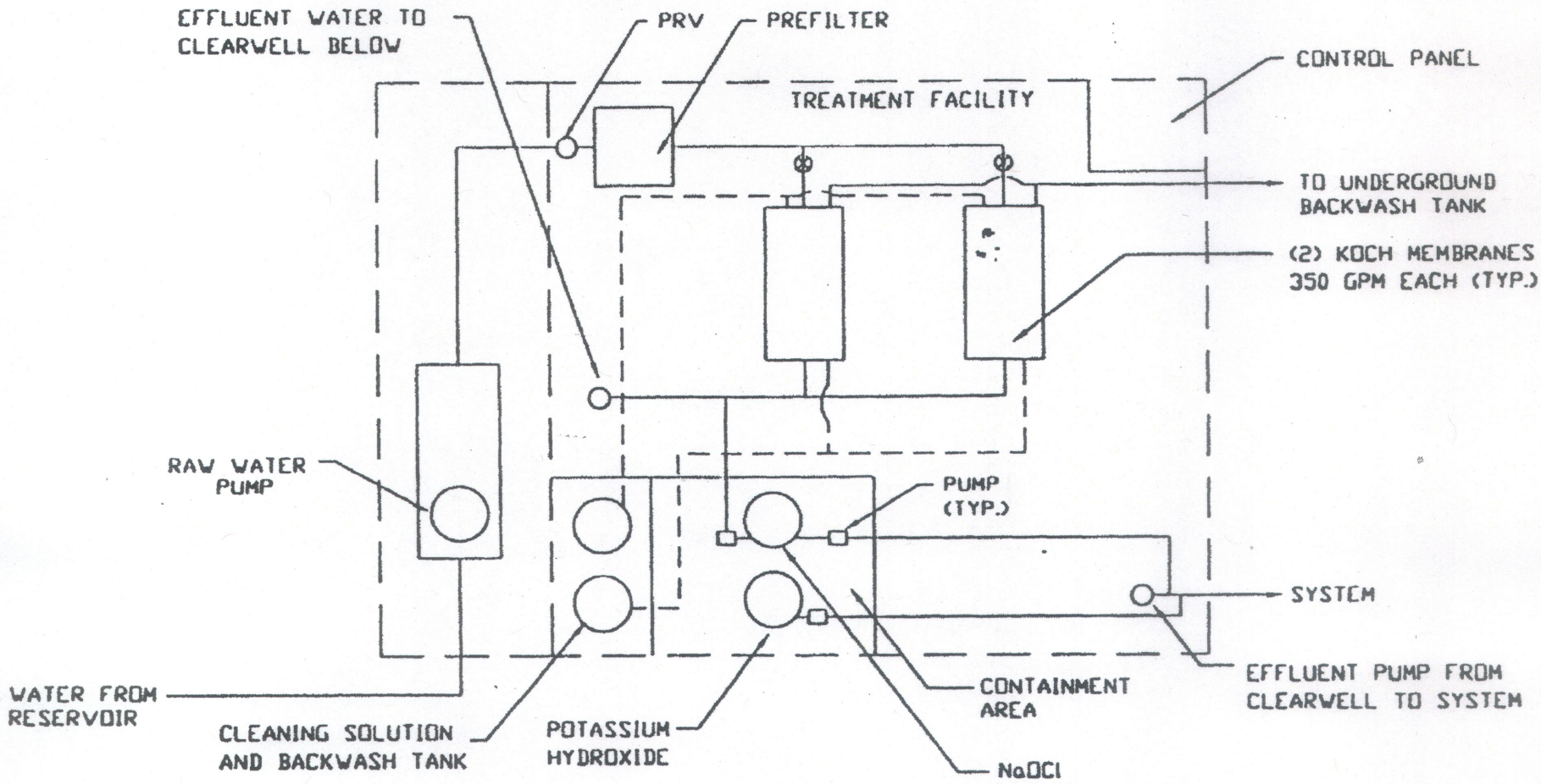
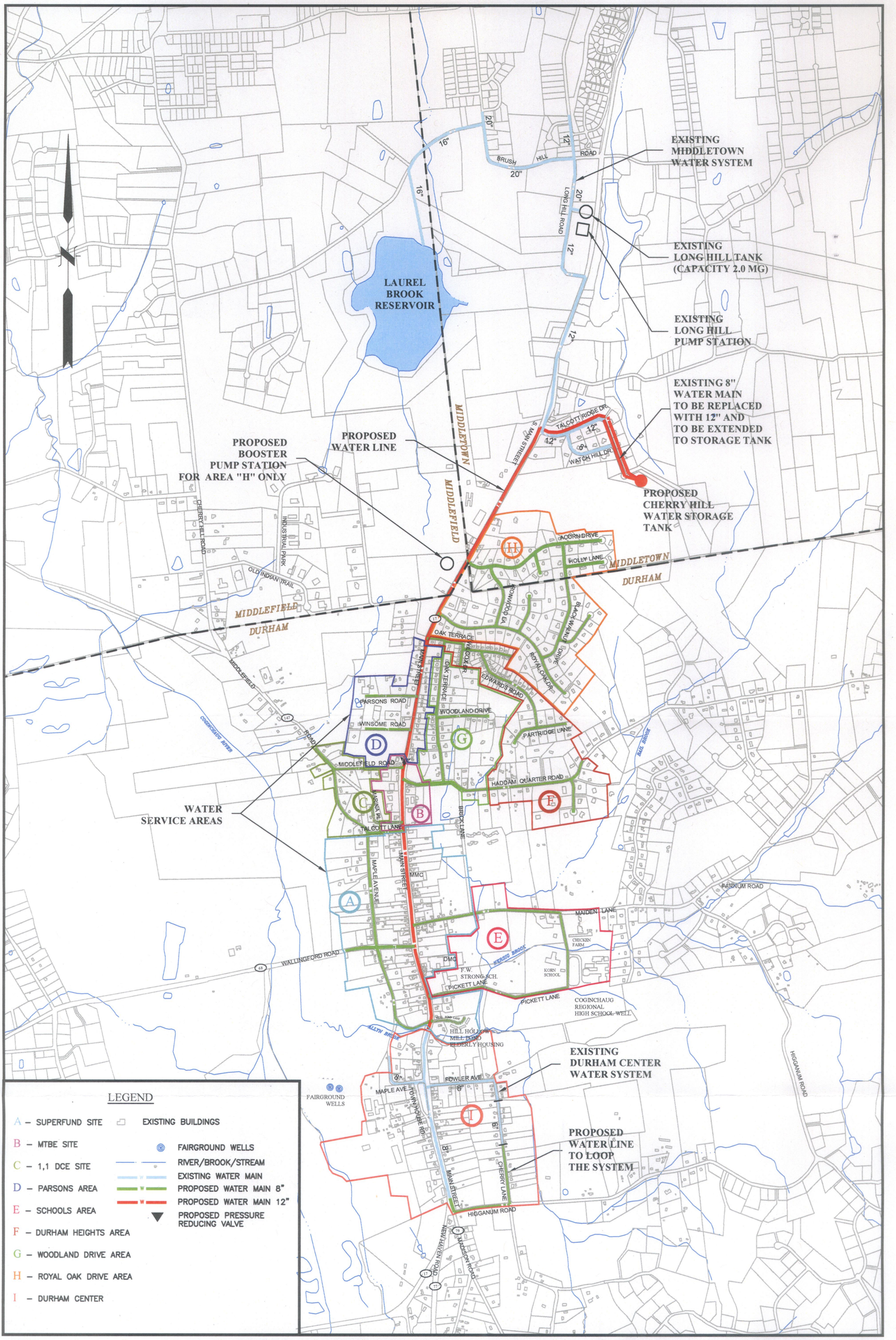
CITY OF MIDDLETOWN
EXISTING SOURCES OF SUPPLY
CITY OF MIDDLETOWN, CT
DURHAM CONNECTICUT

PROJ. No.: 1998823.B20
DATE: SEPTEMBER 2009

FIG.4-1



SCALE: HORZ.: N.T.S. VERT.: DATUM: HORZ.: VERT.:	WWW.FandO.COM FUSS & O'NEILL *Disciplines to Deliver* 146 HARTFORD RD MANCHESTER, CT 06040 860.646.2469	CITY OF MIDDLETOWN PROPOSED ULTRAFILTRATION FACILITY LAUREL BROOK RESERVOIR DURHAM CONNECTICUT	PROJ. No.: 1998823.B20 DATE: SEPTEMBER 2009 FIG.4-2



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STUDY AREAS
PIPE SIZING WITHOUT FIRE PROTECTION
DURHAM CONNECTICUT

PROJ. No.: 98823.B20
DATE: AUGUST 2010

FIG.5-1

File Path: J:\DWG\P\98\98823\B20\Plan\98823B2NWTR001.dwg, Layout: FIG.5-1-11X17 Tue, Dec 14, 2010 - 4:59 PM User: jcheung
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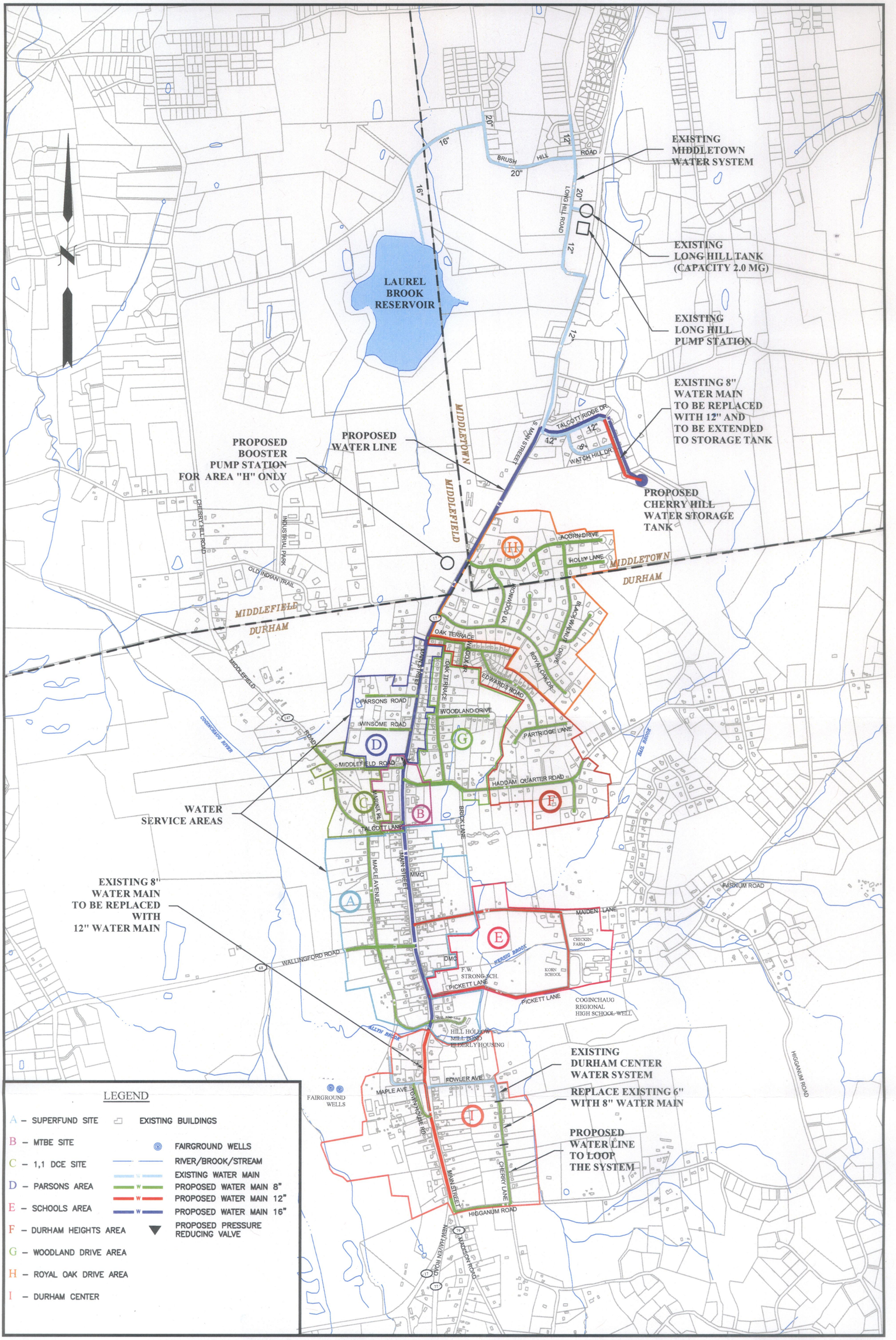

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STUDY AREAS

PIPE SIZING WITH FIRE PROTECTION

DURHAM CONNECTICUT

PROJ. No.: 98823.B20
DATE: AUGUST 2010

FIG.5-2

File Path: J:\DWG\P\98\98823\B20\Plan\98823B2NWTR001.dwg Layout: FIG.5-2-11X17 Tue, Dec 14, 2010 - 4:59 PM User: jcheung

