Village of Monroe

Orange County, New York

Water Master Plan and Rate Study

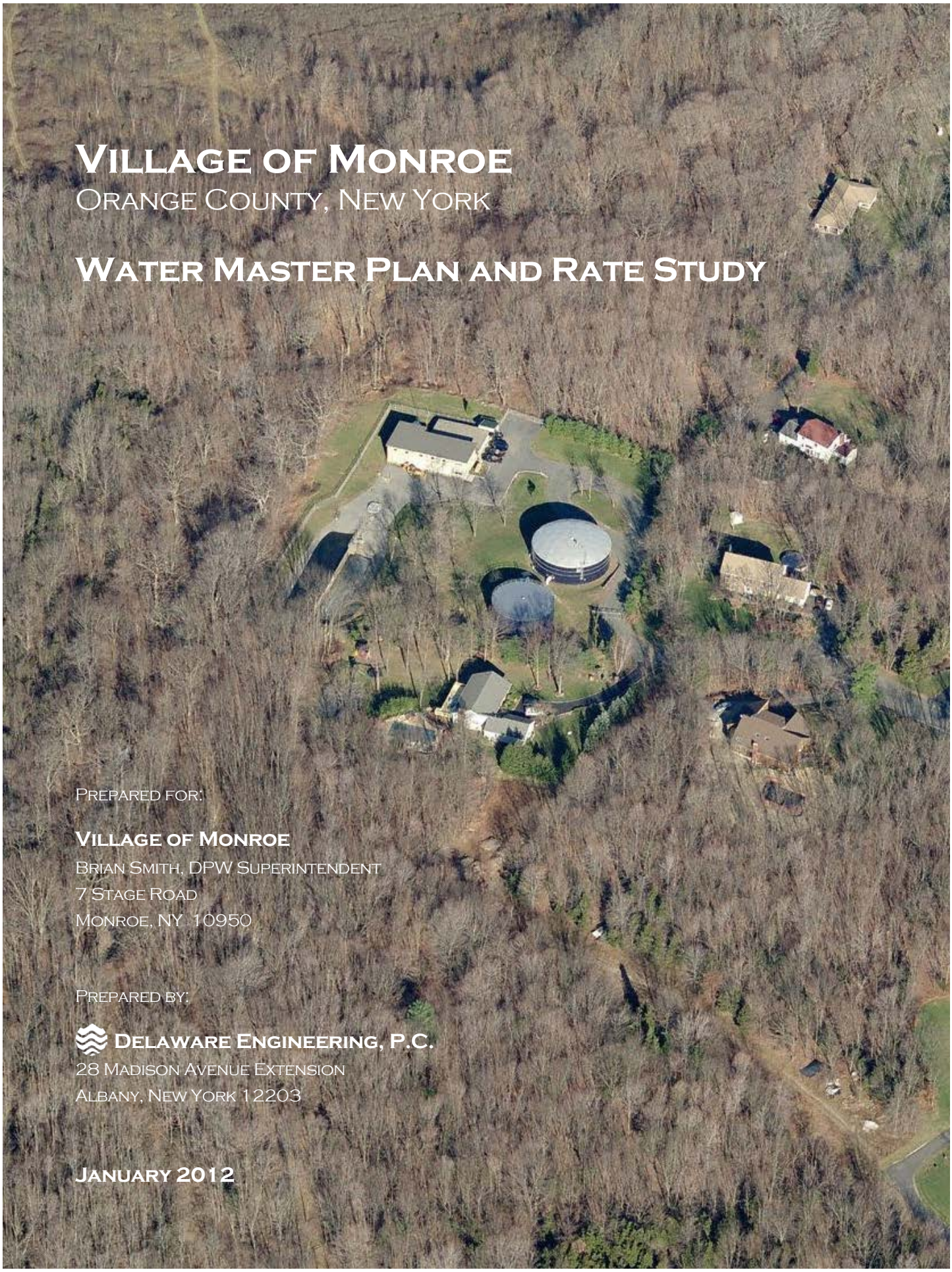

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TABLE OF CONTENTS

APPENDICES

1.0 EXECUTIVE SUMMARY

In 2007, the Village of Monroe engaged in a rate study, the purpose of which was to provide information to allow the Village to adjust water rates such that revenues from consumption based charges and service charges would fund operations, maintenance and debt for the water system. According to a report dated April 17, 2007 entitled "Water Rate Analysis for the Village of Monroe, Water District" prepared by Albert A. Natoli, P.C., as of February 28, 2007, $596,569.42 in Village General Funds had been used to support shortfalls in water revenue. In addition to discussing the revenue needs of the water system, the 2007 report also recommends review of the overall rate structure to provide equity among users based on the benefit received from the provision of water service.

The analysis contained in the 2007 report stated that water rates would have to rise 12.89% for Fiscal Year 2008 to meet the operating costs including capital and repayment of the General Fund. To accommodate the needed increase in revenue, a service charge was implemented. The service charges were allocated based on the percent of revenue generated from each type of customer class (e.g. Village Residential, Commercial, Town and Bulk). In-Village residential customers were charged $10.10 per quarter; $36.00 per quarter was charged to in-Village commercial customers; Town customers were charged $16.00 per quarter; and, bulk customers paid a service charge of $777.00 per quarter. The surcharges generated approximately 9% of the total revenue of the water system.

Through the imposition of a service charge for approximately five years commencing in 2007, the Village water system currently generates revenues commensurate with expenses. Having served the short term purpose of balancing revenues with expenses, the Village seeks to eliminate the service charge as well as the sliding rate scale in favor of a new, equitable rate structure that provides adequate revenue to support operations, maintenance, capital needs, debt service and generates a prudent fund

balance for the water system. The elimination of the service charge together with creation of a new consumption rate structure based on service categories without a sliding scale is in keeping with the recommendations of the 2007 report and accepted standards for municipal water rates.

In addition, a short term debt that was issued to balance the water system finances and fund capital projects will be satisfied in 2013 and a long term debt will be satisfied in 2014. Moreover, the Village is situated in a geographic region that has been and continues to be subject to significant residential and commercial growth which is a potential market for the sale of potable water. Thus, the Village is at a cross roads with respect to the water system, rate structure and future sale of water.

Recognizing this situation, the Village engaged in the preparation of a Water Master Plan to craft a valuable management and decision-making tool for the Village. The Village's goal is to adopt a set of policies and a strategy for the water system that will result in long term public support for investment in the water system. Adoption of a Water Master Plan that identifies the value of the water system to the Village residents not only in terms of ample, high quality water, but also in terms of revenue generation capabilities will create a framework for the Village's fiscal policy with respect to the water system.

The Water Master Plan is intended to provide a framework within which the Village of Monroe can plan, fund and execute maintenance of existing water system infrastructure and extend the useful life of existing equipment, provide safe and adequate service to all customers, ensure that peak flows can be achieved and consider the potential to sell increased volumes of water to neighboring communities. Subsequent sections of this report provide direct observations of the existing water system. By way of summary, recommendations resulting from the Water Master Plan are:

1. An evaluation of the transmission line between Mombasha Lake and the treatment plant is recommended.

2. The generator in the Pine Tree system should be evaluated and upgraded as appropriate.

3. Standby power at the High Street pump station should be evaluated.

4. Consideration of eliminating the backwash lagoons and connecting the filter plant backwash to the public sewer system that may be available in close proximity to the water plant due to a neighboring development project is recommended. Existing tankage at the treatment plant site may provide necessary flow equalization and should be evaluated.

5. The upgrade of control systems at the water plant as well as the opportunity to tie the pump stations into a single system should be evaluated.

6. Mapping of the water system including pipe locations, storage locations, volumes, sizes, materials, etc. should be conducted to allow for accurate management of the distribution system and prioritization of maintenance projects.

7. One or more of the test wells could be evaluated in more detail to determine the viability of increasing system capacity through groundwater resources. It appears that 0.3 MGD – 0.5 MGD could be available; however, competition by neighboring systems and the potential need for treatment of this groundwater may complicate this method of increasing system capacity.

8. While Mombasha Lake has a very limited watershed, information suggests that the lake level is very rarely lowered in any significant manner, suggesting that it may be in large part spring fed. An analysis of Mombasha Lake to increase the taking

(potentially from 2 MGD to 3 MGD) is recommended. If this effort is fruitful, the treatment plant could be expanded to treat the additional water resources.

Having identified a prioritized capital plan within the Water Master Plan, the Rate Study was conducted to determine a rate structure on a going-forward basis that will fund O&M as well as any remaining debt, provide capital for routine annual maintenance and system improvements (e.g. water line repairs and replacements, valves, etc.), and plan for the potential of future debt issuances for major facility upgrades. The objective of this exercise is to provide the Village with an analytical tool (e.g. an Excel spreadsheet model) that can be used by the Village to evaluate various rate structures to ensure the solvency and viability of the Village water system.

The Rate Study recommends cessation of the current service charges since the obligations associated with the service charge will be discharged in the very near future. A rebalancing of rates is recommended to eliminate the current sliding scale based on volumes of use in favor of a rate structure wherein Village residential customers pay the lowest rate equivalent to the benefit they receive from water service, while Village commercial users pay 1.5 times a residential customer to account for the benefit they receive from the ability to make profit in commercial enterprise, and Town and Bulk users pay 2.5 times Village residential customers.

In addition, the Rate Study indicates that due to a combination of the satisfaction of several existing debts associated with the water system as well as a rebalancing of water rates, the capital improvements recommended in the Water Master Plan may be undertaken in whole or in phases without significant increase in annual costs to the average user.

2.0 VILLAGE WATER SYSTEM EVALUATION

The Village of Monroe owns, operates and maintains a potable water system consisting of a surface water source, Lake Mombasha, a surface water treatment plant, a series of groundwater wells with disinfection facilities, potable water storage, and a distribution system that includes three pump stations to provide system pressure. The Village water system provides potable water to approximately 3,109 accounts, including 2209 residential connections and 385 commercial accounts within the Village. An additional 515 accounts provide water service to properties in the adjacent Town of Monroe through individual and bulk accounts. Annually, the Village sells approximately 348,496,815 gallons of water to these customers.

This report discusses the potential quantity and quality of existing and new water resources available to the Village, and evaluates the ability of the existing surface water treatment plant to meet existing average and peak demands. Furthermore, an assessment of the need for capital improvements for source water, transmission lines, treatment plant, storage, and distribution infrastructure is provided with a prioritization of recommended improvements and project budgets with the goal of extending the useful life of the facilities, maximizing quantity and ensuring regulatory compliance.

2.1 Water System Capacity

Typical water demand within the Village water system ranges from 800,000 GPD to 1.0 MGD; however, system operators report very high peak flow days on several occasions each year with flows up to 1.5 MGD and one extreme day that approached 2 MGD. These peak periods occur seasonally during the warmer months of the year. As described in more detail herein, the water treatment plant is challenged to keep pace with 1.5 MGD or greater demands due to the cycling of filters to increase treatment capacity. The Village has increasingly relied on groundwater resources to meet these

peak demands. However, the groundwater resources identified and utilized to date present capacity and quality restrictions that indicate the need to consider other means of achieving peak flows.

