Report

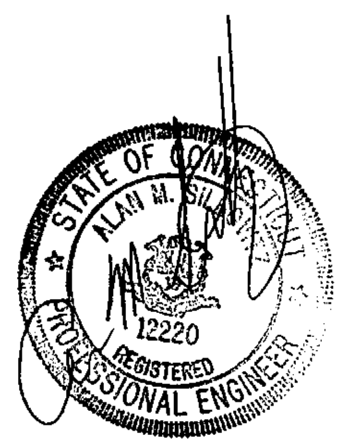
Town *of*

Haddam, Connecticut

Report on

Water System Evaluation Study
Tylerville Commercial Area

May 2000



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1.0 INTRODUCTION

This water system evaluation study has been prepared to assist the Economic Development Commission (EDC) in determining the best course of action for producing public water to the Tylerville Commercial Area (the service area along Bridge Street, between Saybrook Road and the Connecticut River). This study builds upon WSE's previous report titled *Report on Infrastructure Needs Tylerville Commercial Area and Higganum Village Center* and dated February 1999, that identified two (2) viable options for providing public water. The viable options include the creation of a community water system that would utilize a new groundwater supply adjacent to Tylerville and a connection to the existing Connecticut Water Company (CWC) distribution system in Chester, Connecticut. The connection point to the CWC system is located on Route 154 approximately 2½-miles south of the Commercial Area.

1.1 Purpose

The purpose of this study is to explore the feasibility of the two (2) water supply options in terms of technical constraints, initial capital cost, annual operation and maintenance cost, regulatory requirements, and impact on wastewater disposal. The water system options evaluated in this report include provisions for fire protection to the service area through the use of a storage tank. This report does not evaluate the use of a non-potable water system that would draw water from the Connecticut River for fire protection.

1.2 Initial Design Criteria

During the initial evaluation phase of this project, the Economic Development Commission (EDC) selected a water demand for the Commercial Area, established the limits of the service area for the system, and selected a well development site. The results of those decisions are presented below.

1.2.1 Demand

The water demand calculated in the *Infrastructure Needs Report* is utilized for the schematic design of the water system options and is shown in Table 1-1. It is assumed that the water demand established for the design visions will be adequate for growth in the Commercial Area during the next five (5) years. The water demand that was established for "full commercial development" is utilized as a guide for future expansion of water system components. A full discussion of the methodology utilized to establish the "design vision" and "full commercial development" water demand is included in Section 4.0 of our report titled *Report on Infrastructure Needs Tylerville Commercial Area and Higganum Village Center* and dated February 1999. The maximum daily water demand for the residences on Little Meadow Road was estimated at 14,000 gallons per day (GPD) with an average water demand of 7,000 GPD, and is included in the demand as shown on Table 1-1. Cost estimates presented in this report are based on creating a water system adequate to meet the "design vision (5-year)" water demand.

Table 1-1 Water Demand

Parameter	Full Commercial Development		Development to Design Vision (5 yr)	
Maximum Daily Water Demand	450,000 GPD	313 GPM	110,000 GPD	76 GPM
Average Water Demand (GPD)	181,000 to 312,000 GPD	126 to 217 GPM	45,000 to 74,000 GPD	31 to 514 GPM

1.2.2 Service Area

The EDC chose the boundary for the service area, which is shown on Figure 1. The boundary of the service area is the same as the "study area" from the WSE report titled *Infrastructure Needs Report* with the exception of the properties located on Little Meadow Road. These properties were added at the request of the EDC. Within the service area the water system will include service lines to homes and businesses from a larger water distribution main in the public right-of-way. The water system in the service area will also include fire hydrants located along the right-of-way at appropriate spacing.

The service area concept is used initially for conceptual design of the water system. Property owners outside of the delineated service area that are located along a transmission main are not presently included in the water service. If the water demand of those owners can be met by the existing system, the Town may allow such connections. If the demand cannot be met, then the system components will need to be reevaluated for changes necessary to accommodate the new users.

1.2.3 Well Site Selection

In the *Infrastructure Needs Report*, no specific properties were identified for a well site, but the location of a potentially productive gravel aquifer was noted. One of the primary criteria for not selecting a specific property was the lack of any large, Town-owned parcels in the vicinity of the Commercial Area. For this report, however, privately owned parcels are evaluated.

Initially, parcels were identified that, *if acquired*, appear large enough to meet the ownership requirements of the Connecticut Public Health Code (Section 19-13-B51d). For wells with withdrawal rates in excess of 50 gallons per minute (GPM), which is anticipated, the code requires that "Sanitary conditions within the radial distance required [a minimum of 200-feet] shall be under control of the well owner by ownership..." For this report, a well field that includes a 2x2 array of four (4) wells located 100 foot apart was utilized for site selection. The property size required is at least 5¾-acres, a 500-foot by 500-foot area. Only contiguous properties with this land area were considered for selection.