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MS VIEW:
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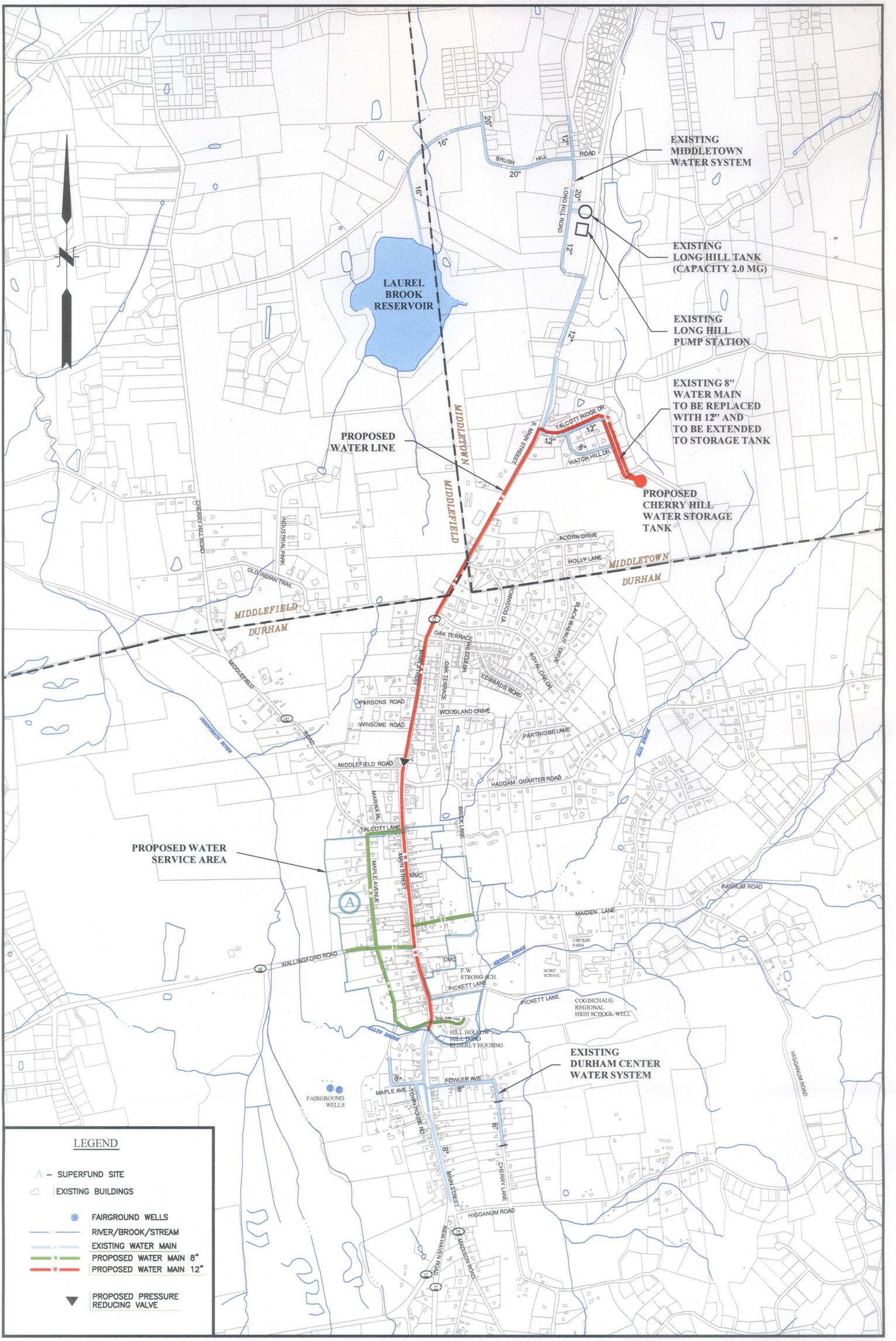
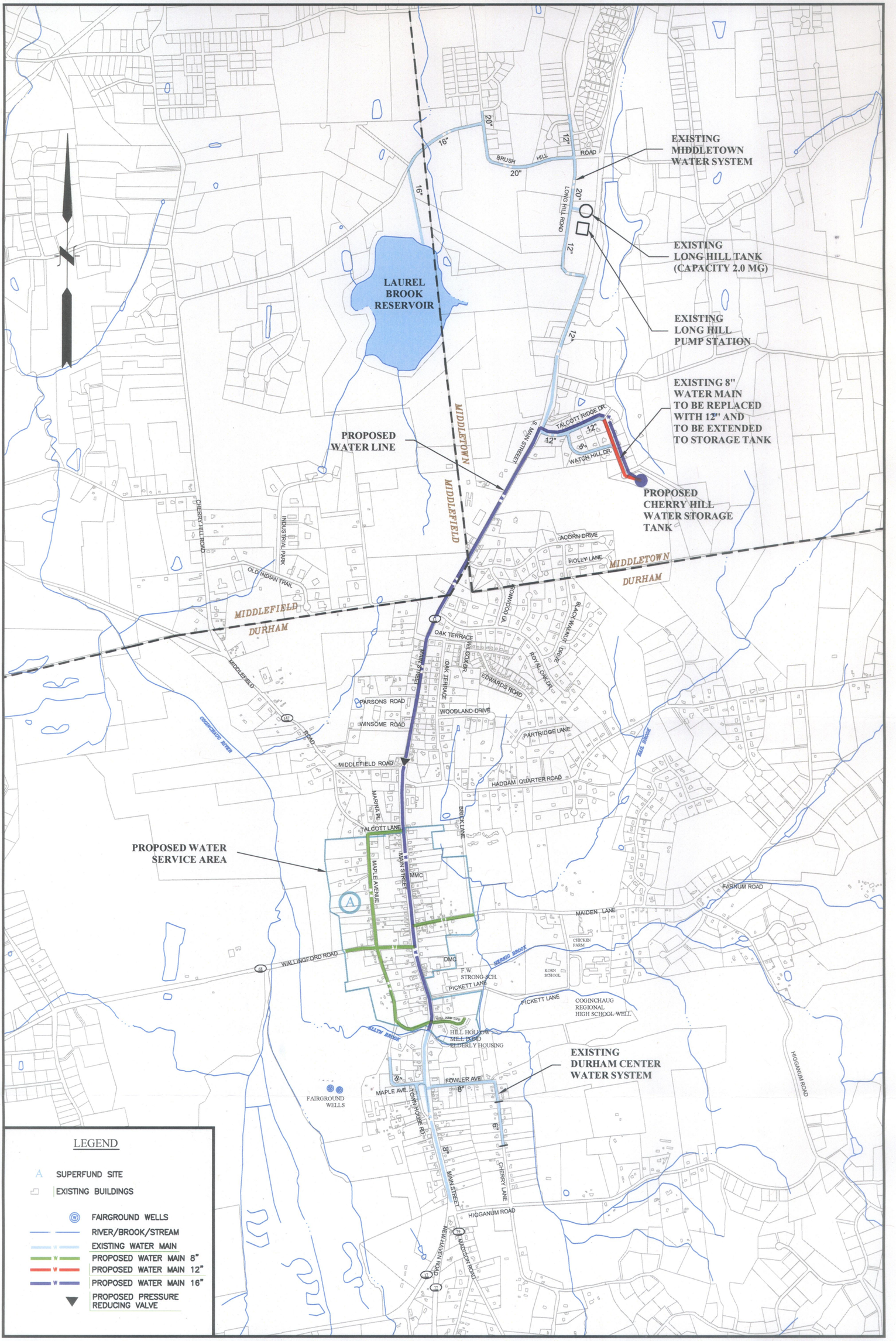


SCALE: HORZ.: 1" = 1500' VERT.: DATUM: HORZ.: VERT.:	WWW.FandO.COM FUSS & O'NEILL *Disciplines to Deliver* 146 HARTFORD RD MANCHESTER, CT 06040 860.646.2469	SUPERFUND SITE AREA "A" PIPE SIZING WITHOUT FIRE PROTECTION DURHAM CONNECTICUT	PROJ. No.: 98823.B20 DATE: DECEMBER 2012 FIG.7-1



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SUPERFUND SITE
AREA "A"
PIPE SIZING WITH FIRE PROTECTION

DURHAM CONNECTICUT

PROJ. No.: 98823.B20
DATE: DECEMBER 2012

FIG.7-2

File Path: J:\CW\GP\98\98823\B20\Plan\98823B2NWTR001.dwg, Layout: FIG.8-2-11X17 Mon, Dec 10, 2012 - 3:03 PM User: dbrkee

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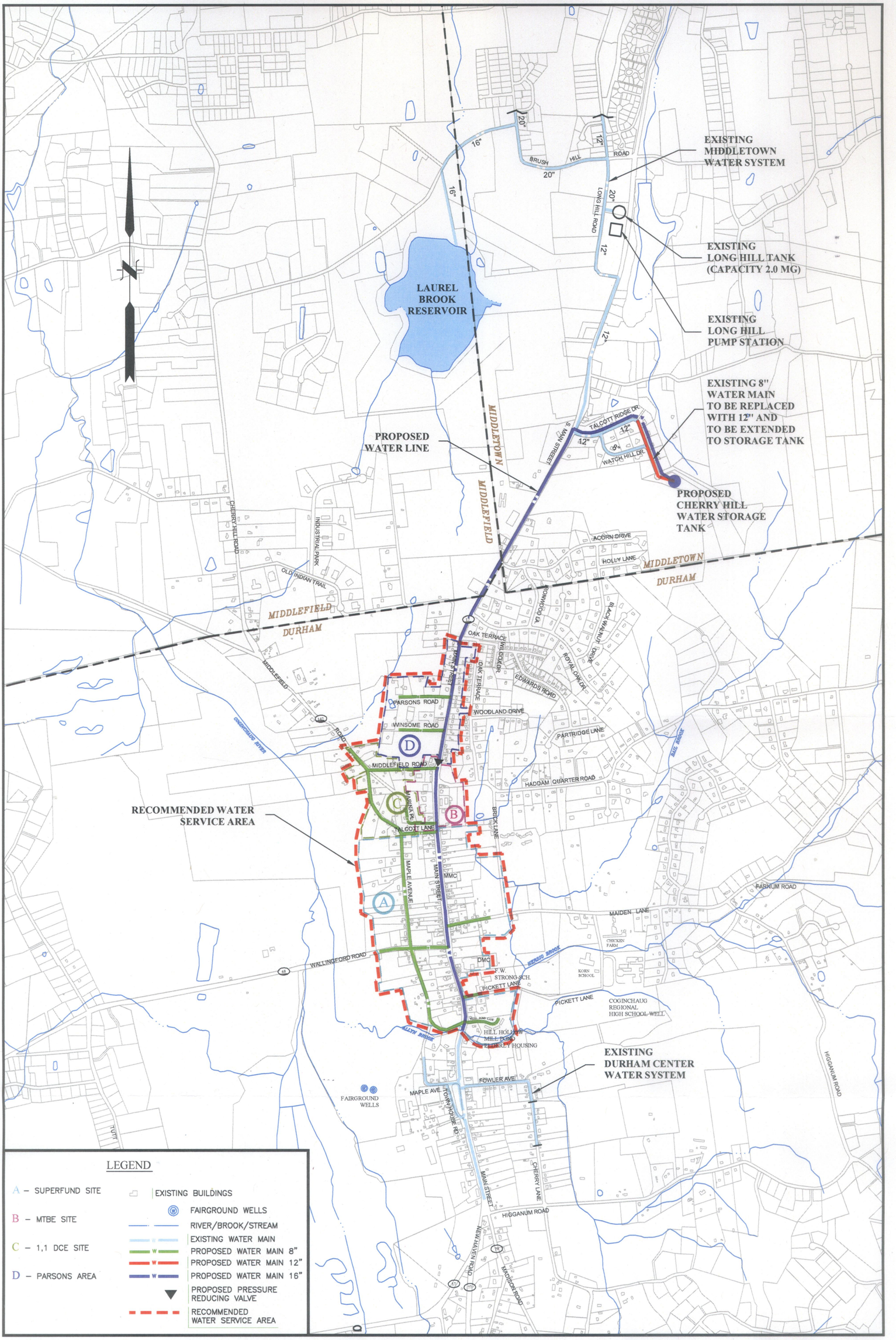

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RECOMMENDED SERVICE AREAS
CORE SERVICE AREA
PIPE SIZING WITH FIRE PROTECTION
DURHAM CONNECTICUT

PROJ. No.: 98823.B20
DATE: DECEMBER 2012

FIG.9-1

File Path: J:\DWG\P98\98823B20\Plan\98823B2NWTR002.dwg, Layout: FIG.10-1-11X17 Mon, Dec 10, 2012 - 3:06 PM User: dbrlee

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Tables

TABLES

TABLE 1-1
DURHAM WATER SYSTEM EXTENSION
AREA LOT DISTRIBUTION
February 16, 2009
Revised May 18, 2009
Revised August 9, 2010