2.1.1 Surface Water Supply

The Village is permitted by the New York State Department of Environmental Conservation to draw water from Mombasha Lake for its potable water system (See Appendix A). Mombasha Lake is a large natural lake that was impounded at the turn of the Twentieth Century to increase its capacity. The Village owns the real property surrounding and underlying the Lake and sanitary control is excellent with few houses or pollution sources in the immediate area around the water source. Interestingly, given the reported volume, the Lake has an unusually small watershed due to topography.

A number of hydrogeological studies have been prepared over the years to evaluate the safe yield capacity of the Lake. Each study has used a basic and simple methodology. The Lake has a very small watershed, and as a result of using watershed based analysis, the hydrogeological studies have resulted in a determination that the Lake's safe yield is restricted to 2.15 MGD (See Appendix B).

In many cases, a simple watershed calculation to determine safe yield is appropriate; however, in the case of Lake Mombasha, it is noted that the Lake level is closely monitored by the Village under a wide range of seasonal conditions (e.g. wet and dry weather; average and peak withdrawals) and despite a wide range of recharge and withdrawal patterns, the Lake's level has fallen no more than two feet in actual fact, even under very dry conditions.

Given the lack of significant level fluctuations in the Lake level, it is reasonable to assume that the Lake is likely fed by groundwater in addition to runoff from its

watershed. It is not uncommon for similar water bodies to be supplied in large part by springs.

Due to the Village's desire to evaluate an increase in capacity for the purpose of water sales outside the Village limits, a hydrogeological analysis that takes into account the Lake's potential as a significant groundwater source as base flow in addition to the watershed contribution is recommended.

2.1.2 Treatment Plant Capacity

The treatment plant utilizes conventional rapid sand filters with Leopold filter blocks at the base. The original plant utilized three rapid sand filters for treatment. In 1999, two additional rapid sand filters were added by lengthening the building that houses the treatment equipment. The total approved treatment capacity is presently 2.1 MGD (See Appendix C).

If the Village wishes to pursue significant additional water sales and it is determined that substantial additional surface water taking on the order of 500,000 gpd to 1 MGD is permissible through a more sophisticated hydrogeologic study, expansion of the filtration plant would be considered. Unfortunately, the treatment plant site is limited in terms of space for expansion in a logical direction relative to the existing equipment layout. The existing building is not configured to allow for easy lengthening to add new filters; however, expansion of plant capacity is possible with a degree of additional costs. Because of this higher cost, expansion of the treatment plant may be fiscally prudent only if 500,000 gpd or more additional taking from the Lake is permitted.

2.1.3 Groundwater Supply

The Village has advanced a number of groundwater wells on lands owned or controlled by the Village in an attempt to ensure adequate water supplies during peak demand

periods when the water plant is challenged to provide for the total demand. Presently, Well #4, which is located behind the Smith's Clove Park, is currently in use. The operating capacity of Well #4 is 300,000 gpd. This well and its disinfection system operate automatically in concert with the water level in the storage tank at the treatment plant.

The other wells that have been advanced by the Village produce water with levels of salt, iron and manganese and/or turbidity that render the water unsuitable for distribution with disinfection alone. More advanced, and costly, levels of water treatment are required for these sources of water. As such, no well other than Well #4 has been developed beyond the initial stage of test well development.

To be thorough with respect to the potential for groundwater resources, the Village has recently advanced a well testing program at the Race Track on a large Village owned parcel near Ramapo Creek. A number of test wells were advanced and each is reported to have elevated levels of salt, which may be due to roadway drainage or other environmental conditions. Given the limited information available regarding these wells, it is not possible to determine if any of these could be viable as source water. Additional testing would be required to determine the viability of the Race Track wells.

The Villages of Harriman (to the east) and Kiryas Joel (to the north) each have significant water supply systems that appear to rely on groundwater (well) resources. During well tests within the Village, these other wells were closely monitored for interference. While it appears that with additional analysis, one or more of the test wells drilled by the Village could be developed to supply an additional 300,000 to 500,000 gpd, the wells in the Village of Monroe will be competing with other area wells for groundwater resources. Additionally, the density of development in the Village presents an ever-present potential for sources of contamination of these wells by salt, petroleum, etc. with the possible exception of those drilled in the Park. Ideally, wellheads should be

protected from potential sources of contamination by being located where there are three to five acres of land controlled to minimize the introduction of contaminants.

2.1.4 Storage Capacity

The existing Village water system has 1,500,000 gallons of storage, which equates to a single day's volume at peak demand. It is reported that the hydrants are used for fire-fighting water volumes. The potential combination of a significant fire-fighting water need on a day with peak demand and low water tank volume is a risk to the Village.

In addition, it is generally prudent to accommodate peak demands with storage rather than additional water supply capacity. Storage is a safe and relatively inexpensive means to address both fire-flows as well as peak demands. While increasing water supply/treatment capacity to address these needs is possible, it is more costly and less reliable due to the need to increase production of treated water which introduces many variables such as potential mechanical failures of treatment equipment that do not exist in comparison to relying on storage and gravity.

Based on the cost and reliability, it is recommended that peak flows from either seasonal demand or fire-fighting are met through construction of a new storage tank. The recommended volume of the tank based on an analysis of water system demands ranges from 1,000,000 to 2,000,000 gallons. The Village owns land on Bald Hill that provides the elevation necessary to function properly and improve water circulation given the elevation of the other tanks in the Village's system. In addition, locating a storage tank across the Village from the water plant/tanks is prudent to provide continued services in event that there is a water line break.

2.2 Pumping and Distribution Systems

2.2.1 Pine Tree System

The Pine Tree System serves the Pine Tree Elementary School and consists of a pump station and 0.5 MG ground-level tank on the same parcel. The tank has been painted within the past ten years and appears to be in good condition. The tank is filled by booster pumps that operate based on a pressure switch in the panel without any remote communications to the water plant or a central location for operator interface. Fire flow is supplied by a motor driven fire pump at this location; however, this pump is not in regular use. Critically, the pump station does not have a standby power system. Thus, when there is a power failure, water pressurized and supplied by this pump station to the School and any other service connections is not available.

Given the lack of certainty of the operations of this pump station under all conditions (e.g. power outage, fire, etc.), it is recommended that the pump station be upgraded by either installing a small generator for the booster pumps and servicing the fire pump and setting it up to exercise automatically, or installing a larger generator to power the fire pump as well and converting the pump to an electric motor drive that will operate with power from either the utility or generator. Remote alarm controls for this system are desirable.

2.2.2 High Street System

The High Street area is provided pressure by a pump station and 0.125 MG elevated tank on two parcels. As with the Pine Street tank, the tank associated with the High Street system was painted in the past ten years and appears to be in good condition.

The pump station has two small low-lift pumps that increase pressure to fill the tank. The pumps operate via a pressure switch in the panel without remote communications

to the water plant or a central location for operator interface. A standby generator is provided for this system; however, it appears to be aging and reliability could be questionable. In addition, the generator is powered by diesel fuel from an underground fuel storage tank.

Recommendations for the High Street system include the replacement of the generator with a new natural gas powered unit as well as abandonment of the underground fuel tank. The implementation of remote alarms and controls for this system is desirable.

2.2.3 Briar Cliff System

Constructed less than five years ago, the Briar Cliff system consists of a pump station and tank. This system has appropriate standby power. While there are no recommendations for improvements in this system, similar to the Pine Tree and High Street, there are no remote alarms or controls for this system and thus, installation of such facilities is desirable.

3.0 RECOMMENDED IMPROVEMENTS

This report outlines the existing and potential sources of water as well as transmission, treatment and storage for current and future sources of water. The following are recommended improvements based on this evaluation. Prioritization and cost estimates are provided in Section 4.0.

3.1 Water Treatment Plant Improvements

3.1.1 Filter Backwash Disposal

The 1999 filter plant improvement project included construction of two asphalt-lined lagoons that were intended to thicken solids from the backwash of the water treatment process. While these lagoons are permitted and operable, the efficiency and effectiveness of this aspect of plant operations is poor and a less operator-intensive method of solids handing would be beneficial.

A new housing development is being planned in the vicinity of the water plant that may result in the installation of a public sewer line within 2000-ft of the water plant. If the housing development is constructed and the public sewer extended towards the water plant, it would be prudent to eliminate the lagoons as well as the SPDES permit associated with them, and install a gravity or force main to direct the backwash from the water treatment plant to the new sanitary sewer system for eventual treatment by the County sewer district.

To accomplish this, surges in flow from backwashing filters would likely need to be equalized. Fortunately, an existing backwash tank that was originally installed for the purpose of recycling a portion of the backwash could likely be adapted to provide the needed equalization.

If it appears that this housing development is progressing towards construction, an evaluation of the sewer system is recommended to determine the capacity of the collection and treatment system to accommodate backwash flows from the water plant.

3.1.2 Process Control Systems

Each filter at the water plant currently relies on a distributed control system for operations. If one unit fails or is damaged by a voltage surge, the other units should continue to operate. However, the distributed control system duplicates electronics and is more complicated to maintain and operate.

The filters are each operated by a proprietary Leopold control panel that utilizes components that are obsolete; unfortunately, replacement parts are no longer available. Thus, the control panels will require refurbishment when they fail.

Given this situation and the lack of remote alarms and controls at the distribution system pump stations, it is recommended that the filters as well as other plant components and the remote tanks and pump stations are integrated into a single Programmable Logic Control (PLC) system. This simplifies maintenance of controls and allows remote access to the system for the operator in the event of plant or pump station problems.

3.1.3 Other Plant Issues

The 1999 building extension appears to have settled; the settlement is reportedly being monitored and is not severe at this time, but should continue to be monitored for any significant changes.

3.2 Water Transmission and Distribution System Improvements

The transmission mains from the Lake to the water plant are reported to be very old and little is known of their condition. These lines could have significant leakage without detection since there is no means to meter flows from the intakes in the Lake to the water plant.

Given this lack of information and the need to ensure the reliability of the transmission of water from the Lake to the plant, it is recommended that excavation be conducted to expose the water lines at regular intervals between the Lake and the plant to observe the physical condition of the lines. At the same time, with the plant shut down, a leak correlator should be used to listen to the pipes and determine if there are significant leaks and if so, the location of the leaks.

A significant issue has been identified in the lack of accurate information regarding transmission and distribution pipelines. This is problematic for a number of reasons including the need for the operators to understand the system hydraulics and be able to quickly locate pipelines in the event of water line breaks or other circumstances. Additionally, the hydraulics of the water system are unclear, making it challenging to reliably determine the ability to provide proper service at required volumes and pressures at existing and potentially new service connections. While some mapping exists, it is incomplete and separate for individual extension projects.