Two (2) properties of adequate size were identified in the vicinity of the Commercial Area. They include Camp Bethel, located on the east side of Camp Bethel Road northeast of the Commercial Area, and a former gravel pit, located on Rutty Ferry Road approximately ¾-mile north of the Commercial Area. The locations of these properties are shown on Figure 1.

The EDC considered both the properties and chose the property on Rutty Ferry Road. It should be noted that the Camp Bethel property is suitable for use as a well-site, but is also located in closer proximity to the contamination known to be present in private wells located within the Commercial Areas. WSE recommends utilizing the Rutty Ferry Road property in lieu of the Camp Bethel property to avoid possible contaminant transport that could occur if the Camp Bethel site were utilized. If this were to occur, significant treatment would be required at an additional expense. WSE has provided costs for the Camp Bethel site for purposes of comparison in this report. However, the system design is based on the Rutty Ferry Road site.

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2.0 SCHEMATIC DESIGN

Based on the criteria initially determined with the EDC, WSE prepared schematic designs of the distribution system, the well site improvements, tank storage, and transmission mains. Figure 2 shows an overall water system schematic, which includes the source of supply, the service area, and tank storage. The purpose of the schematic designs is to quantify those aspects of the water systems that are necessary to prepare planning level cost estimates for construction of the systems.

2.1 Water Distribution System

Water main within the service area, shown on Figure 1, is required along Route 154 (Saybrook Road) and Route 82 (Bridge Street). New water systems typically use 8-inch or 12-inch diameter, cement-lined, ductile iron (DI) pipes. There is little cost differential between the installation of an 8-inch diameter DI pipe and a 12-inch diameter DI pipe. However, the up front capital cost is significantly higher for the 12-inch diameter DI pipe and the potential flows for the area do not warrant the use of 12-inch pipe. Therefore, WSE recommends the distribution system consist of 4,800-linear feet of 8-inch DI main. Mains should be installed such that the top of the pipe is at least 4½-feet below the ground surface for protection against freezing and traffic loads.

Appurtenant construction includes fittings for bends and branches, 8-inch valves on the main, 1-inch copper service lines with brass corporations and curb stops (valves at the main and road right-of-way, respectively), and complete hydrant assemblies.

Where Route 82 crosses the railroad, the main will be constructed within a sleeve to eliminate the need to excavate across the railroad tracks. Within the sleeve, the main is also protected from damage due to the weight and motion of railroad cars.

2.2 Well Site Improvements

The schematic design for well site improvements was prepared in accordance with the technical requirements of the Department of Public Utility Control (DPUC) Regulations for *Application Procedures and Criteria for Issuing Certificates of Public Convenience and Necessity for Small Water Companies (Section 16-262m-8)*. These regulations are jointly administered with the Department of Public Health (DPH). Schematic design of well site improvements includes the following: the number and arrangement of wells, water treatment, and standby power. These features were evaluated and/or designed to the degree necessary to create planning level cost estimates.

The DPUC/DPH regulations require atmospheric (unpressurized) tank storage, hydropneumatic (pressurized) tank storage, and pumps for the transfer of water from the atmospheric to hydropneumatic tank. The DPH has confirmed that this system arrangement is not necessary, since tank storage is combined and located at a separate location from the well field. Ideally, tank location is opposite the service area from the water supply source. The water storage tank could be located at an elevation that will eliminate the need for transfer pumps and provide a reservoir of water for use during fire flow conditions and pressure stabilization during peak flows. The tank requirements and schematic tank design are discussed in Section 2.5.

Chemical treatment, power and control centers, and standby power generator could be housed in a building located adjacent to the well field on Rutty Ferry Road.

2.2.1 Wells & Pumping

The groundwater wells, which could be located at the former gravel pit, would draw water from an unconsolidated aquifer, meaning that the water is located above the bedrock surface. The United States Geological Survey (USGS) completed a study of this aquifer which concludes that individual wells may yield up to 370 GPM (530,000 GPD). In addition, the USGS determined that the aquifer in the vicinity of the proposed well field is 80-feet thick.

Well pumping rates are based on the maximum daily demand of the system. For the five (5) year design vision, the pumping rate would be 76 GPM. Based on the USGS study, it appears that a single well pumping at a minimum rate of 76 GPM would be achievable. The DPUC regulations require, however, that a minimum of two (2) wells are provided with the required pumping capacity. The second well is either used as a backup to the primary well, or the wells are alternated during normal service. The second well is also utilized whenever the primary well is being serviced, to ensure continuous service.