AREA	DESCRIPTION	RESIDENTIAL		COMMERCIAL*	VACANT	OTHER	TOTAL LOTS
A	SUPERFUND	76	SINGLE FAMILY	11	7	2	109
		8	TWO FAMILY			CEMETARY	
		1	(2 structures) TWO FAMILY IN ONE LOT				
		0	THREE FAMILY				
		2	(2 structures) THREE FAMILY IN ONE LOT				
		1	MULTI-USE PRIMARILY RESIDENTIAL				
		1	ELDERLY HOUSING (24 units,one Bed each)				
Total		**89**					
B	MTBE	1	SINGLE FAMILY	13	1	0	15
		0	TWO FAMILY				
		0	THREE FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
		1					
C	1,1-DCE	21	SINGLE FAMILY		1	0	22
		0	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
		21					
D	PARSONS	24	SINGLE FAMILY	8	1	0	37
		1	(2 structures) SINGLE FAMILY IN ONE LOT				
		2	(2 structures) TWO FAMILY IN ONE LOT				
		1	MULTI-USE PRIMARILY RESIDENTIAL				
Total		**28**					
E	SCHOOL	4	SINGLE FAMILY	1	3	4	12
		0	TWO FAMILY			SCHOOL-GROUNDS	
		0	MULTI-USE PRIMARILY RESIDENTIAL				
		4					
F	DURHAM HEIGHTS	91	SINGLE FAMILY	0	3	0	95
		1	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
		92					
G	WOODLAND DRIVE	50	SINGLE FAMILY	0	5	0	55
		0	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
		50					
H	ROYAL OAK DRIVE	109	SINGLE FAMILY	0	3	0	112
		0	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
		109					
I	DURHAM CENTER	28	SINGLE FAMILY	16	0	0	47
	CONNECTED	1	TWO FAMILY				
		1	(2 structures) TWO FAMILY				
		1	DURHAM FAIRGROUND				
	NOT CONNECTED	26	SINGLE FAMILY	1	6	1	36
		1	TWO FAMILY			CEMETARY	
		1	DURHAM FAIRGROUND				
Total		**59**		17			83
TOTAL		**453**		**33**	**30**	**7**	**540**

* There is a 4-Bedroom unit on second floor of the #243 Main Street (Dentist Office)

* There is a 2-Bedroom unit on the second floor of the # 238 Main Street (Durham Market)

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TABLE 3-1
DURHAM WATER SYSTEM EXTENSION
BUILDING DISTRIBUTION
February 16, 2009
Revised May 18, 2009

AREA	DESCRIPTION	RESIDENTIAL		COMMERCIAL	VACANT	OTHER	TOTAL
A	SUPERFUND	76	SINGLE FAMILY	16	7	2	117
		10	TWO FAMILY				
		4	THREE FAMILY				
		1	MULTI-USE PRIMARILY RESIDENTIAL				
		1	ELDERLY HOUSING				
B	MTBE	1	SINGLE FAMILY	15	1	0	17
		0	TWO FAMILY				
		0	THREE FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
C	1,1-DCE	21	SINGLE FAMILY	0	1	0	22
		0	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
D	PARSONS	26	SINGLE FAMILY	8	1	0	40
		4	TWO FAMILY				
		1	MULTI-USE PRIMARILY RESIDENTIAL				
E	SCHOOL	4	SINGLE FAMILY	1	3	4	12
		0	TWO FAMILY			SCHOOL-	
		0	MULTI-USE PRIMARILY RESIDENTIAL			GROUNDS	
F	DURHAM HEIGHTS	91	SINGLE FAMILY	0	3	0	95
		1	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
G	WOODLAND DRIVE	50	SINGLE FAMILY	0	5	0	55
		0	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
H	ROYAL OAK DRIVE	109	SINGLE FAMILY	0	3	0	112
		0	TWO FAMILY				
		0	MULTI-USE PRIMARILY RESIDENTIAL				
I	DURHAM CENTER	28	SINGLE FAMILY	16	0	0	48
	CONNECTED	3	TWO FAMILY				
		1	DURHAM FAIRGROUND				
		26	SINGLE FAMILY	1	8	1	38
	NOT CONNECTED	1	TWO FAMILY		1- Parking	CEMETARY	
		1	DURHAM FAIRGROUND		No Flow		
TOTAL		**460**		**57**	**32**	**7**	**556**

TABLE 3-2
DURHAM WATER SYSTEM EXTENSION
AREAS OF CONCERN
WATER DEMAND CALCULATIONS
March 4, 2009
Revised on June 2, 2009
Revised on August 5, 2010

A	SUPERFUND SITE		QUANTITY	PEOPLE	Water Demand GPD/Person	AVG. DAILY FLOW (gpd)	(7) MAX Day FLOW (ADD X 1.5) (gpd)	PEAK HOUR FLOW (ADD/3) (gpm)
RESIDENTIAL		SINGLE FAMILY	76	4	75	22,800	34,200	127
(1)		TWO FAMILY	10	6	75	4,500	6,750	25
		THREE FAMILY	4	9	75	2,700	4,050	15
	Mill Rd. Lane	ELDERLY HOUSING (24 Units, assumed one bedroom/unit))	24	2	75	3600	5,400	20
		VACANT LOTS	9	4	75	2700	4050	15
COMMERCIAL			SQ. FT.	PEOPLE	GPD		ADD x 1.5	
	236 MAIN ST	UNITED CHURCHES OF DURHAM						
		Church Bldg. -Worship Service (Sundays for 1.5 hours)		150	2	300	450	2
	228R	Fellowship Hall -Sunday School/Event (1/week)		75	2	150	225	1
		- Social Events (100 people, 6 to 8 times per year)		100	5	500	750	3
		- Boy Scots on Tues. & Thurs. (assumed 15 kids)		15	2	30	45	0.2
(2)	228	Office Building (Fairchild House)		2	20	40	60	0.2
(3)	**203R MAIN ST**	DURHAM MANUFACTURING CO.(DMC), FACTORY	66,997		0.1	6,700	10050	37
(2)	203R MAIN ST	DURHAM MANUFACTURING CO. (Office & Factory Office)		28	20	560	840	3
(9)	203R MAIN ST	DMC WAREHOUSE, (Total of 75 employee for 4-day, 10 hour shift.)		75	25	1875	2813	10
Note: Water Demand for the DMC is the sum of the above values developed. Flows for factory are for manufacturing operation and are calculated based on CTDPH commerical flow estimate guidelines based on sqare footage. Flows for other buildings are based on number of employees provide by the DMC.								
(4)	**238 MAIN ST**	DURHAM MARKET (two bedroom on 2nd floor)			325	325	488	2
	205 MAIN ST	FIRE STATION (# persons, shower?)	1,600			550	825	3
	280 MAIN ST	NOTRE DAME CHURCH						
		Worship Service (parisoners/day, Saturdays & sundays)		125	2	250	375	1
		Sunday School (Sunday & Thursday, 50/day))		50	2	100	150	1
(2)		Office		2	20	40	60	0.2
		Live-in Priest		1	150	150	225	1
	196 MAIN ST	CHURCH OF THE EPIPHANY (No Information. Assumed the same as Norte Dam Church)						
		Church Bldg. -Worship Service (Assumed, Sundays for for 1.5 hours)		150	2	300	450	2
		- Social Events (100 people, 12 times per year)		100	5	500	750	3
(3a)	**243 MAIN ST**	FAIRGROUND MORTGAGE (Now is Dental Office & 4 Bedroom on 2r	2,789			1008	1512	6
(10)	**281 MAIN ST**	FORMER LOCATION OF MERRIAM MANUFACTURING CO.	12	2	75	1,800	2700	10
(4)	**321 MAIN ST**	DURHAM PHARMACY		11	20	220	330	1
(4)	**325 MAIN ST**	TLC EATERY (33 seats, 20 gpd/seat))			20	660	990	4
	SUB-TOTAL					52,358	78,536	291
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				**57,593**	**86,390**	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day (mostly commercial buildings)				**60**	**90**	**320**
						Fire Flow (gpm)	MDD	Flow Required
(8)	**TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 3,500 gpm for Commercial Area**					**3,500**	**90**	3590

TABLE 3-2
DURHAM WATER SYSTEM EXTENSION
AREAS OF CONCERN
WATER DEMAND CALCULATIONS
March 4, 2009
Revised on June 2, 2009
Revised on August 5, 2010

B	MTBE SITE		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD X 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	1	4	75	300	450	2
(1)		TWO FAMILY	0	6	75	0	0	0
		THREE FAMILY	0	9	75	0	0	0
COMMERCIAL			SQ. FT.	PEOPLE	GPD		ADD x 1.5	
(4)	357 MAIN ST	LIBERTY BANK	2143	11	20	214	321	1
(4)	376 MAIN ST	CITIZEN'S BANK	2310	12	20	231	347	1
	360 MAIN ST	DURHAM DENTAL (assumed 500 gpd instead of cal. 325 gpm)	1760		0.2	500	750	3
(4)	360 MAIN ST	FERGUSON & MCGUIRE INSURANCE		5	20	100	150	1
(4)	360 MAIN ST	BASCOM & BENJAMIN LLC		9	20	180	270	1
(4)	360 MAIN ST	DELIA REALTORS LLC		1	20	20	30	0
(4)	360 MAIN ST	DURHAM CHIROPRACTIC (assumed 200 gpd)		2	20	200	300	1
(5)	360 MAIN ST	DICKSON DON (Closed ?)				1,500	2,250	8
(4)	336 MAIN ST	B&G POWER EQUIPMENT		1	20	20	30	0
(5)	339 MAIN ST	GOSSIP RESTAURANT	3012			1,500	2,250	8
(4)	331 MAIN ST	TD BANKNORTH	2045		20	205	307	1
(3)	349 MAIN ST	GRIPPO'S MOBIL SERVICE CENTER	4,184		0.1	418	628	2
(5)	349 MAIN ST	DUNKIN DONUTS				1,500	2,250	8
(5)	349 MAIN ST	SUBWAY				1,500	2,250	8
(4)	327 MAIN ST	VALENTINA'S HOME DESIGN		1	20	20	30	0
(3)	350 MAIN ST	WAREHOUSE	2,412		0.1	241	362	1
(3)	350 MAIN ST	EDWARD ZAVASKI AGENCY	5,004		0.1	500	751	3
(3)	350 MAIN ST	ALANA ADAMS WINDOW TREATMENTS	10,340		0.1	1034	1,551	6
(4)	363 MAIN ST	LITTLE ROOSTER LIQUORS		3	20	60	90	0
(4)	370 MAIN ST	VITAL INDULGENCE		1	20	20	30	0
(5)	370 MAIN ST	WHOLE ENCHILADA (RESTAURANT)	1,095			1,500	2,250	8
(3)	370 MAIN ST	VACANT RETAIL UNIT	1,095		0.1	109	164	1
(3)	384 MAIN ST	FAS MART GASOLINE STATION	2,880		0.1	500	750	3
(4)	18 MIDDLEFIELD RD	DEAN AUTOWORKS		8	20	160	240	1
(3)	15R HADDAM QUARTER RD	KENNETH R JAY LANDSCAPE MAINTENANCE	4,536		0.1	454	680	3
	13 MIDDLEFIELD RD	DURHAM AUTO CENTER	4,440			1,500	2,250	8
(5)		VACANT			1500	1,500	2,250	8
TOTAL						15,987	23,980	89
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				17,586	26,378	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divided by 16 hours per day (mostly commercial buildings)				18	27	98
						Fire Flow (gpm)	MDD	Flow Required
(8)	TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 3,500 gpm for Commercial Area					3,500	27	3527

C	1,1-DCE SITE		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD x 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	21	4	75	6,300	9,450	35
(1)		TWO FAMILY	0	6	75	0	0	0
COMMERCIAL		VACANT	1			1,500	2,250	8
(5)								
TOTAL						7,800	11,700	43
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				8,580	12,870	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day				9	13	48
						Fire Flow (gpm)	MDD	Flow Required
(8)	TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 1,000 gpm for Residential Area					1,000	13	1013

TABLE 3-2
DURHAM WATER SYSTEM EXTENSION
AREAS OF CONCERN
WATER DEMAND CALCULATIONS
March 4, 2009
Revised on June 2, 2009
Revised on August 5, 2010

D	PARSONS SITE		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD x 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	26	4	75	7,800	11,700	43
(1)		TWO FAMILY	4	6	75	1800	2700	10
		MULTI-USE PRIMARILY RESIDENTIAL	1	9	75	675	1013	4
COMMERCIAL			SQ. FT.	PEOPLE	GPD		ADD x 1.5	
(4)	422 MAIN ST	KEN MARINO SALES & SERVICE		3	20	60	90.0	0
(4)	428 MAIN ST	DURHAM AUTO CENTER		6	20	120	180.0	1
	472 MAIN ST	LINO'S MARKET (metered for market + 2 units)			250	250	375.0	1
(4)	454 MAIN ST	SKINCARE STUDIO		1	20	20	30.0	0
	448 MAIN ST	TELEPHONE EXCHANGE (No information Available, assumed 120gpd)				120		1
(3)	27 PARSONS LANE	LIGHT MANUFACTURING	38,784		0.1	3,878	5,817.6	22
(3)	23 PARSONS LANE	WAREHOUSE (Any water usage???)	3,576		0.1	358	536.4	2
(3)	35 WINSOME RD	CLAREMONT CORPORATION/KENNETH INDUSTRIAL PRODUC	29,220		0.1	2,922	4,383.0	16
(5)		**VACANT**			1500	**1,500**	2,250	8
TOTAL						**19,503**	**29,075**	**108**
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				**21,453**	**32,180**	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day				**22**	**34**	**119**
						Fire Flow (gpm)	**MDD**	**Flow Required**
(8)	**TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 3,500 gpm for Commercial Area**					**3,500**	**34**	**3534**