The Village would benefit from an effort to consolidate the various maps and plans. In the process of preparing a map of the distribution system piping, information should be consolidated to provide the age, pipe materials and sizes, hydrants, valves and any record of unusual service needs. Based upon this effort, a prioritized schedule can be developed for replacement of problem areas. There are dead ends at several points in the system which should be looped to improve flow. Preparation of the map of the

system will allow for planning of these connections. Eventually, use of a GIS-based system for this information is ideal.

Once a consolidated map is developed, a significant effort will be required by the Water Department or others to field verify the mapping. A map that represents the present effort to consolidate the mapping information is presented as Appendix D.

4.0 PRIORITY LIST AND RECOMMENDED BUDGET

Improvement	Budget	Purpose	Priority
GENERATORS			
Pine Tree Pump Station	$ 150,000	Standby Power	Near Term
High Street Pump Station	$ 50,000		
Subtotal	**$ 200,000**		
SCADA			
Wells #4	$ 15,000	Controls & Alarms	Near Term
Pine Tree Pump Station	$ 15,000		
High Street Pump Station	$ 15,000		
Briar Cliff System	$ 15,000		
Water Treatment Plant	$ 50,000		
Subtotal	**$ 110,000**		
DISTRIBUTION SYSTEM IMPROVEMENTS			
Water Line Improvements	**$ 1,000,000**	Flow & Pressure	Near Term
		Near Term Priority Total	**$ 1,310,000**

DISTRIBUTION STORAGE			
Reservoir - 2 Million Gallons	$ 1,400,000	Peak Demands	Intermediate Term
Transmission to/from Reservoir	$ 400,000		
SCADA at Reservoir	$ 15,000		
Subtotal	**$ 1,815,000**		
WATER PLANT BACKWASH HANDLING			
Connection to Public Sewer - 2000 LF	**$ 400,000**	Eliminate Lagoons	Intermediate Term
		Intermed. Term Priority Total	**$ 2,215,000**

INCREASE WATER SUPPLY			
Lake Mombasha Hydrogeo Analysis	$ 35,000	Study Capacity Increase	Long Term
Ground Water Resource Analysis	$ 200,000		
		Long Term Priority Total	**$ 235,000**

Subtotal of All Recommendations	**$ 3,760,000**
Contingency, Engineering & Legal (25%)	$ 940,000
TOTAL OF ALL RECOMMENDATIONS	**$ 4,700,000**

5.0 WATER SYSTEM OPPORTUNITIES AND CONSTRAINTS

The Village of Monroe is fortunate to have the asset of a public water supply system to support land uses in the Village and the surrounding Town. The opportunities for the Village include:

- Independence and control over water resources and provision of service that is a pre-requisite for continued sustainability of the Village.
- Relatively low-cost needs for improvements to extend the useful life of the Village's water infrastructure and improve system reliability.
- Opportunities to sell water within and outside the incorporated boundaries of the Village as a means to support the water systems and to generate excess revenue for the Village to use for other public purposes.

The Village's water system has relatively few constraints; however, those identified in this Master Plan include:

- Relatively small watershed for surface water resources that may constrain safe yield and ultimately the amount of water that can be withdrawn from Lake Mombasha for treatment and distribution.
- Geological and environmental challenges to developing additional sources of supply from groundwater.
- Competition from neighboring communities for the sale of water to land uses in the neighboring Town of Monroe.

6.0 RATE STUDY

6.1 Methodology

To accomplish the Rate Study, a review of the detailed operating budget for the water system as well as debt schedules for existing obligations was conducted. Detailed metered water sales (consumption and revenue) were analyzed. Since a goal was the elimination of the service charge, the revenue from that charge was also evaluated. The information from the Water Master Plan with respect to capital plans for the water system improvements including annual repair and maintenance was considered with respect to potential future debt obligations.

Once this information was gathered and analyzed, it was modeled to evaluate the current fiscal situation as well as potential rate scenarios. A rate model using an Excel spreadsheet was created. It re-creates present day fiscal conditions including current revenues and expenses and then is constructed to evaluate a number of future scenarios involving rate structures. For each scenario, the impact on rate payers was evaluated based on the current rate structure (consumption plus service charge) as well as modification of the rate structure (e.g. rebalance consumption and service charges, eliminate service charges, simplify consumption categories, eliminate consumption for some or all categories and impose flat charges, etc.). The rate modeling is presented in Appendix E.

6.2 Summary Results

The Rate Study indicates that the imposition of the service fee in combination with the short-term borrowing has balanced revenues to expenses for the present operation of the water system. Thus, the service fee can be eliminated without negative fiscal consequences. Furthermore, it is noted that several existing debt obligations will be satisfied between 2013 and 2014 creating an opportunity to invest in extending the useful life of the water system

and potentially adding capacity for sale to outside users with very little change in existing annual costs.

Another observation from the Rate Study is that the existing rate structure involves a sliding scale of rates based on water use. There is no distinction in the rates between residential and commercial users within the Village; Town and Bulk users pay a premium for water service. Based on the number of customer accounts, the volume of water sold, and the rate structure, a blended rate of $3.40 per 1000 gallons was used to determine existing costs to the typical Village residential or commercial customer.

Using the current water system budget and an escalation in operations and maintenance (O&M) costs of 0.5% per year, the annual budget was projected from 2013 to 2023. The projection includes the satisfaction of existing debts in 2013 and 2014. From this projection, an annual O&M revenue requirement was created for each year from 2013 to 2023. To the annual O&M projection, the cost of debt services for the recommended improvements derived from the Water Master Plan was added. To be conservative, the budget for all recommended improvements, short, intermediate and long term, of $4,700,000 was used and conservative terms for bonding the improvements (4% for 20 years net level debt) was used in the model. Given the historically low interest rates of the present day, it is likely lower costs of borrowing will actually be available to the Village.

Two rate scenarios were evaluated to fund the combined annual revenue requirements based on O&M and debt projections. Rate 1 mirrors the current rate structure where Town users pay 2.24 times Village users and Village residential and commercial users are treated equally. Rate 2 provides a rate structure wherein Village residential customers pay the lowest rate equivalent to the benefit they receive from water service, while Village commercial users pay 1.5 times a residential customer to account for the benefit they receive from the ability to make profit in commercial enterprise, and Town and Bulk users

pay 2.5 times Village residential customers. The Village has indicated that Rate 2 is preferred.

Utilizing Rate 2, the projected increase in O&M over time and the repayment in annual debt service for the recommended improvements, the average Village residential customer may see a slight decrease in cost over present rates of approximately $24 per year. Average commercial customers in the Village would see a slight increase in cost per year of approximately $151 and Town and Bulk customers would also realize a slight increase in annual costs of approximately $45.

In addition to funding on-going O&M and the recommended improvements to the water system, Rate 2 assists the Village create a fund balance that, if allowed to accumulate, would be approximately $650,000 in value within the ten year projected period of the rate model.

6.3 Rate Recommendation

The recommended improvements can be supported with very little impact to average users in the Village and Town due to a combination of satisfaction of existing debt obligation and rebalancing the rate structure using Rate 2 to create equity among users based on the benefits of receiving public water from the Village of Monroe water system. The use of Rate 2 is recommended whether or not the Village proceeds with any level of capital investment in the water system.

APPENDIX A

Water Supply Permit

ECL-20-6(10/90)-25c R3

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

D.E.C PERMIT NUMBER
3-3340-00157/00001

FACILITY/PROGRAM NUMBER(s)
WSA# 9939

PERMIT
Under the Environmental Conservation Law (ECL)

EFFECTIVE DATE
September 27, 2000

EXPIRATION DATE
None, except see General Condition #11 on page 3.

TYPE OF PERMIT (Check All Applicable Boxes)
☒ New ☐ Renewal ☐ Modification ☐ Permit to Construct ☐ Permit to Operate

☐ Article 15, Title 5: Protection of Waters	☐ Article 17, Titles 7, 8: SPDES	☐ Article 27, Title 9; 6NYCRR 373: Hazardous Waste Management
☒ Article 15, Title 15: Water Supply	☐ Article 19: Air Pollution Control	☐ Article 34: Coastal Erosion Management
☐ Article 15, Title 15: Water Transport	☐ Article 23, Title 27: Mined Land Reclamation	☐ Article 36: Floodplain Management
☐ Article 15, Title 15: Long Island Wells	☐ Article 24: Freshwater Wetlands	☐ Articles 1, 3, 17, 19, 27, 37; 6NYCRR 380: Radiation Control
☐ Article 15, Title 27: Wild, Scenic & Recreational Rivers	☐ Article 25: Tidal Wetlands	☐ Other _____
☐ 6NYCRR 608: Water Quality Certification	☐ Article 27, Title 7; 6NYCRR 360: Solid Waste Management	

PERMIT ISSUED TO
Village of Monroe

TELEPHONE NUMBER
(845) 783-8341

ADDRESS OF PERMITTEE
7 Stage Road, Monroe NY 10950

CONTACT PERSON FOR PERMITTED WORK
Alfred Fusco, P.E.

TELEPHONE NUMBER
(845) 343-3759

NAME AND ADDRESS OF PROJECT/FACILITY
Village of Monroe well field

LOCATION OF PROJECT/FACILITY
Archer Drive

COUNTY	TOWN	WATERCOURSE/WETLAND NO.	NYTM COORDINATES
Orange	Monroe	N/A	E: N: 4

DESCRIPTION OF AUTHORIZED ACTIVITY

Take an additional supply of water for use in the existing system by the installation of 3 wells (Well #2, #3, #4 capacities of 230, 200 & 300 gpm respectively) with a combined capacity of 730 gpm. This amount will serve as reserve for emergencies, for the existing Mombasha Lake Reservoir. The total permitted withdrawal rate of the system remains at 2.1 million gallons per day.

By acceptance of this permit, the permittee agrees that the permit is contingent upon strict compliance with the ECL, all applicable regulations, the General Conditions specified and any Special Conditions included as part of this permit.

DEPUTY PERMIT ADMINISTRATOR	ADDRESS	
Michael D. Merriman	21 South Putt Corners Rd., New Paltz NY 12561	☞ lrw
AUTHORIZED SIGNATURE: Michael D. Merriman	Date: September 27, 2000	Page 1 of 5

ADDITIONAL GENERAL CONDITIONS FOR ARTICLE 15, TITLE 15 (Water Supply)

9. Prior to starting work on any construction authorized herein, detailed plans of the structures proposed to be built and specifications for such work shall have been submitted to and approved by the Department. Thereafter such construction work shall be entirely completed in full accordance with the plans and specifications which have been submitted and approved.
NOTE: Approval by this Department of final plans and specifications, and of completed works, will not be issued until equivalent approvals have been issued by the NYS Department of Health.
10. Section 15-1529 of the Environmental Conservation Law forbids the operation of any of these works until, as constructed, they have been approved by the Department. Such final approval will be given only on written request. In general, such approval will not be given until all provisions affecting quality of the water and safety of the works have been complied with in full.
11. The Department reserves the right to rescind this permit or to take whatever action it may deem suitable and proper if the works authorized to be constructed herein are not initiated by _____ December 31, 2001 _____.