Full commercial development conditions will require a pumping rate of 313 GPM. If the pumping rate of the initial two (2) wells is increased to 80 GPM, then a well field would consist of four (4) primary wells yielding a total of 320 GPM and a fifth backup well, yielding a minimum of 80 GPM. The schematic design presented in this report is based on two (2) initial wells with 80 GPM pumping rates.

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2.2.2 Water Treatment

The Connecticut Department of Public Health regulates water quality through the Public Health Code, Section 19-13-B102, "Public Drinking Water Quality Regulations". The regulations specify water treatment based on the water quality determined for the source. When water quality parameters exceed the drinking water standards, treatment and disinfection may be required. Treatment determinations are based on evaluation of the following parameters: bacteriological (coliform), physical (color and turbidity), and inorganic chemicals. Water quality is also regulated after treatment as "ready for consumption" for the following parameters: physical (color, turbidity, odor), inorganic, pesticides, herbicides & PCBs, organic chemicals, radioactivity, and total coliforms. The regulations outline action levels and monitoring requirements for the various parameters.

Lacking actual analytical data for the source groundwater, several assumptions are required to determine the necessity and extent of water treatment. First, we assume that groundwater from the proposed wells will not be "under surface water influence" and, therefore, that filtration is not required. We further assume, conservatively, that chemical treatment will be required. This would include disinfection and corrosion protection. Since most groundwater in New England is acidic, treatment should include raising the pH to remain in compliance with EPA's Lead and Copper Rule regulations. We also anticipate that a system will be required to reduce lead and copper concentrations at the tap. A schematic of the chemical treatment processes is shown on Figure 2.

2.2.3 Standby Power

DPUC regulations require on-site, standby power, which is either a permanently installed generator capable of supporting the pumping and treatment systems in the event of an electrical outage or a similarly sized mobile generator. Aboveground fuel storage would be provided with containment equal to 110-percent of the storage tank volume. Fuel options include gasoline, propane, or diesel fuel. WSE recommends propane as the best fuel option as it can be used to avoid the potential for contamination from hydrocarbon fuels adjacent to the wells. Additionally, the chemical treatment building may be heated with the same propane source.

2.3 Transmission Main for Well Site Option

The transmission main from the Rutty Ferry Road well site to the service area is shown on Figure 1. The route starts at the proposed chemical treatment building on Rutty Ferry Road, continues on Rutty Ferry Road west to Route 154 (Saybrook Road). The route then follows Route 154 south, crossing Rutty Creek and connecting to the service area at a tributary to Rutty Creek. WSE recommends that the transmission main be a 5,000-linear foot, 8-inch diameter, cement lined, ductile iron pipe.

The transmission main from the Camp Bethel well site to the service area is shown on Figure 1. The route starts at the proposed chemical treatment building, continues south on Camp Bethel Road and connects to the service area on Route 82 (Bridge Street). WSE recommends that the transmission main be a 1,300-linear foot, 8-inch diameter, cement lined, ductile iron pipe.

Transmission routes directly through wetlands or along railroad right-of-way were avoided due to the increased, permitting, construction, and coordination cost.

2.4 Transmission Main for Public Water System Option

There are two alternate routings for the transmission main from the CWC system in Chester. The connection point is shown on Figure 3. WSE recommends that the transmission main be a 12-inch diameter, cement lined, ductile iron pipe to accommodate fire flow. CWC has estimated the static water pressure in the Commercial Area to be 85 to 100 pounds per square inch (psi) and estimated that fire flow would be approximately 1,300 GPM with 20 psi of residual pressure. This estimated flow is sufficient to handle half of the required fire flow demand. However, WSE recommends that hydraulic modeling be done to determine actual fire flows from the CWC system.

One alternate route is to proceed from the CWC connection north along the railroad right-of-way then crossing over to Little Meadow Road, continuing north on Little Meadow Road and connecting to the service area on Route 82 (Bridge Street). This alternate would provide water to residents on Little Meadow Road and to Camelot Cruises. However, the route will require increased permitting, due to wetland impacts, and coordination with DEP (DEP owns the right-of-way). In addition, construction along the railroad right-of-way would be difficult and costly. WSE anticipates that since an alternate viable option is available (presented below) that this routing would not be able to be permitted due to its environmental impacts.

The second alternate transmission main route would proceed 12,500-linear feet on Route 154, from the CWC connection, to the service area (see Figure 1). In order to service the residents on Little Meadow Road and Camelot Cruises, the distribution system would extend from Route 82 to Little Meadow Road. This would include an additional 3,500-linear feet of 8-inch diameter, cement lined, DI pipe. Since this alternative limits costs and environmental impacts, WSE recommends this routing.