E	SCHOOLS AREA		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD x 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	4	4	75	1,200	1,800	7
(1)		TWO FAMILY	0	6	75	0	0	0
		Single Family with Chicken Farm ?				1500		
COMMERCIAL		Water Meter Data of 9/22/08 to 12/22/08 (assumed week days only 65 days)	**Total**		**# of Days**	**GPD**	**ADD x 1.5**	
		F.W. STRONG SCHOOL	77,290		65	1,189	1,784	7
		KORN SCHOOL	42,856		65	659	989	4
		COGINCHAUG REGIONAL HIGH SCHOOL	185,170		65	2,849	4,273	16
		RECREATION FIELD	5116		65	79	118	0
		3 VACANT LOTS (one lot is DMC lot, wetland Area - Undevelope)				3,000	4,500	17
TOTAL			310,432			**10,476**	**13,464**	**50**
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				**11,523**	**17,285**	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day				12	18	64
						Fire Flow (gpm)	**MDD**	**Flow Required**
(8)	**TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 3,000 gpm for Schools**					**3,000**	18	3018

TABLE 3-2
DURHAM WATER SYSTEM EXTENSION
AREAS OF CONCERN
WATER DEMAND CALCULATIONS
March 4, 2009
Revised on June 2, 2009
Revised on August 5, 2010

F	DURHAM HEIGHTS AREA		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD x 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	91	4	75	27,300	40,950	152
(1)		TWO FAMILY	1	6	75	450	675	3
		VACANT	3	4	75	900	1,350	5
COMMERCIAL		NONE						
TOTAL						28,650	42,975	159
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				31,515	47,273	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day				33	49	175
						Fire Flow (gpm)	MDD	Flow Required
(8)	TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 1,000 gpm for Residential Area					1,000	49	1049

G	WOODLAND DRIVE AREA		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD x 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	50	4	75	15,000	22,500	83
(1)		TWO FAMILY	0	6	75	0	0	0
		VACANT	5	4	75	1500	2,250	8
COMMERCIAL								
TOTAL						16,500	24,750	92
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				18,150	27,225	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day				19	28	101
						Fire Flow (gpm)	MDD	Flow Required
(8)	TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 1,000 gpm for Residential Area					1,000	28	1028

H	ROYAL OAK DRIVE AREA		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD x 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	109	4	75	32,700	49,050	182
(1)		TWO FAMILY	0	6	75	0	0	0
		VACANT	3	4	75	900	1,350	5
COMMERCIAL								
TOTAL						33,600	50,400	187
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				36,960	55,440	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day				39	58	205
						Fire Flow (gpm)	MDD	Flow Required
(8)	TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 1,000 gpm for Residential Area					1,000	58	1058

TABLE 3-2
DURHAM WATER SYSTEM EXTENSION
AREAS OF CONCERN
WATER DEMAND CALCULATIONS
March 4, 2009
Revised on June 2, 2009
Revised on August 5, 2010

I	DURHAM CENTER		QUANTITY	People	Water Demand GPD/Person	AVG. FLOW	MAX FLOW ADD x 1.5	PEAK FLOW
RESIDENTIAL		SINGLE FAMILY	26	4	75	7,800	11,700	43
(1)		TWO FAMILY	1	6	75	450	675	3
		8 VACANT (One is Church Parking Lot, and one is cemetery))	6	4	75	1800	2,700	10
(6)	Actual Water Meter reading	Existing Demands for Durham Center System				6,000	9000	33
COMMERCIAL		Vacant (Assumed 1,500 gpd)	1			1,500	2,250	8
(5)						0	0	0
TOTAL						**17,550**	**35,100**	**98**
	TOTAL WITHOUT FIRE FLOW (GPD)	Assumed additional 10% for unacounted water				**19,305**	**28,958**	
	TOTAL WITHOUT FIRE FLOW (gpm)	Assumed flow divived by 16 hourd per day				**20**	**30**	**107**
						Fire Flow (gpm)	**MDD**	**Flow Required**
(8)	**TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 2,000 gpm for Commercial Area**					**2,000**	**30**	**2030**

TOTAL ALL THE AREAS (GPD)	**222,666**	**333,998**	
TOTAL ALL THE AREAS (GPM)	**232**	**348**	**1237**
	Fire Flow (gpm)	**MDD**	**Flow Required**
TOTAL WITH FIRE FLOW (MDD + F.F.) = Assumed 3,500 gpm for Commercial Area	**3,500**	**348**	**3848**

Notes:

	Single Family	Two Family	Multi Family
(1) - Residential Buildings: Assumed 75 gpd / person, (4 person/single family, 3 person / two-Bedroom)	300	450	675 gpd
(2) - Office (avg. 200 sq. ft./person-Gross Area)	20 gpdpc		
(3) - Large Retail/Commercial bldg. per sq. ft of -Gross Area	0.1 gpd/sq. ft.		
(3a) Fairground Mortgage is now a dental Office, assumed 0.2 per sq. ft. of gross area. There is a 4 bedroom apartment on the second floor	1008		
(4) - Small Retail bldg.- Less than 2,000 sq. ft of -Gross Area per Employee	20 gpd		
(4a) - No. 238 Main St. - Assumed 100 gpd for the market and two bedroom on the second floor	325 gpd		
(5) - 1,500 gpd assumed for the commercial buildings with no information available.	1,500 gpd		
(6) - Durham Center Average Daily water usage is 6,000 gpd and peak usage during the Agricultural Fair is 90,000 gpd			
(7) - Maximum Day Demand = ADD X 1.5	1.5		
(8) - Fire flow for residential assumed 1,000 gpm, for commercial assumed to be 3,500 gpm, Schools 3,000 gpm and Durham Center 2,000 gpm			
(9) - Warehouse (no showers), Gallons per day per employee	25 gpd		
(10) - Merriam Manufacturing Co.Property. Assumed largest flow for the potential property usage; Elderly Housing with 12 bedrooms. (150 gpd/bedrc	1,800 gpd		

Design Flow values from CT-Department of Public Health Regulations & guidance on subsurface Disposal system. (Dsection IV Design Flow, Dated 1/1/04)

TABLE 3 - 3

DURHAM WATER SYSTEM EXTENSION
WATER DEMAND & PIPE SIZE
SERVICE AREAS
March 11, 2009
Revised August 5, 2010

	STUDY AREAS	Avg. Day Demand (ADD) (gpd)	ADD + (10% Unacounted) (gpd)	Avg. Day Demand (gpm) Assumed 16 hrs/day	Max. Day Demand (gpd) ADD x 1.5	Max. Day Demand (gpm) Assumed 16 hrs/day	Peak Hour (gpm)* ADD x 1/3	Total Flow without Fire Protection (gpd)**	Total Flow with Fire Protection (gpd)***	Pipe Size Without Fire Flow (inch)	Pipe Size With Fire Flow (inch)
A	Superfund Site	52,358	57,593	60	86,390	90	320	172,780	716,390	8"	12", 8"
B	MTBE Site	15,987	17,586	18	26,378	27	98	52,757	656,378	8"	8"
C	1,1 DCE Site	7,800	8,580	9	12,870	13	48	25,740	642,870	8"	8"
D	Parsons Area	19,503	21,453	22	32,180	34	119	64,360	662,180	8"	8"
E	School Area+ Private Properties	10,476	11,523	12	17,285	18	64	34,570	557,285	8"	12"
F	Durham Heights Area	28,650	31,515	33	47,273	49	175	94,545	167,273	8"	8"
G	Woodland Drive Area	16,500	18,150	19	27,225	28	101	54,450	147,225	8"	8"
H	Royal Oak Drive Area	33,600	36,960	39	55,440	58	205	110,880	175,440	8"	8"
I	Durham Center	17,550	19,305	20	28,958	30	107	57,915	268,958	8"	12" & 8"
	All Areas	202,423	222,666	232	333,998	348	1,237	667,997	963,998		
	SCENARIO										
1	A (Superfund Site)	52,358	57,593	60	86,390	90	320	172,780	716,390	12" & 8"	16", 12", 8"
2	A+B+C+D (Core Service Area)	95,647	105,212	110	157,818	164	585	315,636	787,818	12" & 8"	16", 12", 8"
3	(Core Service Area)+E	106,123	116,736	122	175,103	182	649	350,207	805,103	12" & 8"	16", 12", 8"
4	(Core Service Area)+I	113,197	124,517	130	186,776	195	692	373,551	816,776	12" & 8"	16", 12", 8"
5	(Core Service Area)+F	124,297	136,727	142	205,091	214	760	410,181	835,091	12" & 8"	16", 12", 8"
6	(Core Service Area)+F+G+H	174,397	191,837	200	287,756	300	1,066	575,511	917,756	12" & 8"	16", 12", 8"
7	All Areas	202,423	222,666	232	333,998	348	1,237	667,997	963,998		

Note:

* Peak Hour Demand is = (ADD + 10% Unaccounted) X 1/3 = gph /60 = gpm. (Based on DPH/DPUC Formula)

** Total without FF is (ADD + 10% Unaccounted) X 3 for use in Storage Tank Sizing and to account for potential Middletown Developments/connections.

*** Total flow with fire protection is MDD= (ADD +10% Unaccounted) X 1.5 plus 2-3 hours water needed during the fire.

**** The size of water main from proposed Cherry Hill storage tank all the way in Route 17 to north of Allyn Brook would be 16" for Fire Flow option and 12" for No. Fitre Flow option.

Study Areas		Needed Fire Flow	Duration (hrs)	Total Flow Needed During the Fire
A	Superfund Site	3,500 gpm	3	630,000 gpd
B	MTBE Site	3,500 gpm	3	630,000 gpd
C	1,1 DCE Site	3,500 gpm	3	630,000 gpd
D	Parsons Area	3,500 gpm	3	630,000 gpd
E	School Area+ Private Properties	3,000 gpm	3	540,000 gpd
F	Durham Heights Area	1,000 gpm	2	120,000 gpd
G	Woodland Drive Area	1,000 gpm	2	120,000 gpd
H	Royal Oak Drive Area	1,000 gpm	2	120,000 gpd
I	Durham Center	2,000 gpm	2	240,000 gpd

Table 4-1
Middletown's Existing and Projected Water Demands
Revised November 2012

Based on Table 8-2a and Table 8-2b - 2011 Water Supply Plan with Revisions to Show Available Supply accepted by CTDPH

	Water Usage 2004 to 2011, MGD	Water Usage 2010, MGD (1)	Projected Water Demand (MGD)			
			2016	2030	2060	
Average Daily Demand (ADD)	4.33	4.14	4.42	4.77	4.99	
Maximum Month Average Day Demand (MMADD)	**4.83**	**4.79**	**5.13**	**5.53**	**5.79**	
Peak Day Demand	5.98	5.89	6.45	6.97	7.29	
Groundwater Sources of Supply			**2016**	**2030**	**2060**	
Current Available Supply (MGD) for Wells 2,4,5,6,7,8,9 and 10 **(2)**	5.02	5.02	5.02	5.02	5.02	
Potential Future Supply with Replacement Well No. 1A and Well No. 3A	0.00	0.00	1.01	1.01	1.01	
Subtract Backwash from Treatment Facility	-0.30	-0.30	-0.30	-0.30	-0.30	
Surface Water Source of Supply						
Currently Available Water from Higby Reservoirs and Adder Reservoir	1.22	1.22	1.22	1.22	1.22	
Potential Future Supply from Laurel Brook Reservoir **(3)**	0.00	0.00	0.00	0.73	0.73	
Total Available Water (ADD)	**5.94**	**5.94**	**6.95**	**6.95**	**6.95**	*
Total Available Water (MMADD) (4)	**6.88**	**6.88**	**7.89**	**7.89**	**7.89**	*
Total Available Water (PDD) (5)	**9.47**	**9.47**	**10.71**	**10.71**	**10.71**	*
Total Surplus Water	**2004-2011, MGD**	**2010**	**2016**	**2030**	**2060**	
Average Daily Supply	1.61	1.80	2.53	2.18	1.96	
Maximum Month Average Day Supply	2.05	2.09	2.76	2.36	2.10	
Peak Day Supply	3.49	3.58	4.26	3.74	3.42	
Durham Demands						
Excess Water Available for Durham (Maximum Monthly Average Day Demand)	--	--	1.99	1.53	1.23	
Town of Durham Projected Demands for Recommended Core Service Area (with fire protection) (6)	--	--	0.80	0.80	0.80	
Margin of Safety	**2004-2011, MGD**	**2010**	**2016**	**2030**	**2060**	
Average Day	1.37	1.43	1.57	1.46	1.39	
Maximum Month Average Day	**1.42**	**1.44**	**1.54**	**1.43**	**1.36**	
Peak Day	1.58	1.61	1.66	1.54	1.47	

Definitions:

Average Daily Demand is the normal expected water usage by the existing customers

Maximum Month Average Daily Demand is the value used to determine the adequacy of the system's supply

Total Available Water (ADD) is the addition of the groundwater available supplies and the surface water available supplies

Total Available Water (MMADD) is taken from Middletown's latest approved Water Supply Plan

Total Available Water (PDD) is taken from Middletown's latest approved Water Supply Plan

Average Daily Supply is the difference between Total Available Water and Average Daily Demands

Maximum Month Average Daily Supply is the difference between Total Available Water and Maximum Month Average Daily Demands

Peak Day Supply is the difference between Total Available Water and Peak Day Demands

Maximum Month Average Daily Supply is the difference between Total Available Water and Maximum Month Average Daily Demands

Peak Day Supply is the difference between the Total Available Water and the Peak Day Demands.

Margin of Safety is the ratio of Total Available Water for Average, Maximum Month, and Peak Day and the Average, Maximum Month, and Peak Daily Demands.

Notes:

(1) Data on Water Usage from 2004 through 2011 has been included in column 1 for comparison with 2010 data used in Water Supply Plan.