SPECIAL CONDITIONS

1. All the property owned by the permittee around these wells shall be protected and controlled in order to prevent pollution of the ground or groundwater by direct ownership of the land or by the acquisition of protective easements or other appropriate measures.

2. This area shall further be protected from pollution by surface waters originating outside thereof by the construction of suitable diversion ditches or embankments and the development of the water sources shall be so carried out that there shall be no opportunity for pollution entering the water sources.

3. The physical pumping facilities and controls shall be protected against damage or tampering either by a fence or other suitable enclosure or by their manner of construction and installation.

4. Before any water from the well(s) may be used for any purpose, after prolonged pumping test(s), the applicant shall have caused a sample of the water from each to be collected and analyzed, shall have submitted the results of such analyses to the New York State Department of Health in Albany and shall have been advised by that Department either that the water is of a satisfactory sanitary quality or that certain specified treatment or purification thereof is necessary. In this last case such water shall be used only after full compliance with all of the requirements of that Department.

5. The Department reserves the right to require the taking of further sanitary precautions or the further treatment or purification of the water from this source should conditions in the future indicate a need for such action.

6. Nothing contained herein shall be held to authorize the permittee to distribute water to any other district or service area which has not already been approved by the Department or its predecessors without having received a further permit from the Department.

7. Provisions shall be made to provide an adequate supply of water to those residents whose private well water systems are diminished or rendered non-productive by the use of the wells developed by the Permittee.

8. Provisions shall be made to minimize erosion during the construction of the project and to prevent increased sedimentation in any water body on or adjacent to the project.

9. Water used for disinfecting mains, if discharged to area streams, must have a chlorine residual not exceeding 0.05 mg/l at point of discharge.

DEC PERMIT NUMBER		
3-3340-00157/00001		
PROGRAM/FACILITY NUMBER		PAGE 3 OF 5
WSA# 9939		

SPECIAL CONDITIONS

For Article 15 (Water Supply)

10. Upon completion of the construction authorized by this Permit, and the commencement of taking of supplies of water from the source(s) so authorized, all existing facilities indicated in this application as unnecessary to the future operation of the system shall be permanently disconnected therefrom, the piping plugged, and any wells so disconnected capped and sealed, all in manner satisfactory to the New York State Department of Health. The facilities thus abandoned shall not again be used for public water supply purposes without a further Permit from the Department of Environmental Conservation.

11. The permittee is hereby prohibited from developing any new sources of water, replacement sources of water, or increasing the pumping rate from existing sources above the levels approved in this permit, without first obtaining a Water Supply permit from this Department.

12. The permittee must install a water meter on any new service connection prior to supplying water to that connection. A new service connection means a permanent water service drawing from the permittee's water distribution system, after the issuance date of this permit, and which has had no previous water service from a water purveyor.

13. By no later than five years from the issuance date of this permit, the permittee must have meters installed on all existing and new service connections.

14. At least once every ten years, the permittee must have all its water meters calibrated for accuracy according to AWWA standards.

15. The permittee must repair each leak within one month of the leak having been detected.

16. At least once every three years, the permittee must conduct a leak detection program that covers the permittee's entire water distribution system.

17. The permittee must maintain records of annual metered water production and consumption. The data in these records must be tabulated according to a system that can be used to identify the water demand by consumption category. Consumption category includes residential, commercial, industrial, public/governmental and institutional accounts. The records must be maintained for at least ten years.

18. Prior to water service for a newly constructed building, the permittee must obtain proof that only approved plumbing fixtures, defined in ECL 15-0314, were used. Such proof must be in the form of a building inspector report.

SPECIAL CONDITIONS

For Article 15 (Water Supply)

19. The water supply facilities shall be installed prior to the time any purchaser of a residence shall reasonably require a connection to the system. This obligation shall be included as a covenant in the deed conveying each lot to the purchaser and such covenant shall further obligate the Permittee to provide a connection to the water system when reasonably required by each purchaser.

20. The permittee must provide the Department with any records required by this permit within two weeks of a written request for such records by this Department.

STATE ENVIRONMENTAL QUALITY REVIEW

Under the State Environmental Quality Review Act (SEQR), the project associated with this permit is classified as an Unlisted Action and the Department of Environmental Conservation (DEC) has determined that it will not have a significant effect on the environment. Other involved agencies may reach an independent determination of environmental significance for this project.

Distribution:
J. Marcogliese
G. Behn
D. Iyekekpolor
K. Gupta, NYSDOH
D. Benedict, Lanc & Tully
A. Fusco, Fusco Unlimited

DEC PERMIT NUMBER		
3-3340-00157/00001		
FACILITY ID NUMBER	PROGRAM NUMBER	Page 5 of 5

APPENDIX B

Water Supply System Water Shed Yield Study

VILLAGE OF MONROE
WATER SUPPLY SYSTEM
WATER SHED YIELD STUDY

VILLAGE OF MONROE
7 STAGE ROAD
MONROE, NEW YORK 10950

DECEMBER 2000

Prepared By

FUSCO UNLIMITED
94 Mountain Avenue
Middletown, New York 10940
(845) 343-3759

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Executive Summary

The Water Supply System for the Village of Monroe was evaluated to determine safe yield in a drought situation and for its capability to meet current needs. A yield evaluation was made for drought conditions similar to that experienced in the mid 1960's, which is considered the worst on record, and possibly worse than the statistical 100 year drought. Information used to assist in this evaluation included records of the Monroe Filter Plant Operators and the Monroe Water Department, rainfall records as measured in the Town of Wallkill, Orange County, New York, stream flow records from the Shawangunk Kill as compiled by the USGS, and our own field evaluation.

The Monroe Water Supply System is a surface supply system, which includes Mombasha Lake with a volume of 1.438 billion gallons, according to a study done by Wehran Engineering, P.C., dated June 1987. A previous study done in 1941 determined the volume to be 1.622 billion gallons. Mombasha Lake is in the Town of Monroe in Orange County, New York. The results of this study are briefly summarized as follows:

Available yield of the Monroe Water Supply System as it presently exists, based on a drought similar to that experienced in the mid 1960's. 2.15 mgd

Present day demands:
Monroe Water System 1.010 mgd (1999)

Introduction

The purpose of this report is to present an updated yield determination for the Village of Monroe Water Supply System. The yield determination is based on historical data for water shed flows, water consumption, and rainfall, and also from recent field measurements taken to calculate water shed flows.

Description - Monroe Raw Water Supply System

The surface water supply source for the Village of Monroe is Lake Mombasha, which is shown on the accompanying maps, (Figures 1 and 2) and in the tabulation (Table 1) shown below. Reservoir storage volumes shown in the tabulation are taken from Village records and previous studies. Watershed areas and reservoir surface areas were measured from available mapping as part of this study.

TABLE I
VILLAGE OF MONROE - WATER SUPPLY SOURCE
LAKE MOMBASHA

Drainage Area, Square Miles	2.91
Water Surface Area, Acres	325
Flow Line (crest elevation), Ft. MSL	855
Total Storage, Million Gallons	1.438×10^9 to 1.622×10^9 *
Outlet Stream	Tributary to Ramapo River
Drainage Basin	Ramapo River
Location	Town of Monroe
Previous Estimated Yield, MGD	1.25 to 2.4

* 1.62 billion gallons determined in 1941

Mombasha Lake is located in the Town of Monroe, Orange County, New York, located by the following coordinates: 72° 12′ 30″ WEST, 41° 17′ 00″ NORTH. The lake is 1.4 miles long and has a surface area of approximately 325 acres. The watershed is 2.91 square miles, as measured by planimeter from the USGS Monroe Quadrangle map.

The watershed is approximately 75% forested, with some limited residential development (approximately 10%).

The reservoir was sounded in 1941 and the deepest reading was 41.5 feet. The capacity was calculated to have a volume of 1.622×10^9 gallons. It was sounded again in 1986 and, the deepest sounding was 35′ and the volume was calculated to be 1.438×10^9 gallons. The difference may be due to siltation or different techniques.

The available volume was determined in 1986 to be 0.77×10^9 gallons since the intake structure is located 18 feet below the elevation of the spillway crest. This, however, is not the ultimate volume since the intake structure could be lowered, or water could be pumped during an extreme drought emergency.

Records of spillway elevations for the past 18 years are presented in Table II.