2.5 Tank Storage

Distribution storage is provided to meet peak demands of short duration, minimize pressure fluctuations during periods of demand changes in the distribution system, and furnish a reserve for fire fighting. Storage may also serve to provide an emergency supply in case of temporary breakdown of pumping facilities or water main break. Equalization, fire, and emergency storage are typically allocated at specific levels within a storage facility to ensure the storage volume will be available at a hydraulic gradient adequate for the intended purpose. Equalization storage is provided within the top portion of the tank, with fire storage positioned immediately below. Emergency storage is located within the lowest portion of the tank. The following presents an analysis of the Tylerville Commercial Area distribution storage needs.

2.5.1 Equalization Storage

Based on information presented in the American Water Works Association (AWWA) M32, Manual of Water Supply Practices - Distribution Network Analysis for Water Utilities, the volume of water required for equalization storage within a tank should be approximately 15-percent to 25-percent of the maximum day demand for the area served by the tank. As noted previously, the maximum day demand projected for full commercial development of the Tylerville Commercial Area is approximately 450,000 gallons per day. The Town should plan to provide between 67,500 and 112,500 gallons of equalization storage, located such that every customer is provided with a minimum pressure of 50 psi. Based on our experience with similar water systems, WSE recommends equalization storage of approximately 25-percent of the maximum day demand, which is 112,500 gallons.

According to the DPUC Regulations *(Section 16-262m-8)*, a minimum pressure of 35 psi should be provided to customers under normal demand conditions. Thus, only the volume of water within a tank that will provide a pressure of 35 psi to the highest customer elevation can be considered usable as equalization storage. Most communities begin receiving pressure complaints from customers when water pressures dip below 50 psi, due to this WSE recommends the future highest elevated customer receive a water pressure of 50 psi (115-feet). A review of Figure 1 for the service area indicates the highest elevation served in the system could potentially be 90-feet (USGS). This elevation is found west of the Bridge Street and Camp Bethel Road intersection. The volume required for equalization storage, 112,500 gallons, would be provided above the elevation of 205-feet (90-feet + 115-feet) (USGS).

2.5.2 Fire Storage

Fire protection requires tank storage to supply the high flows that are required during a fire event, which range from 2,000 GPM to 12,000 GPM (American Water Works Association, Manual M31, Fire Flow Requirements). The required fire flow depends upon the structure and contents of buildings, the proximity of other buildings, weather conditions, and the length of time the fire has been burning. Theoretical calculations of fire flow by various agencies attempt to incorporate these variables. Using the Insurance Services Office, Inc. (ISO) method and lacking specific data for structures (construction class, floor area, number of floors, combustibility class, wall exposures, sprinklers and fire communication potential), the needed fire flow was estimated using a one-story, 16,000-square foot building of masonry construction with joists. Occupancy is considered "combustible" and minimal exposure or communication of fire is anticipated. The needed fire flow, rounded to the nearest 250 GPM, is 2,500 GPM. The period of time the fire flow is available is also a key component in determining fire protection tank storage, since quantity is the product of rate and time. In accordance with the National Fire Protection Association guidelines, for 2,500 GPM or less, the recommended fire duration is two (2) hours or a total of 300,000 gallons of water. This fire storage volume must be available at a pressure of 20 psi (46-feet) to the highest house elevation in the system. For a potential highest customer elevation previously noted as 90-feet (USGS), the volume of water required for fire storage would need to be provided above an elevation of 136-feet (90-feet + 46-feet) to be considered usable fire flow.

2.5.3 Emergency Storage

Any storage provided within the tanks below the elevation required to maintain the 20 psi pressure for fire storage is considered emergency storage, and would be used during pipeline breaks, raw water contamination, natural disasters, power outages or equipment failures. The volume required is a function of risk with respect to an interruption of supply and, typically, estimated to contain up to two days of the average day water demand.

2.5.4 Storage Tank Location

A storage tank location was selected based on the above criteria. WSE recommends the proposed tank be located off of the Route 9 connector road at the location shown on Figure 1. The location of the tank requires installation of an additional 2,800-linear feet of transmission main between the tank and service area, using groundwater supply wells, or 2,100-linear feet of transmission main, using the CWC system connection. The storage tank will also require a 900-linear foot access road.