(2) Current Available Supply for Wellfield without Well no. 1 and Well No. 3 included. Taken from Table 8-2a.

(3) Proposed future source for Laurel Brook Reservoir (0.73 mgd) - Not included in projected Water Supplies available or margin of safety calculations.

(4) Total Available Water (MMADD) assumes increased supply from both the Surface Water supplies and the Groundwater supplies. It also assumes Well 1 and 3 are available in future projections.

(5) Total Available Water (PDD) assumes increased supply from both the Surface Water supplies and the Groundwater supplies. It also assumes Well 1 and 3 are available in future projections.

(6) Durhams' projected demands with fire protection are taken from Table 3-3 in Feasibility Study Report.

*** Total Available Water Values do not include Projected supplies for the Laurel Brook Reservoir**

Table 4-2
Cromwell Fire District's Existing and Projected Water Demands
May 2009
Tables taken from Cromwell's Approved Water Supply Plan

Projected Demands Information From Table 4-15 Cromwell WSP	Projected Water Demand (MGD)		
	2010	2020	2050
Average Daily Demand (ADD)	2.24	2.42	3.00
Maximum Month Average Day Demand (MMADD)	3.61	3.90	4.83
Max Day Demand (MDD)	5.56	6.00	7.44
Existing Gardiner Wellfield #1,#2 and #3 Production	**2010**	**2020**	**2050**
Average Daily Production (ADP)	5.62	5.62	5.62
Maximum Month Average Day Production (MMADP)	5.62	5.62	5.62
Max Day Production (MDP)	7.49	7.49	7.49
Total Surplus Water	**2010**	**2020**	**2050**
Average Day	3.38	3.20	2.62
Maximum Month Average Day	2.01	1.72	0.79
Peak Day	1.93	1.49	0.05
Margin of Safety	**2010**	**2020**	**2050**
Average Day	2.51	2.32	1.87
Maximum Month Average Day	1.56	1.44	1.16
Peak Day	1.35	1.25	1.01

Notes:

1 - Based on Table 4-15 Provided by CTDEP from Cromwell WSP dated "Revised March 30, 2007"

2 - Projected water demand: Based on Current max. permitted sale of water to Berlin as 300,000 gpd. (WSP Table 4-13)

3 - Assume Well #1, #2 and #3 are on Line. Well #4 not included.

4 - ADD and MMADD are based on 18 hrs pumping per day and MDD is based on 24 hours of pumping per day.

Table 4-3
Cromwell Fire District's Existing and Projected Water Demands
May 2009
Tables taken from Cromwell's Approved Water Supply Plan

Projected Demands Information From Table 4-16 Cromwell WSP	Projected Water Demand (MGD)		
	2010	2020	2050
Average Daily Demand (ADD)	3.65	3.84	4.41
Maximum Month Average Day Demand (MMADD)	5.88	6.18	7.1
Max Day Demand (MDD)	9.05	9.52	10.94
Proposed Supply Capacity, Gardiner well #1,#2, #3 and #4	**2010**	**2020**	**2050**
Average Daily Production (ADP)	7.89	7.89	7.89
Maximum Month Average Day Production (MMADP)	7.89	7.89	7.89
Max Day Production (MDP)	10.51	10.51	10.51
Total Surplus Water	**2010**	**2020**	**2050**
Average Day	4.24	4.05	3.48
Maximum Month Average Day	2.01	1.71	0.79
Peak Day	1.46	0.99	-0.43
Margin of Safety	**2010**	**2020**	**2050**
Average Day	2.16	2.05	1.79
Maximum Month Average Day	1.34	1.28	1.11
Peak Day	1.16	1.10	0.96

Notes:

1 - Based on Table 4-16 Provided by CTDEP from Cromwell WSP dated "Revised October 30, 2006"

2 - Projected water demand: Assumes increase of water supply from Cromwell to Berlin from 300,000 gpd to 1,500,000 gpd (WSP Table 4-14)

3 - Assume Well #1, #2 and #3 and the proposed Gardiner Well #4 are on-line

4 - ADD and MMADD are based on 18 hrs pumping per day. MDD is based on 24 hours of pumping per day.

TABLE 5-1
DURHAM WATER SYSTEM EXTENSION
PIPE LENGTH, WITH FIRE PROTECTION
Revised June 2009
Revised August 2010

AREA	DESCRIPTION	WATER MAIN With Fire Flow (FT)			
		16"	12"	8"	Total Length of Pipe (f.t.)
A	SUPERFUND	13,500	1,460	6,500	21,460
B	MTBE	-	-	590	590
C	1,1-DCE	-	-	4,000	4,000
D	PARSONS	-	-	1,720	1,720
E	SCHOOL	-	4,951	-	4,951
F	DURHAM HEIGHTS	-	-	7,026	7,026
G	WOODLAND DRIVE	-	-	4,648	4,648
H	ROYAL OAK DRIVE	-	-	11,278	11,278
I	DURHAM CENTER	-	3,026	3,364	6,390
	SCENARIO	16"	12"	8"	Total Length of Pipe (f.t.)
1.	A (Superfund Site)	13,500	1,460	6,500	21,460
2.	A+B+C+D (Core Service Area)	13,500	1,460	12,810	27,770
3.	(Core Service Area)+E	13,500	6,411	12,810	32,721
4.	(Core Service Area)+I	13,500	4,486	16,174	34,160
5.	(Core Service Area)+F	13,500	1,460	19,836	34,796
6.	(Core Service Area)+F+G+H	13,500	1,460	35,762	50,722
7.	All Areas	13,500	9,437	39,126	62,063

TABLE 5-2
DURHAM WATER SYSTEM EXTENSION
PIPE LENGTH, WITHOUT FIRE PROTECTION
Revised June 2009
Revised Aug. 2010

AREA	DESCRIPTION	WATER MAIN Without Fire Flow (FT)		
		12"	8"	Total Length of Pipe (f.t.)
A	SUPERFUND	13,500	7,960	21,460
B	MTBE	-	590	590
C	1,1-DCE	-	4,000	4,000
D	PARSONS	-	1,720	1,720
E	SCHOOL	4,951	-	4,951
F	DURHAM HEIGHTS	-	7,026	7,026
G	WOODLAND DRIVE	-	4,748	4,748
H	ROYAL OAK DRIVE	-	11,278	11,278
I	DURHAM CENTER	-	2,264	2,264
	SCENARIO	12"	8"	Total Length of Pipe (f.t.)
1.	A (Superfund Site)	13,500	7,960	21,460
2.	A+B+C+D (Core Service Area)	13,500	14,270	27,770
3.	(Core Service Area)+E	18,451	14,270	32,721
4.	(Core Service Area)+I	13,500	16,534	30,034
5.	(Core Service Area)+F	13,500	21,296	34,796
6.	(Core Service Area)+F+G+H	13,500	37,322	50,822
7.	All Areas	18,451	39,586	58,037

TABLE 7-1a: SUPERFUND SITE (AREA "A")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	13,500	$130	$1,755,000
2	8" DIP Water Main and Fittings	L.F.	7,960	$110	$875,600
3	Allowance for Rock Excavation	C.Y.	1,900	$85	$161,500
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	11	$4,000	$42,920
5	8" Gate Valve & Box	EA	10	$2,000	$19,900
6	12" Gate Valve & Box	EA	17	$3,000	$50,625
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	3	$500	$1,500
9	1" Copper Water Service Connection	L.F.	3,040	$65	$197,600
10	Direct.Drill or Open Cut 1" Copper WSC	EA	27	$2,000	$54,000
11	1" Corporation	EA	100	$300	$30,000
12	1" Curb Stop	EA	100	$350	$35,000
13	Provide Water Service to the Buildings				
	a. Potable Well Abandonment (four lots share two wells)	EA	98	$2,000	$196,000
	b. Remove & Return Filter Systems	EA	38	$500	$19,000
	c. Meter Setter, Jumper, Prep & Connect	EA	100	$600	$60,000
	d. Check Valves	EA	100	$100	$10,000
	e. 1" Copper, WSC from Prop. Line to House	L.F.	4,850	$65	$315,250
14	Allowance for Sidewalk Replacement	S.F.	27,000	$10	$270,000
15	Temporary Pavement Repair (Town)	L.F.	7,960	$18	$143,280
16	Permanent Pavement Repair (Town)	S.Y.	5,400	$25	$135,000
17	State Road Crossing (Pipe Only)	EA	3	$5,000	$15,000
18	Temporary Pavement Repair (State)	L.F.	750	$20	$15,000
19	Permanent Pavement Repair (State)	S.Y.	170	$70	$11,900
20	State Road Driveway Apron Overlay	S.Y.	600	$30	$18,000
21	Bit. Driveway Repair	S.Y.	410	$25	$10,250
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
23	Maintenance & Protection of Traffic	LS	1	$100,000	$100,000
24	State Police Officers	HR	3,088	$90	$277,920
25	Certified Flaggers	HR	1,072	$50	$53,600
26	12" PRV with Vault	EA	1	$30,000	$30,000
				Subtotal	$4,903,845
	Contingency 25%				$1,225,961
	Engineering/Administration 15%				$735,577
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$6,870,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (12" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 46 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street water main to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street water main to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. Assume abandoning of 98 existing potable wells.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-2a: MTBE SITE (AREA "B")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	0	$130	$0
2	8" DIP Water Main and Fittings	L.F.	590	$110	$64,900
3	Allowance for Rock Excavation	C.Y.	100	$85	$8,500
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	0	$4,000	$0
5	8" Gate Valve & Box	EA	2	$2,000	$4,000
6	12" Gate Valve & Box	EA	2	$3,000	$6,000
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	0	$500	$0
9	1" Copper Water Service Connection	L.F.	435	$65	$28,275
10	Direct.Drill or Open Cut 1" Copper WSC	EA	5	$2,000	$10,000
11	1" Corporation	EA	14	$300	$4,200
12	1" Curb Stop	EA	14	$350	$4,900
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	590	$18	$10,620
16	Permanent Pavement Repair (Town)	S.Y.	400	$25	$10,000
17	State Road Crossing (Pipe Only)	EA	1	$5,000	$5,000
18	Temporary Pavement Repair (State)	L.F.	50	$20	$1,000
19	Permanent Pavement Repair (State)	S.Y.	40	$70	$2,800
20	State Road Driveway Apron Overlay	S.Y.	140	$30	$4,200
21	Bit. Driveway Repair	S.Y.	30	$25	$750
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	0	$90	$0
25	Certified Flaggers	HR	80	$50	$4,000
26	12" PRV with Vault	EA	0	$30,000	$0
				Subtotal	$169,145
	Contingency 25%				$42,286
	Engineering/Administration 15%				$25,372
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$240,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 14 existing potable wells (approximately $28,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-3a: 1,1-DCE SITE (AREA "C")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	0	$130	$0
2	8" DIP Water Main and Fittings	L.F.	4,000	$110	$440,000
3	Allowance for Rock Excavation	C.Y.	400	$85	$34,000
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	4	$4,000	$16,000
5	8" Gate Valve & Box	EA	6	$2,000	$12,000
6	12" Gate Valve & Box	EA	1	$3,000	$3,000
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	2	$500	$1,000
9	1" Copper Water Service Connection	L.F.	525	$65	$34,125
10	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
11	1" Corporation	EA	21	$300	$6,300
12	1" Curb Stop	EA	21	$350	$7,350
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	4,000	$18	$72,000
16	Permanent Pavement Repair (Town)	S.Y.	2,700	$25	$67,500
17	State Road Crossing (Pipe Only)	EA	1	$5,000	$5,000
18	Temporary Pavement Repair (State)	L.F.	50	$20	$1,000
19	Permanent Pavement Repair (State)	S.Y.	40	$70	$2,800
20	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
21	Bit. Driveway Repair	S.Y.	190	$25	$4,750
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	0	$90	$0
25	Certified Flaggers	HR	544	$50	$27,200
26	12" PRV with Vault	EA	0	$30,000	$0
				Subtotal	$734,025
	Contingency 25%				$183,506
	Engineering/Administration 15%				$110,104
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,030,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 21 existing potable wells (approximately $42,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-4a: PARSONS (AREA "D")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	0	$130	$0
2	8" DIP Water Main and Fittings	L.F.	1,720	$110	$189,200
3	Allowance for Rock Excavation	C.Y.	200	$85	$17,000
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	2	$4,000	$8,000
5	8" Gate Valve & Box	EA	2	$2,000	$4,000
6	12" Gate Valve & Box	EA	2	$3,000	$6,000
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	2	$500	$1,000
9	1" Copper Water Service Connection	L.F.	965	$65	$62,725
10	Direct.Drill or Open Cut 1" Copper WSC	EA	10	$2,000	$20,000
11	1" Corporation	EA	36	$300	$10,800
12	1" Curb Stop	EA	36	$350	$12,600
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	1,720	$18	$30,960
16	Permanent Pavement Repair (Town)	S.Y.	1,200	$25	$30,000
17	State Road Crossing (Pipe Only)	EA	2	$5,000	$10,000
18	Temporary Pavement Repair (State)	L.F.	100	$20	$2,000
19	Permanent Pavement Repair (State)	S.Y.	70	$70	$4,900
20	State Road Driveway Apron Overlay	S.Y.	430	$30	$12,900
21	Bit. Driveway Repair	S.Y.	70	$25	$1,750
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	0	$90	$0
25	Certified Flaggers	HR	240	$50	$12,000
26	12" PRV with Vault	EA	0	$30,000	$0
				Subtotal	$435,835
	Contingency 25%				$108,959
	Engineering/Administration 15%				$65,375
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$610,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 36 existing potable wells (approximately $72,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-5a: SCHOOLS & PRIVATE PROPERTIES (AREA "E")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	4,951	$130	$643,630
2	8" DIP Water Main and Fittings	L.F.	0	$110	$0
3	Allowance for Rock Excavation	C.Y.	400	$85	$34,000
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	7	$4,000	$28,000
5	8" Gate Valve & Box	EA	5	$2,000	$10,000
6	12" Gate Valve & Box	EA	1	$3,000	$3,000
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	0	$500	$0
9	1" Copper Water Service Connection	L.F.	225	$65	$14,625
10	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
11	1" Corporation	EA	9	$300	$2,700
12	1" Curb Stop	EA	9	$350	$3,150
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	4,951	$18	$89,118
16	Permanent Pavement Repair (Town)	S.Y.	3,400	$25	$85,000
17	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
18	Temporary Pavement Repair (State)	L.F.	0	$20	$0
19	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
20	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
21	Bit. Driveway Repair	S.Y.	80	$25	$2,000
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	3	$15,000	$45,000
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	1,136	$90	$102,240
25	Certified Flaggers	HR	0	$50	$0
26	12" PRV with Vault	EA	0	$30,000	$0
				Subtotal	$1,062,463
	Contingency 25%				$265,616
	Engineering/Administration 15%				$159,369
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,490,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 9 existing potable wells (approximately $18,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-6a: DURHAM HEIGHTS (AREA "F")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised November 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	0	$130	$0
2	8" DIP Water Main and Fittings	L.F.	7,026	$110	$772,860
3	Allowance for Rock Excavation	C.Y.	700	$85	$59,500
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	7	$4,000	$28,000
5	8" Gate Valve & Box	EA	16	$2,000	$32,000
6	12" Gate Valve & Box	EA	1	$3,000	$3,000
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	6	$500	$3,000
9	1" Copper Water Service Connection	L.F.	2,300	$65	$149,500
10	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
11	1" Corporation	EA	92	$300	$27,600
12	1" Curb Stop	EA	92	$350	$32,200
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	7,026	$18	$126,468
16	Permanent Pavement Repair (Town)	S.Y.	4,700	$25	$117,500
17	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
18	Temporary Pavement Repair (State)	L.F.	0	$20	$0
19	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
20	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
21	Bit. Driveway Repair	S.Y.	820	$25	$20,500
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	0	$90	$0
25	Certified Flaggers	HR	944	$50	$47,200
26	12" PRV with Vault	EA	0	$30,000	$0
				Subtotal	$1,419,328
	Contingency 25%				$354,832
	Engineering/Administration 15%				$212,899
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,990,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 92 existing potable wells (approximately $184,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-7a: WOODLAND DRIVE (AREA "G")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	0	$130	$0
2	8" DIP Water Main and Fittings	L.F.	4,748	$110	$522,280
3	Allowance for Rock Excavation	C.Y.	400	$85	$34,000
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	8	$4,000	$32,000
5	8" Gate Valve & Box	EA	10	$2,000	$20,000
6	12" Gate Valve & Box	EA	2	$3,000	$6,000
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	1	$500	$500
9	1" Copper Water Service Connection	L.F.	1,250	$65	$81,250
10	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
11	1" Corporation	EA	50	$300	$15,000
12	1" Curb Stop	EA	50	$350	$17,500
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	4,748	$18	$85,464
16	Permanent Pavement Repair (Town)	S.Y.	3,200	$25	$80,000
17	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
18	Temporary Pavement Repair (State)	L.F.	0	$20	$0
19	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
20	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
21	Bit. Driveway Repair	S.Y.	450	$25	$11,250
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	2	$15,000	$30,000
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	0	$90	$0
25	Certified Flaggers	HR	640	$50	$32,000
26	12" PRV with Vault	EA	0	$30,000	$0
				Subtotal	$967,244
	Contingency 25%				$241,811
	Engineering/Administration 15%				$145,087
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,350,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 50 existing potable wells (approximately $100,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-8a: ROYAL OAK DR. (AREA "H")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	0	$130	$0
2	8" DIP Water Main and Fittings	L.F.	11,278	$110	$1,240,580
3	Allowance for Rock Excavation	C.Y.	1,000	$85	$85,000
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	13	$4,000	$52,000
5	8" Gate Valve & Box	EA	26	$2,000	$52,000
6	12" Gate Valve & Box	EA	2	$3,000	$6,000
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	6	$500	$3,000
9	1" Copper Water Service Connection	L.F.	2,725	$65	$177,125
10	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
11	1" Corporation	EA	109	$300	$32,700
12	1" Curb Stop	EA	109	$350	$38,150
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	11,278	$18	$203,004
16	Permanent Pavement Repair (Town)	S.Y.	7,600	$25	$190,000
17	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
18	Temporary Pavement Repair (State)	L.F.	0	$20	$0
19	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
20	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
21	Bit. Driveway Repair	S.Y.	970	$25	$24,250
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	0	$90	$0
25	Certified Flaggers	HR	1,504	$50	$75,200
26	12" PRV with Vault	EA	0	$30,000	$0
28	Booster Opump Station	EA	1	$250,000	$250,000
				Subtotal	$2,429,009
	Contingency 25%				$607,252
	Engineering/Administration 15%				$364,351
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$3,400,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 109 existing potable wells (approximately $218,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-9a: DURHAM CENTER (AREA "I")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost Without Fire Protection
Durham, Connecticut
Revised June 2009