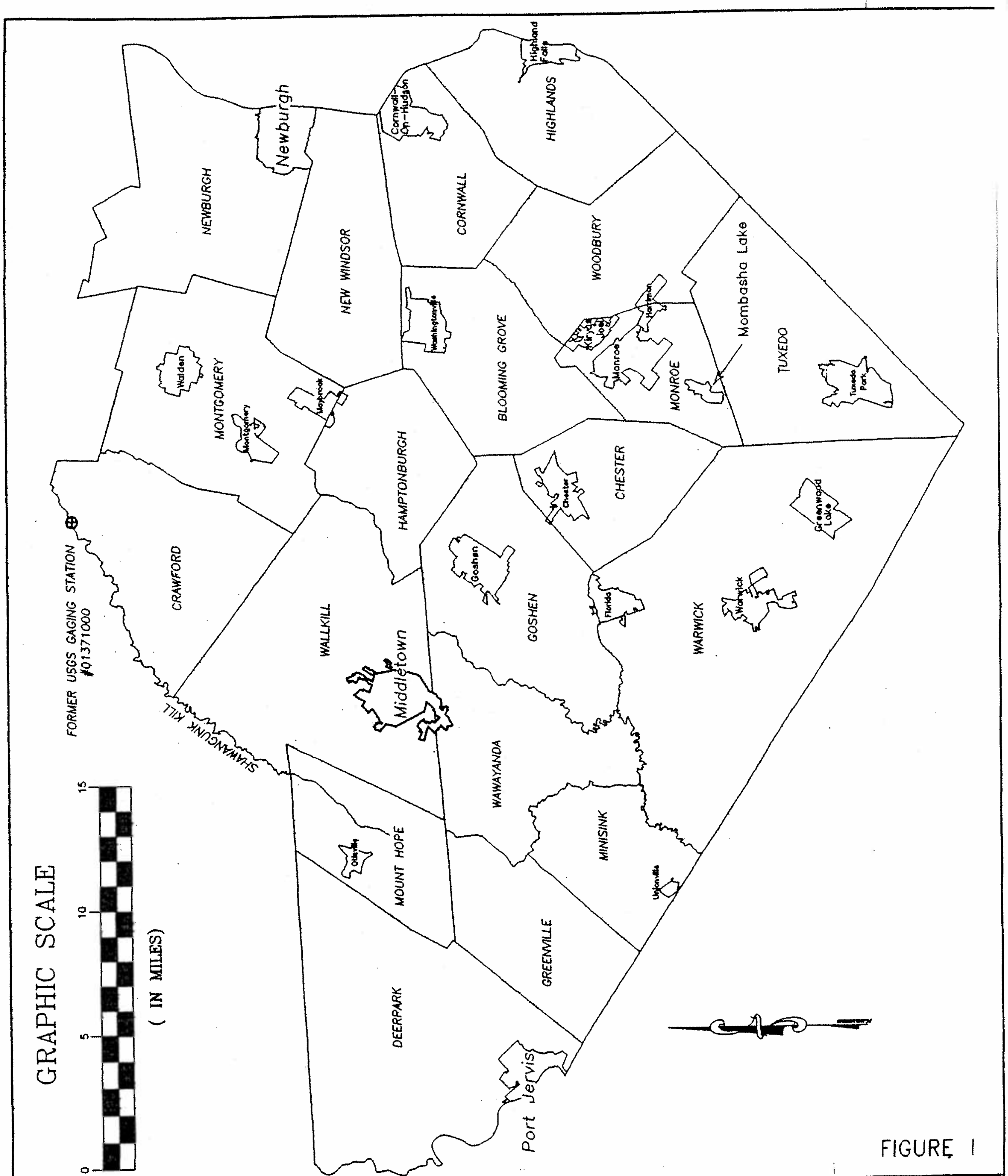


FIGURE 1

LOCATION PLAN – MOMBASHA LAKE

TOWN OF MONROE ORANGE COUNTY, NEW YORK

DECEMBER, 2000

TABLE II

WATER SURFACE ELEVATIONS AT MOMBASHA LAKE - RELATIVE TO SPILLWAY

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
January	N.A.	3" +	3" +	Even	12" -	1" +	Even	Even	.5" +	1.5" +
February	Even	Even	1" +	1" +	Even	Even	1" +	.5" +	.5" +	.5" +
March	Even	2" +	2" +	2" +	Even	Even	3" +	.5" +	1" +	.5" +
April	Even	2" -	1" +	.5" +	RunOver	Even	1" +	Even	Even	.5" +
May	Even	3" +	Even	2" +	Even	2" -	2" -	Even	Even	1" +
June	1" -	3" +	4" -	Even	Even	2" -	8" -	10" -	.5" +	Even
July	2" -	3" -	12" -	Even	Even	4" -	14" -	10" -	2" -	Even
August	2" -	6" -	18" -	4" -	3" -	10" -	16" -	15" -	5" -	Even
September	3" -	12" -	23" -	6" -	1" +	14" -	1" +	15" -	1" +	.5" -
October	3" -	13" -	20" -	13" -	Even	14" -	1" +	18" =	1" +	Even
November	15" -	14" -	2" +	12" -	2" +	5" -	1" +	1" +	1" +	Even
December	1" +	6" -	2" +	Even	Even	Even	Even	.5" +	Even	1" +

	1991	1992	1993	1994	1995	1996	1997	1998	1999	
January	.5" +	Even	Even	1" +	Even	2" +	Even	Even	0.5" +	
February	Even	.5" +	Even	.5" +	0.5" +	0.5" +	Even	1" +	1" +	
March	.5" +	1" +	3" +	1.5" +	Even	0.5" +	1" +	1.5" +	1" +	
April	.5" +	Even	.5" +	.5" +	Even	1" +	0.5" +	Even	Even	
May	2" -	1" +	4" -	.5" -	1" -	2" -	1" -	1" +	1.5" -	
June	12" -	1" -	10" -	2" -	9" -	Even	8" -	Even	12" -	
July	11" -	2" -	18" -	3" -	15" -	Even	18" -	10" -	16" -	
August	8" -	3" -	24" -	4" -	19" -	4" -	18" -	18" -	20" -	
September	11" -	4" -	23" -	3" -	24" -	0.5" +	14" -	20" -	0.5" +	
October	6 -	11" -	18" -	4" -	12" -	Even	14" -	18" -	0.5" +	
November	.5" +	3" -	6" -	5" -	Even	2" +	3" -	21" -	0.5" +	
December	Even	1.5" +	6" -	.5" +	1" -	0.5" +	0.5" +	20" -	Even	

NOTE: Measurements taken monthly by Village of Monroe Water Department personnel, and show water surface level in inches above or below spillway.

Normal Operation of the Water Supply System

During years of moderate or normal rainfall, the Village Public Works Department endeavors to achieve full reservoir capacity in the Spring, in anticipation of possible drawdown during the drier summer months.

During the summer or fall months, reservoir levels may drop, depending on demand and the amount of rainfall. However, inspection of Table II shows that water surface levels have not dropped lower than 24 inches below the spillway during the time period from 1981 to the present, when such records have been kept.

Table III below shows annual average amount of water withdrawn from Mombasha Lake, to supply the Village of Monroe water system.

TABLE III

VILLAGE OF MONROE WATER SYSTEM
AVERAGE ANNUAL WATER USAGE*

Year	Water Usage (MGD)	Year	Water Usage (MGD)
1980	0.617	1990	0.796
1981	0.577	1991	0.914
1982	0.694	1992	0.922
1983	0.829	1993	1.126
1984	0.786	1994	0.962
1985	0.782	1995	0.961
1986	0.864	1996	1.074
1987	0.861	1997	1.040
1988	0.811	1998	1.005
1989	0.802	1999	1.010

* Water taken from Mombasha Lake, from raw water meter at Village of Monroe Water Treatment Plant

Comparison of Tables II and III shows that the amounts of water withdrawn from Lake Mombasha to supply the Village of Monroe water system have not causes significant depletion of the Lake volume since 1981, according to available village records.

TABLE IV
ANNUAL RAINFALL

Year	Inches*	Inches **	Year	Inches*	Inches**
1962	36.30		1982	39.88	41.03
1963	35.91		1983	53.50	63.25
1964	27.70		1984	47.31	52.52
1965	28.11		1985	38.76	44.22
1966	31.10		1986	45.23	45.13
1967	39.25		1987	41.88	49.95
1968	38.76		1988	41.11	43.52
1969	42.41		1989	44.71	53.97
1970	40.55		1990	52.76	59.63
1971	44.22		1991	37.84	43.73
1972	53.24		1992	41.52	46.23
1973	53.57		1993	42.26	45.56
1974	42.19		1994	45.50	53.01
1975	55.29		1995	37.35	42.26
1976	43.16		1996	54.34	69.06
1977	43.38		1997	38.93	44.76
1978	38.06		1998	42.00	47.79
1979	48.25		1999	39.78	51.85
1980	31.52				
1981	33.00	13.10†			

38 Year Annual Average = 41.86", at the Town of Wallkill
18 1/2 Year Annual Average = 49.43", at Monroe, New York

* As recorded in the Town of Wallkill, New York
** As recorded at Monroe, New York
† August-December: at Wallkill, 12.61 inches from August - December

The full impact of the mid-1960's drought on most water systems in orange County was severe, but difficult to accurately assess for Monroe because of the lack of important records, and because most of the Village Water Department personnel of that time are no longer available to interview. The Village records the reservoir water surface elevations on or about the first of each month. However, only data from 1981 is available.

Use of Available Information - 1960's Drought

The yield of the Monroe Water Supply System, at the time of the 1960's drought, cannot be determined with the available information described above. There would have to be reservoir volume records for each month throughout the drought. The available information is insufficient to

track the cyclical depletion and replenishing of the reservoir as needed to determine yield.

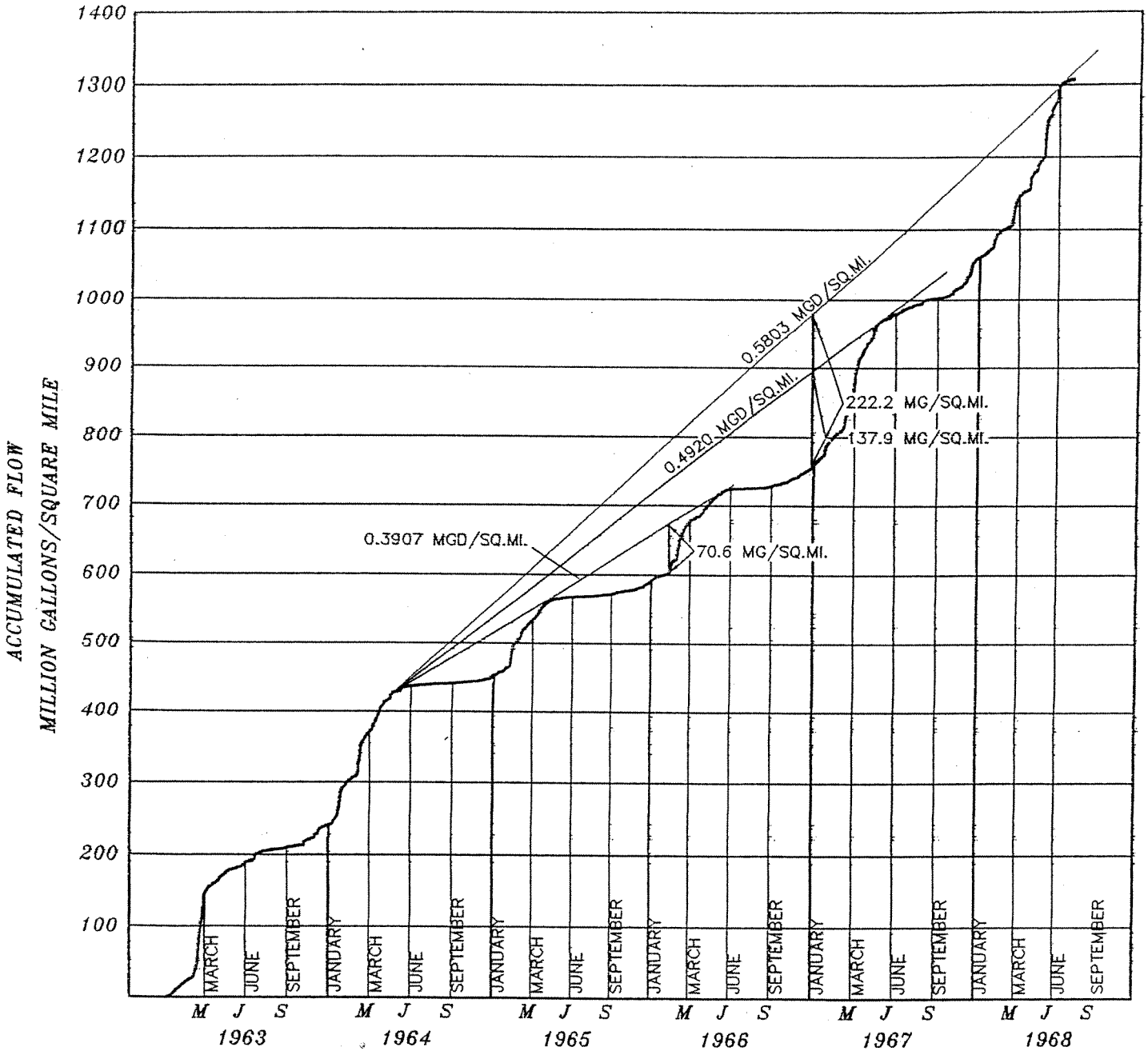
Fortunately, other information is available for use in calculating the yield for a drought period like the 1960's drought. The United States Geological Survey (USGS) maintained a stream gauge station on the Shawangunk Kill for many years from the 1920's until it was discontinued after 1992. Some data from the late 1970's and the early 1980's is unavailable but daily stream discharge records for the 1960's is available. The Stream Gauge Station (Station No. 01371000) was located at Hardenburgh Road, near the hamlet of Pine Bush. The daily stream flow readings were downloaded from the internet, at www.Waterdata.usgs.gov/nwis-w/NY/data. The Shawangunk Kill has a watershed area of 104 square miles at Hardenburgh Road. Daily readings are in cubic feet per second (cfs).