2.5.5 Storage Tank Sizing and Options

Two storage tank sizes are recommended for the service area. The storage tank sizes correspond to the available water supply options and their ability to provide fire protection. The total volume required for fire protection is 300,000 gallons. If a groundwater source were utilized, the storage tank would be required to store all 300,000 gallons. However, if a connection were made with CWC, the volume of storage required for fire protection would be reduced to 150,000, since CWC could provide the remaining flow.

WSE recommends a flat bottom, dome roof reservoir storage tank for the groundwater source. It would have the approximate dimensions of 42-feet high and 42-feet in diameter and provide a total capacity of 435,000 gallons. This would provide the required equalization storage of 112,500 gallons over the top 9-feet of the tank while providing a minimum water pressure of 50 psi to every customer. The current highest building in the service area, at 90-feet, would receive a water pressure of approximately 54-psi (215-feet – 90-feet) when the tank is filled to its capacity at an elevation of 215-feet.

If the tank were built before the water demand increased, it could have stagnation problems due to its large size. When the water demands are low the tank will not drain and refill at the rate required to maintain the chlorine residual within the tank. This could lead to the growth of coliform bacteria within the system. If this were to occur, the town would need to install a local chlorine circulation system at the tank site and perform maintenance on the system at regular intervals until the water demand increased.

A standpipe type storage tank is recommended for the CWC connection alternative. The tank would be 38-feet high and 35-feet in diameter and have a total capacity of 273,000 gallons. This would provide the required equalization storage of 112,500 gallons over the top 13-feet of the tank while providing a minimum water pressure of 50 psi to every customer. The current highest building in the service area, at 90-feet, would receive a water pressure of approximately 56-psi (219-feet – 90-feet) when the tank is filled to its capacity at an elevation of 219-feet. The approximate capacity of the tank would be 273,000 gallons. The tank can be smaller than the groundwater source alternative tank since the fire flow demand can be supplemented by the CWC system. Due to this, the possibility of stagnation and the need for a local chlorine recirculation system is reduced.

Table 2-1 Water Storage Tank Analysis Results

Criteria	Result or Value	
Fire Flow	2,500 GPM at minimum 20 psi	
Fire Duration	2 hours	
Minimum Normal Demand Pressure in Service Area	50 psi	
High Ground Elevation in Service Area	90 feet (USGS)	
Minimum Tank Water Surface Elevation for Fire Storage	136 feet (USGS)	
Minimum Tank Water Surface Elevation to Provide 50 psi to Highest Ground Elevation	206 feet (USGS)	
	Groundwater Supply	*CWC Connection*
Overflow Elevation of Tank	215 feet (USGS)	219 feet (USGS)
Tank Capacity		
Equalization Storage	112,500 Gallons	112,500 Gallons
Fire Protection Storage	300,000 Gallons	150,000 Gallons*
Total Useable Storage Required	**412,500 Gallons**	**262,500 Gallons**
Total Storage Provided	435,000 Gallons	273,000 Gallons
Diameter	42 feet	35 feet
Height	42 feet	38 feet

* Assumes CWC system provides half of required fire flow.

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3.0 COST ESTIMATE BASIS

In this section, the basis of planning level cost estimates is presented. Using information generated in the schematic designs, overall cost estimates (See Section 5.0) have been developed. The planning level costs are typically the initial capital cost of the system necessary to meet the five (5) year demand. Certain components of the system will be adequate well beyond that demand, and others will require improvements to meet increased demand in the future. Where appropriate, the cost estimates also include engineering fees. Legal fees and land acquisition cost are not included in the estimates. All prices are based on December 1999 ENR costs. An evaluation of operation and maintenance cost is also presented.

3.1.1 Groundwater Exploration

The first phase of a well supply development includes groundwater exploration, which encompasses an engineering evaluation of the well site to determine potential test well locations. The locations of the test wells require approval by the DPUC/DPH in the first phase of the certificate process for a new water supply. Following DPUC/DPH approval, a well driller is hired to install the test wells and perform a pump test for a minimum of 72-hours. The driller will also install monitoring wells in the surrounding area to monitor the water surface level during the pump test. Analytical samples are collected during the pump test and submitted to a testing laboratory for analysis. It is anticipated that the test wells will be 8-inches in diameter. The overall cost of groundwater exploration, including engineering fees, drilling cost for two (2) test wells and monitoring wells, pump test cost, and analysis cost is estimated at $100,000.

3.1.2 Well Site Improvements

Improvements to the well site, following the groundwater exploration, include the following:

- the cost of conversion from individual test wells to an operational well field,
- the cost of water treatment equipment,
- the cost of power, standby power, and control equipment, and
- the cost of the chemical treatment building.