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	12" DIP Water Main and Fittings	L.F.	0	$130	$0
2	8" DIP Water Main and Fittings	L.F.	2,264	$110	$249,040
3	Allowance for Rock Excavation	C.Y.	200	$85	$17,000
4	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	15	$4,000	$60,000
5	8" Gate Valve & Box	EA	6	$2,000	$12,000
6	12" Gate Valve & Box	EA	0	$3,000	$0
7	Flushing Valve Assembly	EA	0	$500	$0
8	Blow-offs Valve Assembly	EA	1	$500	$500
9	1" Copper Water Service Connection	L.F.	840	$65	$54,600
10	Direct.Drill or Open Cut 1" Copper WSC	EA	3	$2,000	$6,000
11	1" Corporation	EA	30	$300	$9,000
12	1" Curb Stop	EA	30	$350	$10,500
13	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
14	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
15	Temporary Pavement Repair (Town)	L.F.	2,264	$18	$40,752
16	Permanent Pavement Repair (Town)	S.Y.	1,600	$25	$40,000
17	State Road Crossing (Pipe Only)	EA	1	$5,000	$5,000
18	Temporary Pavement Repair (State)	L.F.	50	$20	$1,000
19	Permanent Pavement Repair (State)	S.Y.	40	$70	$2,800
20	State Road Driveway Apron Overlay	S.Y.	30	$30	$900
21	Bit. Driveway Repair	S.Y.	240	$25	$6,000
22	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
23	Maintenance & Protection of Traffic	LS	0	$100,000	$0
24	State Police Officers	HR	0	$90	$0
25	Certified Flaggers	HR	304	$50	$15,200
26	12" PRV with Vault	EA	0	$30,000	$0
				Subtotal	$530,292
	Contingency 25%				$132,573
	Engineering/Administration 15%				$79,544
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$740,000**

Notes:

1. Assumes 1 hydrant every 1,000 ft along the proposed water main route for water main flushing, and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 30 existing potable wells (approximately $60,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-1b: SUPERFUND SITE (AREA "A")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	13,500	$150	$2,025,000
2	12" DIP Water Main and Fittings	L.F.	1,460	$130	$189,800
3	8" DIP Water Main and Fittings	L.F.	6,500	$110	$715,000
4	Allowance for Rock Excavation	C.Y.	1,900	$85	$161,500
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	40	$4,000	$160,000
6	8" Gate Valve & Box	EA	11	$2,000	$22,000
7	12" Gate Valve & Box	EA	2	$3,000	$6,000
8	16" Butterfly Valve & Box	EA	22	$6,000	$132,000
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	3	$500	$1,500
11	1" Copper Water Service Connection	L.F.	3,040	$65	$197,600
12	Direct.Drill or Open Cut 1" Copper WSC	EA	27	$2,000	$54,000
13	1" Corporation	EA	100	$300	$30,000
14	1" Curb Stop	EA	100	$350	$35,000
15	Provide Water Service to the Buildings				$0
	a. Potable Well Abandonment (four lots share two wells)	EA	98	$2,000	$196,000
	b. Remove & Return Filter Systems	EA	38	$500	$19,000
	c. Meter Setter, Jumper, Prep & Connect	EA	100	$600	$60,000
	d. Check Valves	EA	100	$100	$10,000
	e. 1" Copper, WSC from Prop. Line to House	L.F.	4,850	$65	$315,250
16	Allowance for Sidewalk Replacement	S.F.	27,000	$10	$270,000
17	Temporary Pavement Repair (Town)	L.F.	7,960	$18	$143,280
18	Permanent Pavement Repair (Town)	S.Y.	5,400	$25	$135,000
19	State Road Crossing (Pipe Only)	EA	3	$5,000	$15,000
20	Temporary Pavement Repair (State)	L.F.	750	$20	$15,000
21	Permanent Pavement Repair (State)	S.Y.	170	$70	$11,900
22	State Road Driveway Apron Overlay	S.Y.	600	$30	$18,000
23	Bit. Driveway Repair	S.Y.	410	$25	$10,250
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
25	Maintenance & Protection of Traffic	LS	1	$100,000	$100,000
26	State Police Officers	HR	3,088	$90	$277,920
27	Certified Flaggers	HR	1,072	$50	$53,600
28	16" PRV with Vault	EA	1	$40,000	$40,000
				Subtotal	$5,419,600
	Contingency 25%				$1,354,900
	Engineering/Administration 15%				$812,940
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$7,590,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 46 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street water main to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street water main to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. Assume abandoning of 98 existing potable wells.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-2b: MTBE SITE (AREA "B")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	0	$130	$0
3	8" DIP Water Main and Fittings	L.F.	590	$110	$64,900
4	Allowance for Rock Excavation	C.Y.	100	$85	$8,500
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	0	$4,000	$0
6	8" Gate Valve & Box	EA	2	$2,000	$4,000
7	12" Gate Valve & Box	EA	0	$3,000	$0
8	16" Butterfly Valve & Box	EA	3	$6,000	$18,000
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	0	$500	$0
11	1" Copper Water Service Connection	L.F.	435	$65	$28,275
12	Direct.Drill or Open Cut 1" Copper WSC	EA	5	$2,000	$10,000
13	1" Corporation	EA	14	$300	$4,200
14	1" Curb Stop	EA	14	$350	$4,900
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	590	$18	$10,620
18	Permanent Pavement Repair (Town)	S.Y.	400	$25	$10,000
19	State Road Crossing (Pipe Only)	EA	1	$5,000	$5,000
20	Temporary Pavement Repair (State)	L.F.	50	$20	$1,000
21	Permanent Pavement Repair (State)	S.Y.	40	$70	$2,800
22	State Road Driveway Apron Overlay	S.Y.	140	$30	$4,200
23	Bit. Driveway Repair	S.Y.	30	$25	$750
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	0	$90	$0
27	Certified Flaggers	HR	80	$50	$4,000
28	16" PRV with Vault	EA	0	$40,000	$0
				Subtotal	$181,145
	Contingency 25%				$45,286
	Engineering/Administration 15%				$27,172
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$250,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 14 existing potable wells (approximately $28,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-3b: 1,1-DCE SITE (AREA "C")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	0	$130	$0
3	8" DIP Water Main and Fittings	L.F.	4,000	$110	$440,000
4	Allowance for Rock Excavation	C.Y.	400	$85	$34,000
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	4	$4,000	$16,000
6	8" Gate Valve & Box	EA	6	$2,000	$12,000
7	12" Gate Valve & Box	EA	0	$3,000	$0
8	16" Butterfly Valve & Box	EA	2	$6,000	$12,000
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	2	$500	$1,000
11	1" Copper Water Service Connection	L.F.	525	$65	$34,125
12	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
13	1" Corporation	EA	21	$300	$6,300
14	1" Curb Stop	EA	21	$350	$7,350
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	4,000	$18	$72,000
18	Permanent Pavement Repair (Town)	S.Y.	2,700	$25	$67,500
19	State Road Crossing (Pipe Only)	EA	1	$5,000	$5,000
20	Temporary Pavement Repair (State)	L.F.	50	$20	$1,000
21	Permanent Pavement Repair (State)	S.Y.	40	$70	$2,800
22	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
23	Bit. Driveway Repair	S.Y.	190	$25	$4,750
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	0	$90	$0
27	Certified Flaggers	HR	544	$50	$27,200
28	16" PRV with Vault	EA	0	$40,000	$0
				Subtotal	$743,025
	Contingency 25%				$185,756
	Engineering/Administration 15%				$111,454
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,040,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 21 existing potable wells (approximately $42,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-4b: PARSONS (AREA "D")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	0	$130	$0
3	8" DIP Water Main and Fittings	L.F.	1,720	$110	$189,200
4	Allowance for Rock Excavation	C.Y.	200	$85	$17,000
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	2	$4,000	$8,000
6	8" Gate Valve & Box	EA	2	$2,000	$4,000
7	12" Gate Valve & Box	EA	0	$3,000	$0
8	16" Butterfly Valve & Box	EA	2	$6,000	$12,000
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	2	$500	$1,000
11	1" Copper Water Service Connection	L.F.	965	$65	$62,725
12	Direct.Drill or Open Cut 1" Copper WSC	EA	10	$2,000	$20,000
13	1" Corporation	EA	36	$300	$10,800
14	1" Curb Stop	EA	36	$350	$12,600
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	1,720	$18	$30,960
18	Permanent Pavement Repair (Town)	S.Y.	1,200	$25	$30,000
19	State Road Crossing (Pipe Only)	EA	2	$5,000	$10,000
20	Temporary Pavement Repair (State)	L.F.	100	$20	$2,000
21	Permanent Pavement Repair (State)	S.Y.	70	$70	$4,900
22	State Road Driveway Apron Overlay	S.Y.	430	$30	$12,900
23	Bit. Driveway Repair	S.Y.	70	$25	$1,750
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	0	$90	$0
27	Certified Flaggers	HR	240	$50	$12,000
28	16" PRV with Vault	EA	0	$40,000	$0
				Subtotal	$441,835
	Contingency 25%				$110,459
	Engineering/Administration 15%				$66,275
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$620,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 36 existing potable wells (approximately $72,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-5b: SCHOOLS & PRIVATE PROPERTIES (AREA "E")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	4,951	$130	$643,630
3	8" DIP Water Main and Fittings	L.F.	0	$110	$0
4	Allowance for Rock Excavation	C.Y.	400	$85	$34,000
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	7	$4,000	$28,000
6	8" Gate Valve & Box	EA	0	$2,000	$0
7	12" Gate Valve & Box	EA	5	$3,000	$15,000
8	16" Butterfly Valve & Box	EA	0	$6,000	$0
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	0	$500	$0
11	1" Copper Water Service Connection	L.F.	235	$65	$15,275
12	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
13	1" Corporation	EA	10	$300	$3,000
14	1" Curb Stop	EA	10	$350	$3,500
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	4,951	$18	$89,118
18	Permanent Pavement Repair (Town)	S.Y.	3,400	$25	$85,000
19	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
20	Temporary Pavement Repair (State)	L.F.	0	$20	$0
21	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
22	State Road Driveway Apron Overlay	S.Y.	30	$30	$900
23	Bit. Driveway Repair	S.Y.	80	$25	$2,000
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	3	$15,000	$45,000
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	0	$90	$0
27	Certified Flaggers	HR	672	$50	$33,600
28	16" PRV with Vault	EA	0	$40,000	$0
				Subtotal	$998,023
	Contingency 25%				$249,506
	Engineering/Administration 15%				$149,703
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,400,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 9 existing potable wells (approximately $18,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-6b: DURHAM HEIGHTS (AREA "F")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised November 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	0	$130	$0
3	8" DIP Water Main and Fittings	L.F.	7,026	$110	$772,860
4	Allowance for Rock Excavation	C.Y.	700	$85	$59,500
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	7	$4,000	$28,000
6	8" Gate Valve & Box	EA	16	$2,000	$32,000
7	12" Gate Valve & Box	EA	0	$3,000	$0
8	16" Butterfly Valve & Box	EA	1	$6,000	$6,000
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	6	$500	$3,000
11	1" Copper Water Service Connection	L.F.	2,300	$65	$149,500
12	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
13	1" Corporation	EA	92	$300	$27,600
14	1" Curb Stop	EA	92	$350	$32,200
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	7,026	$18	$126,468
18	Permanent Pavement Repair (Town)	S.Y.	4,700	$25	$117,500
19	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
20	Temporary Pavement Repair (State)	L.F.	0	$20	$0
21	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
22	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
23	Bit. Driveway Repair	S.Y.	820	$25	$20,500
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	0	$90	$0
27	Certified Flaggers	HR	944	$50	$47,200
28	16" PRV with Vault	EA	0	$40,000	$0
				Subtotal	$1,422,328
	Contingency 25%				$355,582
	Engineering/Administration 15%				$213,349
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,990,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 92 existing potable wells (approximately $184,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-7b: WOODLAND DRIVE (AREA "G")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	0	$130	$0
3	8" DIP Water Main and Fittings	L.F.	4,648	$110	$511,280
4	Allowance for Rock Excavation	C.Y.	400	$85	$34,000
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	8	$4,000	$32,000
6	8" Gate Valve & Box	EA	10	$2,000	$20,000
7	12" Gate Valve & Box	EA	0	$3,000	$0
8	16" Butterfly Valve & Box	EA	2	$6,000	$12,000
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	1	$500	$500
11	1" Copper Water Service Connection	L.F.	1,250	$65	$81,250
12	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
13	1" Corporation	EA	50	$300	$15,000
14	1" Curb Stop	EA	50	$350	$17,500
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	4,648	$18	$83,664
18	Permanent Pavement Repair (Town)	S.Y.	3,100	$25	$77,500
19	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
20	Temporary Pavement Repair (State)	L.F.	0	$20	$0
21	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
22	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
23	Bit. Driveway Repair	S.Y.	450	$25	$11,250
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	0	$90	$0
27	Certified Flaggers	HR	624	$50	$31,200
28	16" PRV with Vault	EA	0	$40,000	$0
				Subtotal	$927,144
	Contingency 25%				$231,786
	Engineering/Administration 15%				$139,072
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,300,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 50 existing potable wells (approximately $100,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 109 existing potable wells (approximately $218,000) is not included in the Cost.