Mass Diagram

The daily readings from the stream gauge station were used to plot a mass diagram (Figure 3) showing accumulated flow from 1963 to 1968. Starting from January 1, 1963, daily flows were accumulated to make the mass diagram. The accumulated flows are expressed in terms of million gallons per square mile of watershed in order to make the mass diagram applicable to other watershed areas. The assumption that the mass diagram is applicable for use at other locations was reinforced by stream flow measurements made as part of a study done on the City of Middletown water system by Clark Patterson Associates, dated May 2000. As part of that study, stream flow measurements were taken at two locations on the Shawangunk Kill, from November, 1999 to April 2000. One location was at Hardenburgh Road, at the site of the former gauging station, where the tributary watershed area is 104 square miles. The other location was at Kohler Road in the Town of Mt. Hope, where the watershed area is 5.5 square miles. Runoff volumes resulting from several rain events were calculated at both locations, and compared for consistency. The comparisons showed that the mass diagram can be applied to smaller watershed areas.

Interpretation of the Mass Diagram

The slope of any given segment of line along the mass diagram indicates the average stream flow for the time period covered by that segment. Steeper slopes reflect higher stream flow rates and flatter slopes indicate lower stream flow rates. In the absence of any reservoir



MASS DIAGRAM – SHAWANGUNK KILL

FLOW DATA FROM USGS GAUGING STATION NO. 01371000 AT HARDENBURGH RD.

FIGURE 3

storage, the available yield of a watershed is equivalent to the minimum stream flow of the water course draining that portion of the watershed. When reservoir storage is available, the available yield of a watershed is higher, because periods of minimum stream flows are bridged by the volume provided in the reservoir(s). During dry periods of low stream flow, the available yield can be satisfied by depleting the volume of the reservoirs, which are then refilled when wet weather brings higher stream flows. Higher reservoir volumes increase the available yield of a watershed, as longer periods of low stream flow can be bridged. For example, inspection of Figure 3 shows several straight lines that are tangent to the mass diagram line. The bottom most line is tangent to the mass diagram line between the dates of April 19, 1964 and May 10, 1966. The slope of this line, expressed in terms of million gallons per day per square mile of watershed (MGD/sq.mi.) represents the available yield of the watershed between these two dates, assuming adequate reservoir storage to cover periods of low stream flow. The volume of reservoir storage needed is equal to the maximum vertical ordinate between the straight tangent line and the mass diagram line. Figure 3 shows this vertical line, and its value is 70.6 million gallons per square mile of watershed (mg/sq.mi.). That much storage would have provided an available yield of 0.3907 mgd/sq.mi. over the worst two year period of the 1960's drought for the Shawangunk Kill watershed. Figure 3 also shows that if 137.9 mg/sq.mi. of reservoir storage was available, the available yield would be 0.4920 mgd/sq.mi. for the worst 3 year period of the 1960's drought. The reservoir storage volumes discussed above would provide greater yield during non-drought periods.

Adaptation of the Mass Diagram for the Mombasha Lake Watershed

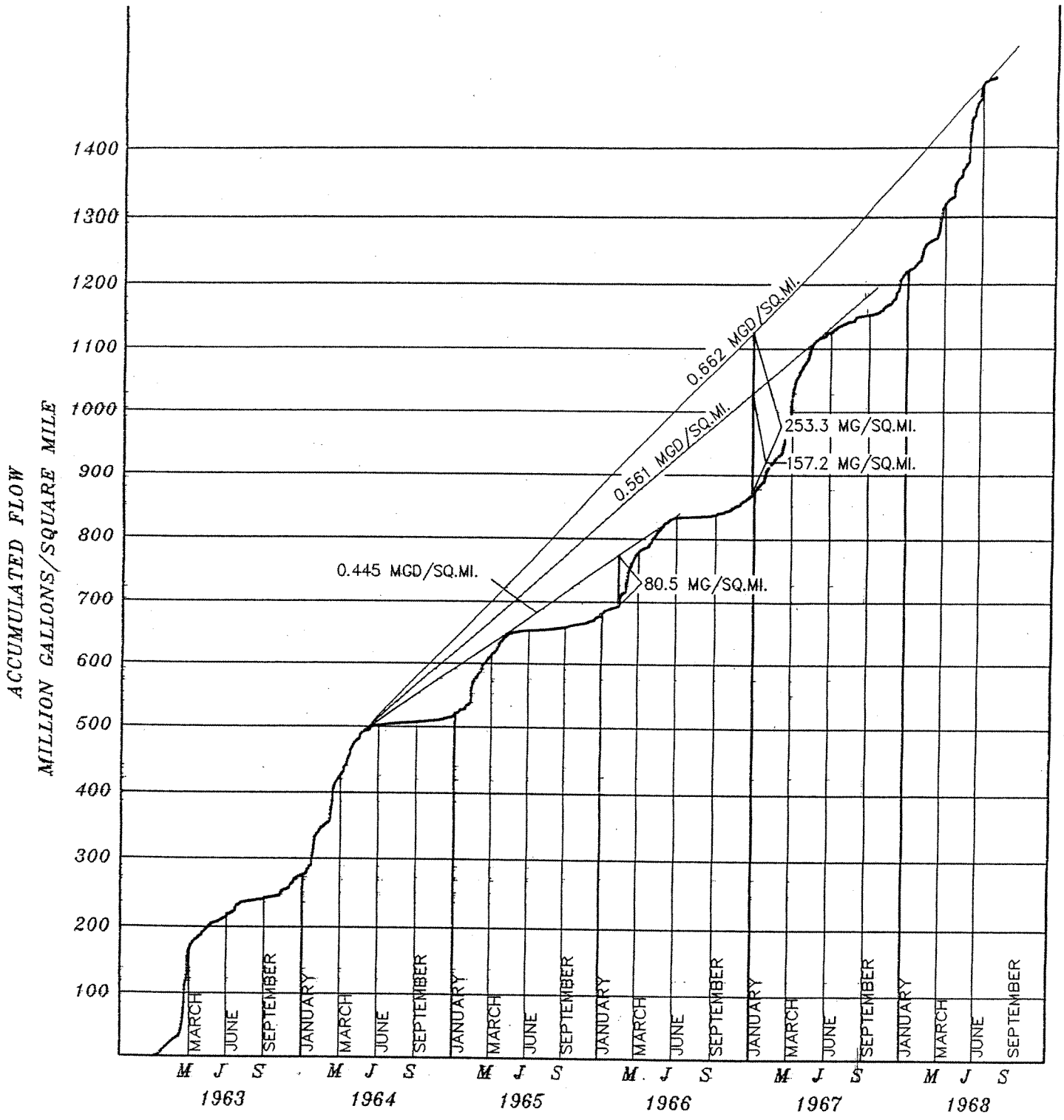
Considering the absence of stream gauging data for the Mombasha Lake watershed, especially during the 1960's drought, the above mentioned mass diagram is utilized for this study, as it documents the effects of that record drought. The data compiled to construct the mass diagram, while not originating within the Mombasha Lake watershed, does consist of rainfall and stream flow measurements made in Orange County. The same wet weather and dry weather periods are experienced in both watersheds (Mombasha Lake and Shawangunk Kill). The two watersheds have certain similarities, in that both are mostly rural containing a mixture of forested lands, some open lands, and a small percentage of residential areas. Terrain varies from

gentle to steep in both watersheds, although there is more gently sloping land, percentage wise, in the Shawangunk Kill watershed. Much of the surface soil cover within the Mombasha watershed consists of Hollis-Rock outcrop soils, according to the Soil Conservation Service (SCS), whereas Mardin-Erie and Hoosic-Mardin soils are found in the Shawangunk Kill watershed. Considering the above, we would expect that storm runoff in the Shawangunk Kill watershed would not exceed that in the Mombasha Lake watershed, on a per unit area basis, and would actually be less. In this respect, the mass diagram would be conservative when applied to the Mombasha Lake watershed.

The only modifications made to the mass diagram is an adjustment in consideration of the higher annual rainfall recorded at Monroe compared to that recorded in the Town of Wallkill. Inspection of Table IV shows that annual rainfall at Monroe was consistently higher than at the Town of Wallkill, for the time period from 1981 to 1999. We were unable to find rainfall records for Monroe for years preceding 1981. The average annual rainfall at Monroe was 14% higher than at the Town of Wallkill, for this time period. The consistent nature of this difference, from year to year, was justification in our opinion for making the adjustment to the mass diagram. Accordingly, Figure 4 shows a modified mass diagram, where the accumulated flow, and thus the yield slope, is higher by 14%. The adjustment is conservative, because for a given watershed area, a rainfall event that is 14% higher would result in a corresponding runoff volume that is more than 14% greater, compared with that from the smaller rainfall event, assuming the same antecedent conditions of soil moisture content.

Yield Determination Using the Mass Diagram

Inspection of the modified mass diagram in Figure 4 shows that the slope of the straight line bridging the period between April 1964 and June 1968 is 0.662 mgd/sq.mi. For the 2.91 square mile watershed area of Mombasha Lake, this yield figure would be 1.93 mgd, assuming available reservoir storage of at least 253.3 million gallons per square mile (of watershed). The actual reservoir storage volume, using the 1,438 million gallon figure, is equivalent to 494.2 million gallons per square mile, which justified the use of the higher yield slope line.



MODIFIED MASS DIAGRAM – SHAWANGUNK KILL
MODIFIED FOR MOMBASHA LAKE WATERSHED

FLOW DATA FROM USGS GAUGING STATION NO. 01371000 AT HARDENBURGH RD.
AND ADJUSTED FOR HIGHER RAINFALL AT MONROE, N.Y.

FIGURE 4

Adjustments in Computed Yield

1. Additional Reservoir Volume

As discussed above, the full volume of Mombasha Lake is greater than that needed to justify selection of the yield slope line used (0.662 mgd/sq.mi.). Some of the lake volume is below the elevation of the intake, which reportedly is 18 feet below the spillway elevation. The volume above the intake is 0.77 billion gallons, according to the above referenced study by Wehran Engineering, P.C. The remaining volume below the intake normally would not be considered as readily accessible because water would have to be pumped to the intake if the reservoir level drops below this level. However, in a dire emergency, such as an extreme drought, such pumping would be warranted in order to maintain supply to the Village of Monroe water system. Therefore, in the case of an extreme drought emergency, that portion of the reservoir volume below the intake should be considered as available, even if temporary emergency pumping is necessary.