Conversion of the test wells would consist of installation of a submersible well pump and a "pitless adapter" which supports the well pump, well discharge line, and electronics (level

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measurement and power/control for the pump). The pitless adapter also provides a horizontal connection to the branch pipe in the well field. Further, the adapter seals the top of the well to prevent contamination from the surface. The branch piping that leads to each well joins a larger header pipe that leads to the chemical treatment building. The chemical treatment building will contain the water treatment equipment, electrical controls for power, pumping and metering, and the standby generator.

The estimated cost for converting the individual test wells to an operational well field is $80,000. Developing the site with a building and the necessary equipment for the well, such as electrical controls and the standby generator, is estimated at $200,000. These costs may vary after sampling of the test wells and specific types of water treatment are determined.

It should be noted that groundwater analytical data is not available and therefore actual treatment requirements can not be determined at this time. If additional treatment of the groundwater supply for compounds such as iron and magnesium is required, these costs could increase substantially.

3.2 Distribution System and Transmission Mains

The estimated cost of the distribution system and transmission mains was determined by using per foot prices that reflect the presence of service lines, the type of pavement repair, and the anticipated removal of rock from the trench. The initial unit price of a distribution main is estimated to be $85 per linear foot of 8-inch and $100 per linear foot of 12-inch main. The initial unit price includes the main with services and fire hydrants, excavation and backfill, rock removal from the trench, trench pavement repair, services, engineered design and contingency. Based on recent bid prices, service connections to the main, including corporations, curb stops, copper service line, excavation, backfill, and restoration, account for ten 10-percent of the bid price for the main. Therefore, the estimated unit price for a transmission main is $77 per linear foot for 8-inch and $90 for 12-inch main.

Where water main trench in the state right-of-way is located in pavement, an overlay from the centerline to the gutter will be required. The initial unit price includes trench repair only. The estimated cost differential between the overlay and trench repair is three dollars ($3) per linear foot.

The total initial capital cost of the various mains is included in Section 5.1.

3.3 Tank Storage

The flat bottom, dome roof reservoir for the groundwater source measuring 42-feet high and 42-feet in diameter is estimated at a base cost of $275,000, including fabrication and erection. WSE estimates the base cost of the 38-foot high, 35-foot diameter standpipe for the CWC connection at $225,000, including fabrication and erection. The tank location will require a 900-linear foot access road at an estimated cost of $100 per linear foot. Tank foundation, field painting, site work and engineering design for a storage tank must also be included in the tank estimate. The total estimated cost for these storage tanks, including the foundation, painting, site work, engineering design, access road and contingency is $525,000 and $475,000 respectively.

3.4 Operations and Maintenance

Although not included in the initial cost of a system, the operations and maintenance (O&M) cost can be sizeable, especially for smaller systems. The per capita O&M cost for a smaller, independent system is generally higher than the O&M cost of an outside provider, such as CWC, will charge. For the purposes of this report, the O&M costs are viewed over a 10 year annual cost that have been evaluated as a present worth cost for comparison. It was assumed that increased cost due to inflation represents 3% per year during the present worth analysis.

For a water supply system that uses a new groundwater supply, O&M costs are incurred for electricity, equipment maintenance, chemical supply, preparing sampling and testing, and personnel. From WSE experience, O&M costs for a similar sized system are estimated at $8,000 per month of operation, or $96,000 per year. The present worth of an annual cost of $96,000 over ten years with 3% inflation is $906,040. This represents the present total O&M cost to run the groundwater supply system for ten years.

For public water system connections, the operations and maintenance cost is translated into a user charge for water. Several options exist for the O&M and billing of the distribution system, but for this report it will be assumed that the CWC will perform the O&M on the system and bill the customers directly. Using the CWC current rate schedule that metered users pay, a total system cost can be evaluated using the average water demands (presented in section 1.2.1 of this report) and the assumption that there will be 200 service connections in ten years. The present cost for the entire system in 2010 based on the CWC rate schedule is $143,700. This is the cost that the customers will pay directly to the CWC for water service.

The present worth cost for the entire system in 2001 is dependent on the amount of customers that connect to the system. If 40 customers connect during the first year, the present worth cost the customers will pay to the CWC is approximately $28,800. For the purposes of comparison, it will be assumed that the amount of customers is increased incrementally from 40 in 2001 to 200 in 2010. The total present worth cost of water by the CWC over ten years would is estimated at $891,000.

The storage tank will require painting of the interior and exterior, this should occur at approximately 20- or 25-year intervals of service. Since this report is looking at a 10-year present worth analysis, no present worth cost was included for the repainting of the storage tank.