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7-8b: ROYAL OAK DR. (AREA "H")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	0	$130	$0
3	8" DIP Water Main and Fittings	L.F.	11,278	$110	$1,240,580
4	Allowance for Rock Excavation	C.Y.	1,000	$85	$85,000
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	13	$4,000	$52,000
6	8" Gate Valve & Box	EA	26	$2,000	$52,000
7	12" Gate Valve & Box	EA	0	$3,000	$0
8	16" Butterfly Valve & Box	EA	2	$6,000	$12,000
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	6	$500	$3,000
11	1" Copper Water Service Connection	L.F.	2,725	$65	$177,125
12	Direct.Drill or Open Cut 1" Copper WSC	EA	0	$2,000	$0
13	1" Corporation	EA	109	$300	$32,700
14	1" Curb Stop	EA	109	$350	$38,150
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	11,278	$18	$203,004
18	Permanent Pavement Repair (Town)	S.Y.	7,600	$25	$190,000
19	State Road Crossing (Pipe Only)	EA	0	$5,000	$0
20	Temporary Pavement Repair (State)	L.F.	0	$20	$0
21	Permanent Pavement Repair (State)	S.Y.	0	$70	$0
22	State Road Driveway Apron Overlay	S.Y.	0	$30	$0
23	Bit. Driveway Repair	S.Y.	970	$25	$24,250
24	Culvert Crossing Premium (Hay bales & Silt Fence)	EA	0	$15,000	$0
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	0	$90	$0
27	Certified Flaggers	HR	1,504	$50	$75,200
28	16" PRV with Vault	EA	0	$40,000	$0
29	Booster Opump Station	EA	1	$250,000	$250,000
				Subtotal	$2,435,009
	Contingency 25%				$608,752
	Engineering/Administration 15%				$365,251
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$3,410,000**

TABLE 7-9b: DURHAM CENTER (AREA "I")
Durham Water System Extension Feasibility Study
Water Mains Budgetary Opinion of Capital Cost With Fire Protection
Durham, Connecticut
Revised June 2009
Revised August 2010

Item No.	Item Description	Units	Estimated Quantity	Unit Price	Estimated Price
1	16" DIP Water Main and Fittings	L.F.	0	$150	$0
2	12" DIP Water Main and Fittings	L.F.	3,026	$130	$393,380
3	8" DIP Water Main and Fittings	L.F.	3,364	$110	$370,040
4	Allowance for Rock Excavation	C.Y.	600	$85	$51,000
5	6" Fire Hydrants Assembly (includes 6" valve and 6" D.I.)	EA	15	$4,000	$60,000
6	8" Gate Valve & Box	EA	2	$2,000	$4,000
7	12" Gate Valve & Box	EA	4	$3,000	$12,000
8	16" Butterfly Valve & Box	EA	0	$6,000	$0
9	Flushing Valve Assembly	EA	0	$500	$0
10	Blow-offs Valve Assembly	EA	0	$500	$0
11	1" Copper Water Service Connection	L.F.	1,380	$65	$89,700
12	Direct.Drill or Open Cut 1" Copper WSC	EA	4	$2,000	$8,000
13	1" Corporation	EA	57	$300	$17,100
14	1" Curb Stop	EA	57	$350	$19,950
15	Provide Water Service to the Buildings			$0	$0
	a. Potable Well Abandonment	EA	0	$2,000	$0
	b. Remove & Return Filter Systems	EA	0	$500	$0
	c. Meter Setter, Jumper, Prep & Connect	EA	0	$600	$0
	d. Check Valves	EA	0	$100	$0
	e. 1" Copper, WSC from Prop. Line to House	L.F.	0	$65	$0
16	Allowance for Sidewalk Replacement	S.F.	0	$10	$0
17	Temporary Pavement Repair (Town)	L.F.	6,390	$18	$115,020
18	Permanent Pavement Repair (Town)	S.Y.	4,300	$25	$107,500
19	State Road Crossing (Pipe Only)	EA	4	$5,000	$20,000
20	Temporary Pavement Repair (State)	L.F.	200	$20	$4,000
21	Permanent Pavement Repair (State)	S.Y.	140	$70	$9,800
22	State Road Driveway Apron Overlay	S.Y.	30	$30	$900
23	Bit. Driveway Repair	S.Y.	240	$25	$6,000
24	Culvert Crossing, pipe under bridge Premium (Hay bales & Silt	EA	1	$35,000	$35,000
25	Maintenance & Protection of Traffic	LS	0	$100,000	$0
26	State Police Officers	HR	704	$90	$63,360
27	Certified Flaggers	HR	464	$50	$23,200
28	16" PRV with Vault	EA	0	$40,000	$0
				Subtotal	$1,409,950
	Contingency 25%				$352,488
	Engineering/Administration 15%				$211,493
	Total Estimated Budget Cost (Rounded)			**Rounded Total**	**$1,970,000**

Notes:

1. Assumes 1 hydrant every 500 ft along the proposed water main route and approximately 10 ft of 6" water main per hydrant. Each hydrant also requires one 6" gate valve and box.
2. Each intersection is triple gated.
3. Each occupied lot located along the proposed water main route will have service connection.
4. State Police Officers cost estimate is based on 2 officers present during water main and service installation. and paving on state roads at a rate of $90 per hour for an 8 hour day, installing 70 linear ft/day.
5. Certified Flaggers cost estimate is based on 2 flaggers present during water main installation, services and paving on Town roads at a rate of $50 per hour for an 8 hour day, installing 120 linear ft/ hour.
6. Assume 1 gate valve every 800 feet to allow for isolating parts, 3 valves at street intersections
7. Install Blow-off assembly at the end of each Dead -End water main
8. Cost of PRV includes vault, piping, valves, PRV, power, lights and sump.
9. Includes an allowance for rock based on 10 % of the total LF of the main line trench (4 ft wide by 5 ft deep) and 10% of the lateral trenches (2 ft wide by 5 ft deep) having rock.
10. Water main is to be installed off the pavement on Route 17 and Route 68. Service connections across the road will be directionally drilled.
11. Water main is to installed off the pavement on Route 147
12. Pavement repair on Town Roads will be the width of trench (assume 6' wide)
13. Pavement repair on Route 147 consists of a temporary patch and curb to centerline overlay.
14. Sidewalk replacement cost based on replacing 50% of Main Street (16" WM) & 4 ft wide various types of sidewalks.
15. State road driveway apron repair based on 27 lots with a 20' x 10' repair area
16. Bituminous Driveway Repair based on 50 lots with a repair area of 20' x 4'
17. Assume Main Street watermain is located in the sidewalk on the east side of the street.
18. Assume 10 feet of water service from Main Street watermain to property line for properties located on the east side of the road.
19. Assume 60 feet of directional drilling from Main Street watermain to property line for properties located on the west side of the road.
20. Assume 60 feet of water service from property line to building in Superfund Site Area (properties on Main Street).
21. Assume 25 feet of water service from water main to property line for properties on town roads.
22. Assume 35 feet of water service from property line to building in Superfund Site Area (properties on town roads).
23. Assume permanent pavement for street crossings to be 6' x 50'
24. Assume State Road Driveway Apron repair to be 20' x 10' for properties on east side of Main Street.
25. All existing potable water wells to be permanently abandoned. Abandoning of the 30 existing potable wells (approximately $60,000) is not included in the Cost.
26. Auume reconnecting the existing buildings to new 12" water main (approxoimately 27 resi. & commercial) along Main street

Middletown Improvements

1. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
2. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
3. Assume various size storage tank are required for the areas and scenarios investigated.