From inspection of Figure 4, the required full reservoir volume to sustain the maximum yield over a record drought period is 253.3 million gallons per square mile of watershed, or 738 million gallons. The additional volume is 700 million gallons (1438 - 738 = 700). The resulting additional available yield is calculated by allocating this additional over the time period spanned by the yield slope line, approximately 1500 days. The additional yield is 0.46 mgd (700 ÷ 1500 = 0.46)

2. Evaporation Losses

An adjustment in available yield must be made to account for evaporation losses from the surface of the reservoir, since the mass diagram for the Shawangunk Kill reflects stream flows from a watershed with a relatively negligible percentage of its total area inundated with surface impoundments. Metcalf and Eddy, in their April 1967 Report, uses a figure of 10 inches per year, for the surface areas of reservoirs. Metcalf and Eddy cites previous studies for this figure, which accounts for the difference in losses between evaporation losses from water surfaces,

and evapo-transpiration losses from land surfaces. A mass diagram would account for evapo-transpiration losses in the watershed, because only the remaining water (after evapo-transpiration losses) was measured at the gauging station. Therefore, only the 10 inch difference needs to be considered as an adjustment. We note that the 1987 Wehran Report uses a figure of 33 inches per year for water surface evaporation. We do not disagree with this figure, and it is not inconsistent with the 10 inch differential cited by Metcalf and Eddy, and used in this report, since the evapo-transpiration losses from the equivalent land surface area have already been accounted for.

From Table I the total surface area of Mombasha Lake is 325 acres. Using the 10 inch per year figure, the yield adjustment would be 0.24 mgd.

Computed Yield of Monroe Water Supply System - 1960's Drought

A summary of the above represents the calculated drought safe yield of the Monroe Water Supply System in its present state based on the effects of a record drought similar to that experienced in the mid 1960's. The summary of calculations is as follows:

Lake Mombasha Reservoir Watershed Area	1.93 mgd
Adjustment for Reservoir Volume	0.46 mgd
Adjustment for evaporation loss	-0.24 mgd
Total Yield	2.15 mgd

This figure is within the parameters requested in the Village Water Supply Application.

Alternative Supplies (Wells)

The Village has developed a well system which is capable of producing 1.05 mgd.

The Village has requested and received approval of a water supply application to utilize the wells. The Village will utilize the combination of surface water, Mombasha Lake and well supply to handle the needs of the Village. The combined taking will be (2.1 mgd) from both surface and groundwater supplies. This safe yield analysis of Mombasha Lake shows that the safe yield is 2.15 mgd from Mombasha

Lake. The wells will be used in emergencies to augment the Village's supply. The Village will also manage the system to optimize benefit to the Village by utilization of Mombasha Lake surface supply and the well field ground water supplies.

Water Conservation

The Village is also aware that water conservation is an important part of water management. Meters on homes and businesses together with education publications are effective tools to conserve water.

Also, the Village has parameters to limit water usage at a critical or drought periods. The Village also has a leak detection and repair program to limit losses.

Final Analysis

The Village of Monroe has a safe yield of 2.15 mgd from Mombasha Lake and 1.05 mgd from wells. The Village request a combined water supply taking of 2.1 mgd and will manage the system to optimize benefit from the alternate supplies.

Furthermore, water conservation and proper water management will assist in maintaining the system for the residents.

The Village of Monroe therefore is in a position with their surface supplies, ground water supplies, water conservation and proper management to insure continued excellent service to their constituents. The Village constantly monitors and improves their water system as required with due diligence. Their commitment has and will allow them to provide the quantity and quality of water required for their users.

APPENDIX C

Water Treatment Plant Capacity

W YORK STATE DEPARTMENT OF HEALTH
ureau of Water Supply Protection

Approval of Completed Works For Public Water Supply Improvement

This approval is issued under the provisions of 10 NYCRR, Part 5:

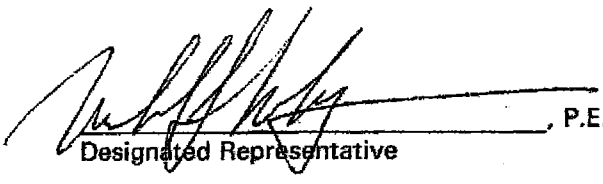
Applicant Name Monroe (V)	
Location of Works (city, town, village) Monroe (V)	
County Orange County	Water District (specific area served) Village of Monroe

Plans for the construction of this project were approved on Mo 04 / Day 27 / Yr 2000.

Log No. 12630: WSA #10005: DWSRF #15934

Expansion and upgrade of direct filtration water treatment plant from 1.4 MGD to 2.1 MGD, change of primary disinfectant from gas chlorine to sodium hypochlorite, new water line from water treatment plant to existing water storage tanks to increase chlorine contact time and appurtenances.

ISSUED FOR THE STATE COMMISSIONER OF HEALTH



, P.E.
Designated Representative

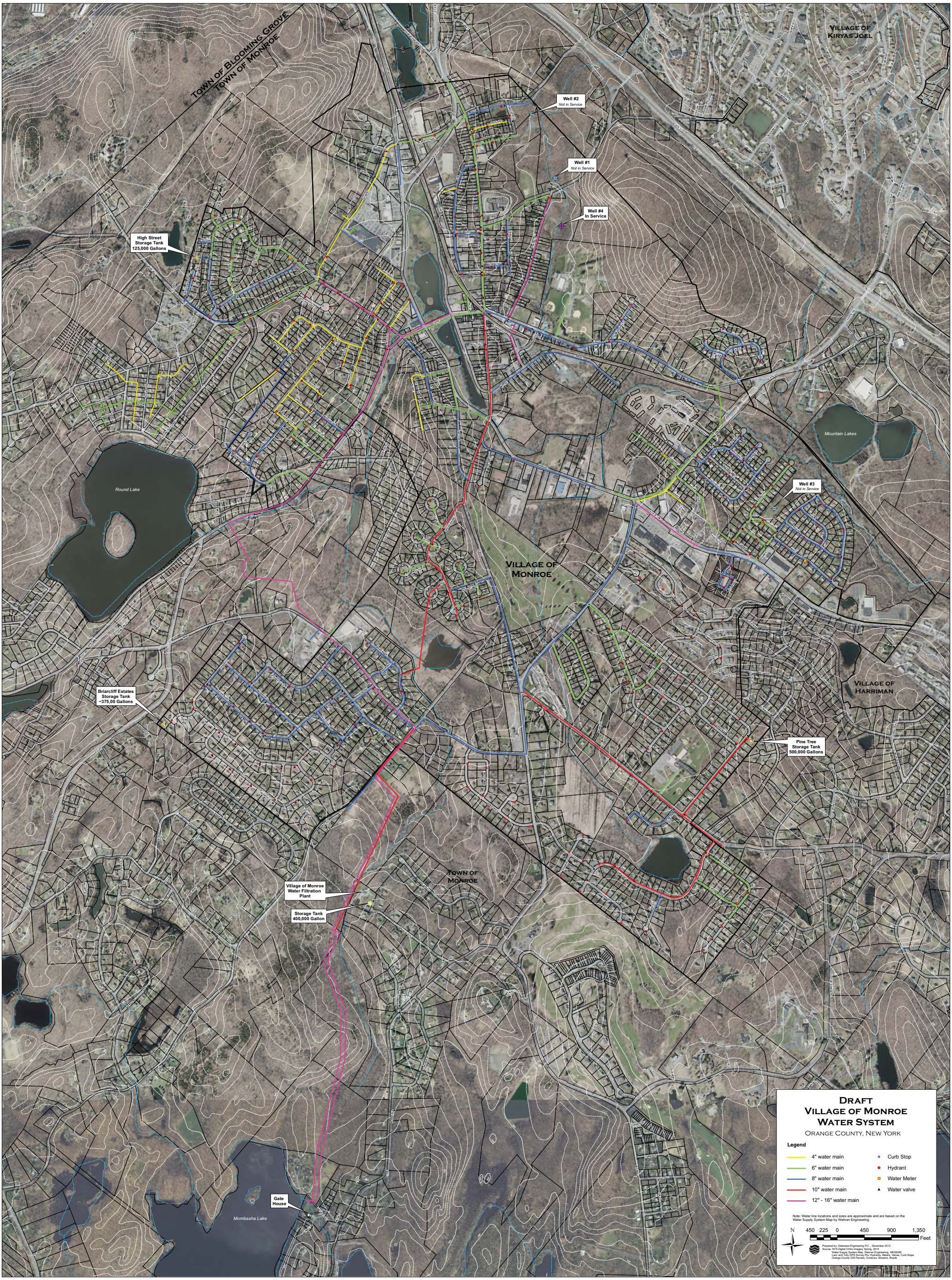
Mo 10 / Day 09 / Yr 2007
Date

Please print

Name	Michael J. Montysko, P.E.
Title	Chief, Design Section, BWSP

APPENDIX D

Draft Water System Map


Town of Blooming Grove
Town of Monroe
Village of Kiryas Joel
Well #2
Not in Service
Well #1
Not in Service
Well #4
In Service
High Street
Storage Tank
125,000 Gallons
Round Lake
Mountain Lakes
Well #3
Not in Service
Village of
Monroe
Village of
Harriman
Briarcliff Estates
Storage Tank
~375,00 Gallons
Pine Tree
Storage Tank
500,000 Gallons
Town of
Monroe
Village of Monroe
Water Filtration
Plant
Storage Tank
400,000 Gallon
Gate
House
Mombasha Lake
Draft
Village of Monroe
Water System
Orange County, New York
Legend
4" water main
6" water main
8" water main
10" water main
12" - 16" water main
Curb Stop
Hydrant
Water Meter
Water valve
Note: Water line locations and sizes are approximate and are based on the Water Supply System Map by Wehran Engineering.
N
450 225 0 450 900 1,350
Feet
Prepared by: Delaware Engineering P.C., December 2012
Source: NYS Digital Ortho Imagery Spring, 2010
Water Supply System Map, Wehran Engineering, WE06290
Lanc and Tully GPS Survey Pts: Hydrants, Meters, Valves, Curb Stops
Orange County GIS Parcels, Contours, Streams, Roads

APPENDIX E

Water Rate Models

Model Inputs

Water Consumption Based on Metered Billing	Two Years	Annual	Daily	Accounts	Ave Per Act	Annual Ave Per Act.
Village	490,995,300	245,497,650	672,596	2209	304	111,135
Commercial	117,900,329	58,950,165	161,507	385	419	153,117
Town and Bulk	88,098,000	44,049,000	120,682	515	234	85,532
Total	696,993,629	348,496,815	954,786	3109	307	112,093

Water Production	Annual	Daily	Accounts	
2010	359,767,355	985,664	3,109	317
2011	334,004,152	915,080	3,109	294
Average	346,885,754	950,372	3,109	306

CURRENT BUDGET

Revenues Per Budget	**2011**	**2012**
Metered Water Sales	$ 1,340,853.22	$ 1,262,664.00
Service Charge	$ 176,318.00	$ 170,628.00
Misc	$ 63,060.00	$ 116,850.00
	$ 1,582,242.22	$ 1,552,154.00

O&M Budget	**2011**	**2012**
	$ 1,289,969.00	$ 1,265,691.89

Debt Per Budget	**2011**	**2012**
Serial Bond Principal	$ 55,000.00	$ 50,000.00
Serial Bond Interest	$ 11,004.00	$ 8,538.00
BANs Principal	$ 72,000.00	$ 72,000.00
BANs Interest	$ 5,854.00	$ 3,219.00
EFC Principal	$ 140,000.00	$ 140,000.00
EFC Interest	$ 66,000.00	$ 60,100.00
Total Debt	$ 349,858.00	$ 333,857.00

Current Consumption Rates	**0-5000 gal**	**5001 - 30000 gal**	**30,001 - Over**
Village	$ 3.08	$ 3.45	$ 3.68
Commercial	$ 3.08	$ 3.45	$ 3.68
Town	$ 7.60		

Service Fee	**Quarterly**	**Annually**
Village	$ 10.10	$ 40.40
Commercial	$ 36.00	$ 144.00
Town	$ 16.00	$ 64.00

Revenue Check Users to Budget

Service Fees		
Village	$ 89,243.60	
Commercial	$ 55,440.00	
Town	$ 32,960.00	
Total Service Fee	$ 177,643.60	Check!