4.0 PERMITTING AND FUNDING

4.1 Permitting Requirements

The following state and local permits have been identified:

4.1.1 Certificate of Public Necessity

As previously discussed, community water systems must adhere to the Connecticut State Regulations regarding "Application Procedures and Criteria for Issuing Certificates of Public Convenience and Necessity for Small Water Companies", issued by the Connecticut DPUC on September 28, 1987. These regulations describe the three (3) phase process that is required to apply for a certificate, the design criteria for small public water systems, and financial, managerial, and technical qualifications of the applicant. The first phase (I-A) of the certification process is approval for the selection of well sites and permission to obtain a well drilling permit. The next phase (I-B) is an evaluation of the well yield and water quality so that the system can be designed in accordance with the regulations. The final phase (II) is certification of the system, which allows construction of the distribution, storage, and treatment systems to begin.

The certification process is a joint effort between the DPUC and the DPH, which regulates water quality issues. There is a regulatory schedule for review of applications by the DPUC/DPH. Phase I-A reviews are to be completed within 60-days of filing; Phase I-b, within 30-days of receipt of additional information; and Phase II, within 60-days of the final submissions on the system. The total review period is 5-months, but delays often occur during the review process, and the schedule does not include engineering and exploration time between submittals.

4.1.2 Diversion Permit

A diversion permit will be required from the Connecticut Department of Environmental Protection (DEP) since the maximum daily water demand is greater than 50,000 GPD. Recently, the DEP has added a general permit for withdrawal of up to 250,000 GPD under certain conditions, which includes water supply interconnections, community water systems, and diversions up to 250,000 GPD. General permits are characteristically easier to obtain than individual permits. General permits for diversion permit reportedly take 4-months to acquire. A specific diversion permit, as may be required for future demand (450,000 GPD), reportedly takes 1 to 2-years or longer to obtain from the DEP. One key component in the diversion permit process is the impact of the groundwater removal on adjacent surface water bodies and wetlands.

The well field appears suitably situated to avoid both of these impacts. Aquifer testing is needed, however, to determine the potential impact on adjacent water bodies or wetlands.

4.1.3 Road Encroachment Permit

The majority of the water distribution and transmission work will require an Encroachment Permit from the Connecticut Department of Transportation (DOT). The permit is administered by the District offices, which in the case of Haddam, is District II in Norwich. The contractor completing the work submits the application for the encroachment, together with bonds and insurance to the District Engineer. Prior to that time, the DOT is involved in an informal way checking that the drawings and specifications agree with State standards and the encroachment permit regulations. Prior to application for a permit, the DOT *may* stamp a set of drawings and specifications as generally acceptable to the DOT. The DOT has recently increased their requirements for pavement replacement and utility line coordination. Based on the pavement serviceabiltiy rating of a roadway, one-half of the roadway (or between adjacent roadway joints) may have to be milled and overlaid with 1½-inches of pavement.

4.1.4 Wetlands

Local wetland approvals will be required from the Wetlands Commissions in Haddam and Chester. The water system is anticipated to only impact wetland buffers for water main installed in roadway right-of-way. It is anticipated that less than 5,000-square feet of wetland will be impacted by the installation of the water system, eliminating application to the Army Corps of Engineers for approval.

4.1.5 Water Main Extension Approval

The Department of Public Health must be notified before making modifications to an existing public water system that have "sanitary significance" (19-13-B102 (d)(2)). Approval must be obtained prior to starting construction. The format of the notification is generally a letter prepared by the utility.

4.2 Potential Sources of Funding

The funding sources were identified by Ms. Ann Faust, Grants Administrator for the Town of Haddam. Ms. Faust has identified grants from the United States Department of Agriculture for water supply systems, Community Development Block Grants from the Housing and Urban Development Department for job creation, and grants under Title IX from the Department of Commerce for sudden loss of income. The demographics of the Town are not generally favorable for acquiring grants. Other possible sources of funding are the State Bond Commission and grants available from the Connecticut Department of Environmental Protection. Ms. Faust is continuing her research into grant funding.

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5.0 SUMMARY OF FINDINGS AND RECOMMENDATION

Water systems utilizing a groundwater supply or a connection to an existing public water system were studied to provide the EDC with technical, economic, and permitting information necessary to fully consider the option. Initial system configuration decisions by the EDC were utilized to create schematic designs of water systems, and the schematic designs were utilized to create planning-level cost estimates. Permitting by various state and local agencies is also summarized. In this section, we provide brief summaries of the initial cost of the water systems, the anticipated permitting effort, and the impact on wastewater design.

5.1 Summary of Initial Capital Cost

Table 5-1 presents a summary of the initial cost of a water system for the Tylerville Commercial Area, which utilizes a new groundwater source on Rutty Ferry Road. The estimates are based on the schematic designs and cost basis presented in Sections 2.0 and 3.0.