TABLE 7 - 10

DURHAM WATER SYSTEM EXTENSION
BUDGETARY OPINION OF CAPITAL COST WITHOUT FIRE PROTECTION
DURHAM, CT
SERVICE AREA SCENARIOS
Revised July 2009
Revised August 2010
Revised September 2012
Summary Table

NO.	SCENARIOS	Estimated Durham & Middletown Upgrade & Const. Cost	Contingency (25%)	Engin. Admin (15%)	ROUNDED TOTAL	Range + 30%	Range - 15%
1.	A (Superfund Site)	$6,098,345	$1,524,586	$914,752	**$8,540,000**	**$11,102,000**	**$7,259,000**
2.	A+B+C+D (Core Service Area)	$7,602,350	$1,900,588	$1,140,353	**$10,640,000**	**$13,832,000**	**$9,044,000**
3.	(Core Service Area)+I	$8,215,142	$2,053,786	$1,232,271	**$11,500,000**	**$14,950,000**	**$9,775,000**
4.	(Core Service Area)+E	$8,697,813	$2,174,453	$1,304,672	**$12,180,000**	**$15,834,000**	**$10,353,000**
5.	(Core Service Area)+F	$9,137,178	$2,284,295	$1,370,577	**$12,790,000**	**$16,627,000**	**$10,871,500**
6.	(Core Service Area)+F+G+H	$12,599,431	$3,149,858	$1,889,915	**$17,640,000**	**$22,932,000**	**$14,994,000**
7.	All Areas	$14,318,686	$3,579,672	$2,147,803	**$20,050,000**	**$26,065,000**	**$17,042,500**

	Durham Construction Cost			
AREAS	AREA'S NAME	Estimated Durham Const. Cost	Range + 30%	Range - 15%
A	Superfund Site	$4,903,845	**$6,374,999**	**$4,168,268**
B	MTBE Site	$169,145	**$219,889**	**$143,773**
C	1,1 DCE Site	$734,025	**$954,233**	**$623,921**
D	Parsons Area	$435,835	**$566,586**	**$370,460**
E	School Area+ Private Properties	$1,062,463	**$1,381,202**	**$903,094**
F	Durham Heights Area	$1,419,328	**$1,845,126**	**$1,206,429**
G	Woodland Drive	$967,244	**$1,257,417**	**$822,157**
H	Royal Oak Area	$2,429,009	**$3,157,712**	**$2,064,658**
I	Durham Center	$530,292	**$689,380**	**$450,748**

	Middletown Improvements Required for each scenarios:								
NO.	SCENARIOS & Tank Sizes	Cost of Water Main Upgrade (4)	Cost of Pump Station Upgrade (5)	Cost of Storage Tank (6)	Total Upgrade Cost (7)	Range + 30%	Range - 15%	Tank Size (Gal.) Required for each Scenarios	Additional Cost for Various Scenarios
1.	A (Superfund Site), [0.25 MG Tank] (1)	$182,000	$600,000	$412,500	**$1,194,500**	**$1,552,850**	**$1,015,325**	**250,000**	
2.	A+B+C+D (Core Service Area), [0.35 MG Tank] (2)	$182,000	$600,000	$577,500	**$1,359,500**	**$1,767,350**	**$1,155,575**	**350,000**	165,000
3.	(Core Service Area)+I, [0.4 MG Tank] (3)	$182,000	$600,000	$660,000	**$1,442,000**	**$1,874,600**	**$1,225,700**	**400,000**	247,500
4.	(Core Service Area)+E, [0.37 MG Tank] (3)	$182,000	$600,000	$610,500	**$1,392,500**	**$1,810,250**	**$1,183,625**	**370,000**	198,000
5.	(Core Service Area)+F, [0.42 MG Tank] (3)	$182,000	$600,000	$693,000	**$1,475,000**	**$1,917,500**	**$1,253,750**	**420,000**	280,500
6.	(Core Service Area)+F+G+H, [0.6 MG Tank] (3)	$182,000	$600,000	$759,000	**$1,541,000**	**$2,003,300**	**$1,309,850**	**600,000**	346,500
7.	All Areas [0.7 MG Tank] (3)	$182,000	$600,000	$885,500	**$1,667,500**	**$2,167,750**	**$1,417,375**	**700,000**	473,000

Notes:
1. Cost for Middletown improvements include Water Main upgrade, pump station upgrade, and storage tank installation.
2. Cost for Middletown improvements include Water Main upgrade, pump station upgrade, and storage tank installation.
3. Cost for Middletown improvements include Water Main upgrade, pump station upgrade, and storage tank installation.
4. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 l.f. Required under Superfund Scenario)
5. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
6. Assume various size storage tank are required for the areas and scenarios investigated, for smaller tank (less than 500,000 gal), assumed $1.50/gall for tank cost
   for all other tanks assume $1.15/gallons for tank cost $1.50 $1.15 per gallons.
   Additional 10% for site work and piping connection is included in the storage tank cost.
7. Engineering and Admin. Cost are included in the Summary Table at the top.

TABLE 7 - 11

DURHAM WATER SYSTEM EXTENSION
BUDGETARY OPINION OF CAPITAL COST WITH FIRE PROTECTION
DURHAM, CT
SERVICE AREA SCENARIOS
Revised July 2009
Revised August 2010
Revised January 2011
Revised September 2012

NO.	SCENARIOS	Estimated Durham & Middletown Upgrade & Const. Cost	Contingency (25%)	Engin. Admin (15%)	ROUNDED TOTAL	Range + 30%	Range - 15%
1.	A (Superfund Site)	$7,150,350	$1,787,588	$1,072,553	**$10,010,000**	**$13,013,000**	$8,508,500
2.	A+B+C+D (Core Service Area)	$8,579,605	$2,144,901	$1,286,941	**$12,010,000**	**$15,613,000**	$10,208,500
3.	(Core Service Area)+I	$8,604,905	$2,151,226	$1,290,736	**$12,050,000**	**$15,665,000**	$10,242,500
4.	(Core Service Area)+E	$8,604,905	$2,151,226	$1,290,736	**$12,050,000**	**$15,665,000**	$10,242,500
5.	(Core Service Area)+F	$8,642,855	$2,160,714	$1,296,428	**$12,100,000**	**$15,730,000**	$10,285,000
6.	(Core Service Area)+F+G+H	$13,553,836	$3,388,459	$2,033,075	**$18,980,000**	**$24,674,000**	$16,133,000
7.	All Areas	$16,025,059	$4,006,265	$2,403,759	**$22,440,000**	**$29,172,000**	$19,074,000

Durham Construction Cost

AREAS	AREA'S NAME	Estimated Durham Const. Cost	Range + 30%	Range - 15%
A	Superfund Site	$5,419,600	**$7,045,480**	**$4,606,660**
B	MTBE Site	$181,145	**$235,489**	**$153,973**
C	1,1 DCE Site	$743,025	**$965,933**	**$631,571**
D	Parsons Area	$441,835	**$574,386**	**$375,560**
E	School Area+ Private Properties	$998,023	**$1,297,430**	**$848,320**
F	Durham Heights Area	$1,422,328	**$1,849,026**	**$1,208,979**
G	Woodland Drive	$927,144	**$1,205,287**	**$788,072**
H	Royal Oak Area	$2,435,009	**$3,165,512**	**$2,069,758**
I	Durham Center	$1,409,950	**$1,832,935**	**$1,198,458**

Middletown Improvements Required for each scenarios

NO.	SCENARIOS & Tank Sizes	Cost of Water Main Upgrade (4)	Cost of Pump Station Upgrade (5)	Cost of Storage Tank (6)	Total Upgrade Cost (7)	Range + 30%	Range - 15%	Tank Size (Gal.) Required for each Scenarios
1.	A (Superfund Site), [0.75 MG Tank] (1)	$182,000	$600,000	$948,750	**$1,730,750**	**$2,249,975**	**$1,471,138**	**750,000**
2.	A+B+C+D (Core Service Area), [0.8 MG Tank] (2)	$182,000	$600,000	$1,012,000	**$1,794,000**	**$2,332,200**	**$1,524,900**	**800,000**
3.	(Core Service Area)+I, [0.82 MG Tank] (3)	$182,000	$600,000	$1,037,300	**$1,819,300**	**$2,365,090**	**$1,546,405**	**820,000**
4.	(Core Service Area)+E, [0.82 MG Tank] (3)	$182,000	$600,000	$1,037,300	**$1,819,300**	**$2,365,090**	**$1,546,405**	**820,000**
5.	(Core Service Area)+F, [0.85 MG Tank] (3)	$182,000	$600,000	$1,075,250	**$1,857,250**	**$2,414,425**	**$1,578,663**	**850,000**
6.	(Core Service Area)+F+G+H, [0.95 MG Tank] (3)	$182,000	$600,000	$1,201,750	**$1,983,750**	**$2,578,875**	**$1,686,188**	**950,000**
7.	All Areas [1.0 MG Tank] (3)	$182,000	$600,000	$1,265,000	**$2,047,000**	**$2,661,100**	**$1,739,950**	**1,000,000**

Notes:

1. Cost for Middletown improvements include Water Main upgrade, pump station upgrade, and storage tank installation.
2. Cost for Middletown improvements include Water Main upgrade, pump station upgrade, and storage tank installation.
3. Cost for Middletown improvements include Water Main upgrade, pump station upgrade, and storage tank installation
4. Replacing the existing 8" water main on Talcott Ridge Dr. with 12", and extending to the Proposed Cherry Hill Storage Tank (1,400 LF. required under Superfund Scenario)
5. Upgrade of existing Long Hill Pump Station (New pump with VFD, electric service, addition to the building & upgrading the generator)
6. Assume various size storage tank are required for the areas and scenarios investigated. Assumed $1.15/gallons for tank cost with F.F. Additional 10% for site work and piping connection is included in the storage tank cost.
7. Engineering and Admin. Cost are included in the Summary Table at the top.

A

ATTACHMENT "A"
Figure 8 of the 2005 Environmental Protection Agency's Record of Decision (EPA ROD)

Original includes color coding.

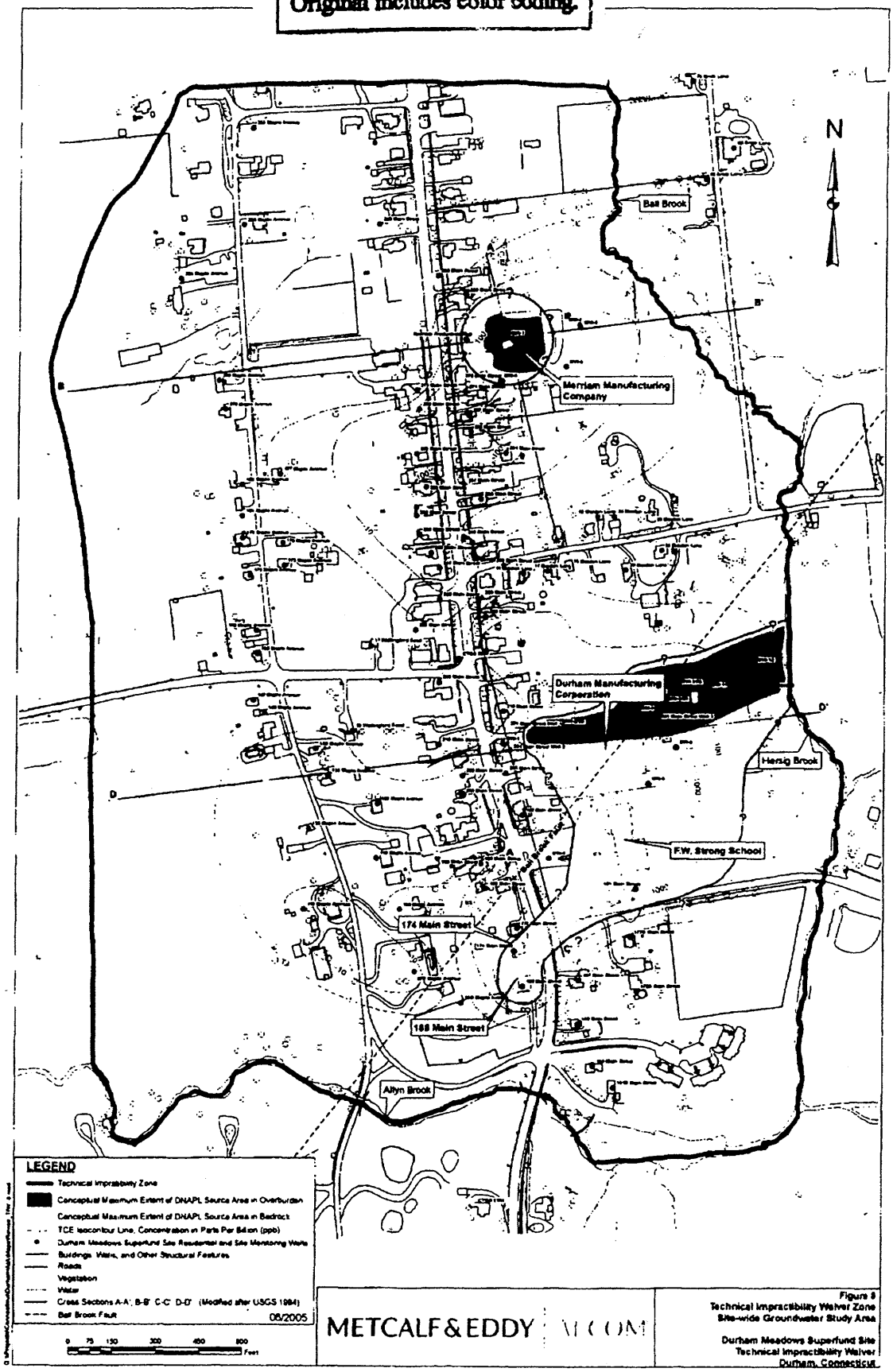

Figure 8
Technical Impracticality Waiver Zone
Site-wide Groundwater Study Area

Durham Meadows Superfund Site
Technical Impracticality Waiver
Durham, Connecticut