Table 5-1 Cost – New Groundwater Source (Rutty Ferry Road)

System Component	Estimated Initial Cost
Groundwater Exploration	$100,000
Well Site Improvements (1)	$280,000
Transmission Main Well Site to Service Area	$400,000
Transmission Main Service Area to Storage Tank	$255,000
Distribution Mains	$730,000
Storage Tank	$525,000
15% Contingency	$325,000
Total Option Cost	$2,615,000

Notes:
(1) It should be noted that additional treatment of the groundwater supply for compounds such as iron and magnesium may be required. This additional treatment would increase this cost substantially.

Table 5-2 presents a summary of the initial cost of a water system for the Tylerville Commercial Area, which utilizes a new groundwater source on Camp Bethel. The estimate is based on using a similar arrangement and equipment size as would be required for the Rutty Ferry Road site. No schematic design was performed in preparing this estimate.

Table 5-2 Cost – New Groundwater Source (Camp Bethel)

System Component	Estimated Initial Cost
Groundwater Exploration	$100,000
Well Site Improvements [1]	$280,000
Transmission Main Well Site to Service Area	$105,000
Transmission Main Service Area to Tank Storage	$255,000
Distribution Mains	$730,000
Storage Tank	$525,000
15% Contingency	$280,000
Total Option Cost	$2,275,000

Notes:
(1) It should be noted that additional treatment of the groundwater supply for compounds such as iron and magnesium may be required. This additional treatment would increase this cost substantially.

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Table 5-3 presents a summary of the initial cost of a water system for the Tylerville Commercial Area, which utilizes a connection to the CWC system in Chester. The estimates are based on the schematic designs and cost basis presented in Sections 2.0 and 3.0.

Table 5-3 Cost – Public Water Supply Connection

System Component	Estimated Initial Capital Cost
Transmission Main Public Water System to Service Area	$1,165,000
Transmission Main to Storage Tank	$190,000
Distribution Mains	$730,000
Storage Tank	$475,000
15% Contingency	$370,000
Total Option Cost	$2,930,000

5.2 Operation and Maintenance Cost

The ten-year present worth O&M cost for groundwater supply is $906,000, while the CWC connection cost is $891,000. Both of these estimates are relatively equal in cost, but this cost does not include a cost for a water meter reader or billing staff for the groundwater supply alternative. In the CWC connection alternative, administrative items such meter reading or billing are incorporated as part of the water rates.

The costs above are based on 200 water service connections ten years in the future. If only 100 connections are made, it is fair to assume that less money would be collected from water use rates. In a smaller system such as Tylerville, O&M monetary problems could develop if numerous service connections are not made to pay costs. An advantage to connecting to the CWC system is that the CWC would be directly responsible for this and the Tylerville Commercial Area could develop at a slower pace without affecting the water system.

5.3 Required Permits

For a water system supplied using new groundwater wells, the following permits are anticipated:

- Certificate of Public Necessity from the DPUC jointly with the DPH.
- Diversion Permit from the DEP.
- Road Encroachment Permit from the DOT.
- Wetlands Permit from the Haddam Wetlands Commission.

For a water system supplied by a connection to the CWC system in Chester, the following permits are anticipated:

- Road Encroachment Permit from the DOT.
- Wetlands Permit from the Haddam and Chester Wetlands Commissions.
- Water Main Extension Approval from the DPH.

5.4 Impact on Wastewater Systems

Creation of a water system in the service area will primarily impact wastewater disposal by reducing the separation distances required under the Connecticut Public Health Code, Section 19-13-B100 or B103, "Regulations and Technical Standards for Subsurface Sewage Disposal Systems". The code requires separation of 75 to 100-feet between drinking water wells and on-site wastewater disposal systems. The separation reduces to 10-feet from a water service line, therefore increasing the available land for development.

5.5 Recommendation

Based on the information presented in this report, Weston & Sampson recommends that the Town of Haddam connect to the Connecticut Water Company system to service the Tylerville Commercial Area. The cost for connection, distribution system and storage tank is estimated at $2,930,000. This cost is $315,000 higher than the estimated $2,615,000 Rutty Ferry Road well site option. The connection to the Connecticut Water Company could provide water to a smaller storage tank without the use of a well site and the required permitting and further study required for the well site. High pumping rates at the Rutty Ferry Road or Camp Bethel well site could be impacted by contaminated groundwater from the contaminated area, especially at the Camp Bethel site due to the proximity to the contaminated area. The cost to remediate the well sites due to contamination could be quite costly, if remediation could be accomplished at all.