Consumption*	**at $3.08**	**at $3.45**	**at $3.68**	**at ave $3.40**	
Village	$ 756,132.76	$ 846,966.89	$ 903,431.35	$ 834,692.01	
Commercial	$ 181,566.51	$ 203,378.07	$ 216,936.61	$ 200,430.56	
Town at $7.60	$ 334,772.40	$ 334,772.40	$ 334,772.40	$ 334,772.40	
Totals	$ 1,272,471.67	$ 1,385,117.36	$ 1,455,140.36	$ 1,369,894.97	Check at consumption rates!!!

Using Village Commercial Ave of	$ 3.40	
Village to Town Ratio	2.24	
Town Rate	$ 7.60	

Current Customer Costs	**Consumption**	**Service Fee**	**Total**	**Accounts**	**Consumption**	**Service Fee**
Village	$ 377.86	$ 40.40	$ 418.26	2209	$ 834,692.01	$ 89,243.60
Commercial	$ 520.60	$ 144.00	$ 664.60	385	$ 200,430.56	$ 55,440.00
Town	$ 650.04	$ 64.00	$ 714.04	515	$ 334,772.40	$ 32,960.00
					$ 1,369,894.97	$ 177,643.60

EXPENSES AND REVENUE PROJECTED

O&M Budget	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Start Ave 2011 & 2012. Escalate 0.5% per year	$ 1,277,830	$ 1,284,220	$ 1,290,641	$ 1,297,094	$ 1,303,579	$ 1,310,097	$ 1,316,648	$ 1,323,231	$ 1,329,847	$ 1,336,496	$ 1,343,179

Debt	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Serial Bond Principal	$ 50,000.00	$ 50,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Serial Bond Interest	$ 2,475.00	$ 2,475.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
BANs Principal	$ 72,000.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
BANs Interest	$ 1,246.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
EFC Principal	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00	$ 140,000.00
EFC Interest	$ 25,847.00	$ 20,677.60	$ 16,542.08	$ 13,233.66	$ 10,586.93	$ 8,469.54	$ 6,775.64	$ 5,420.51	$ 4,336.41	$ 3,469.13	$ 2,775.30
BAN DPW Facility Principal	$ 19,374.03	$ 19,682.08	$ 19,995.03	$ 20,312.95	$ 20,307.81	$ -	$ -	$ -	$ -	$ -	$ -
BAN DPW Facility Interest	$ 1,590.00	$ 1,281.96	$ 969.01	$ 651.09	$ 328.11	$ -	$ -	$ -	$ -	$ -	$ -
Bond DPW Facility Principal	$ 20,149.10	$ 20,955.01	$ 21,793.21	$ 22,664.94	$ 23,571.54	$ 24,514.40	$ 25,494.98	$ 26,514.78	$ 27,575.37	$ 28,678.38	$ 29,825.52
Bond DPW Facility Interest	$ 24,000.00	$ 23,194.04	$ 22,355.84	$ 21,484.11	$ 20,577.51	$ 19,634.65	$ 18,654.07	$ 17,634.27	$ 16,573.68	$ 15,470.67	$ 14,323.53
Total Debt	***$ 291,568.00***	***$ 278,265.69***	***$ 221,655.17***	***$ 218,346.74***	***$ 215,371.90***	***$ 192,618.59***	***$ 190,924.69***	***$ 189,569.56***	***$ 188,485.46***	***$ 187,618.18***	***$ 186,924.35***

Total Expenses/Revenue Required	$ 1,569,398.45	$ 1,562,485.28	$ 1,512,295.86	$ 1,515,440.64	$ 1,518,951.27	$ 1,502,715.86	$ 1,507,572.44	$ 1,512,800.55	$ 1,518,332.60	$ 1,524,114.56	$ 1,530,103.21
New Debt $4,700,000, 4%, 20 Years	$ -		$ 345,834.00	$ 345,834.00	$ 345,834.00	$ 345,834.00	$ 345,834.00	$ 345,834.00	$ 345,834.00	$ 345,834.00	$ 345,834.00
Total Existing O&M, Debt + New Debt	$ 1,569,398.45	$ 1,562,485.28	$ 1,858,129.86	$ 1,861,274.64	$ 1,864,785.27	$ 1,848,549.86	$ 1,853,406.44	$ 1,858,634.55	$ 1,864,166.60	$ 1,869,948.56	$ 1,875,937.21

RATE ANALYSIS

Water Consumption Based on Metered Billing	**Annual**	**Accounts**	**Ave GPY Per Act**
Village	245,497,650	2209	111,135
Commercial	58,950,165	385	153,117
Town and Bulk	44,049,000	515	85,532
Total	348,496,815	3109	112,093

	Rate 1	**Rate 2**
Village	$ 3.90	$ 3.55
Commercial	$ 3.90	$ 5.33
Town and Bulk	$ 8.74	$ 8.88

Rate 1 Mirrors Current Rate Town 2.24x
Rate 2 Commercial 1.5x and Town 2.5x

	Rate 1	**Rate 2**
Total Expenses/Revenue Required	$ 1,569,398.45	$ 1,569,398.45
Village	$ 957,440.84	$ 871,516.66
Commercial	$ 229,905.64	$ 313,909.63
Town	$ 384,812.06	$ 390,934.88
Total Revenue At Rate 1	$ 1,572,158.54	$ 1,576,361.16
Revenue vs. Expenses	$ 2,760.10	$ 6,962.71
Average Village SF Annual Cost Est.	$ 433.43	$ 394.53
Aveage Commercial Annual Cost Est.	$ 597.16	$ 815.35
Average Town SF Annual Cost Est.	$ 747.21	$ 759.10

Comparison to Current	**Rate 1 vs Current**	**Rate 2 vs. Current**
Average Village SF Annual Cost Est.	$ 15.17	$ (23.73)
Aveage Commercial Annual Cost Est.	$ (67.44)	$ 150.75
Average Town SF Annual Cost Est.	$ 33.16	$ 45.05

Rates No New Debt	Using Rate 2		**Revenue Requirements O&M Plus Debt as of 2012**										
			2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
User Category	**Rates**	**GPY**	$ 1,569,398.45	$ 1,562,485.28	$ 1,512,295.86	$ 1,515,440.64	$ 1,507,572.44	$ 1,502,715.86	$ 1,507,572.44	$ 1,512,800.55	$ 1,518,332.60	$ 1,524,114.56	$ 1,530,103.21
Village	$ 3.55	245,497,650	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66	$ 871,516.66
Commercial	$ 5.33	58,950,165	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63	$ 313,909.63
Town and Bulk	$ 8.88	44,049,000	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88	$ 390,934.88
Revenue			$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16	$ 1,576,361.16
Fund Balance/Deficit			$ 6,962.72	$ 13,875.88	$ 64,065.30	$ 60,920.52	$ 68,788.72	$ 73,645.30	$ 68,788.72	$ 63,560.61	$ 58,028.56	$ 52,246.60	$ 46,257.95
Total Fund Bal/Def 10 yrs	$ 577,140.89												
Average Annual Customer Costs 2015 -													
Village	$ 394.53												
Commercial	$ 815.35												
Town and Bulk	$ 759.10												

Rates New Debt	Using Rate 2		**Revenue Requirements O&M Plus Recommended Improvements Debt**										
			2013*	**2014***	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
User Category	**Rates 2015**	**GPY**	$ 1,569,398.45	$ 1,562,485.28	$ 1,858,129.86	$ 1,861,274.64	$ 1,864,785.27	$ 1,848,549.86	$ 1,853,406.44	$ 1,858,634.55	$ 1,864,166.60	$ 1,869,948.56	$ 1,875,937.21
Village	$ 4.35	245,497,650	$ 871,516.66	$ 989,355.53	$ 1,067,914.78	$ 1,067,914.78	$ 1,067,914.78	$ 1,067,914.78	$ 1,067,914.78	$ 1,067,914.78	$ 1,067,914.78	$ 1,067,914.78	$ 1,067,914.78
Commercial	$ 6.53	58,950,165	$ 313,909.63	$ 349,279.73	$ 384,649.83	$ 384,649.83	$ 384,649.83	$ 384,649.83	$ 384,649.83	$ 384,649.83	$ 384,649.83	$ 384,649.83	$ 384,649.83
Town and Bulk	$ 10.88	44,049,000	$ 390,934.88	$ 434,983.88	$ 479,032.88	$ 479,032.88	$ 479,032.88	$ 479,032.88	$ 479,032.88	$ 479,032.88	$ 479,032.88	$ 479,032.88	$ 479,032.88
Revenue			$ 1,576,361.16	$ 1,773,619.13	$ 1,931,597.48	$ 1,931,597.48	$ 1,931,597.48	$ 1,931,597.48	$ 1,931,597.48	$ 1,931,597.48	$ 1,931,597.48	$ 1,931,597.48	$ 1,931,597.48
Fund Balance/Deficit			$ 6,962.72	$ 211,133.85	$ 73,467.62	$ 70,322.84	$ 66,812.21	$ 83,047.62	$ 78,191.04	$ 72,962.93	$ 67,430.88	$ 61,648.92	$ 55,660.27
Total Fund Bal/Def 10 yrs	$ 847,640.89												
*2013 Rate New Rate Without Project Debt & 2014 Rates 1/2 of 2015 Increase in Rates													
Average Annual Customer Costs 2015 -													
Village	$ 483.44												
Commercial	$ 999.09												
Town and Bulk	$ 930.16												

Rate Change From Current to Projected 2015 With Recommended Improvement Debt				
	Current	2015	Difference	Debt RateRestructure
Village	$ 418.26	$ 483.44	$ 65.18	$ 88.91 $ (23.73)
Commercial	$ 664.60	$ 999.09	$ 334.49	$ 183.74 $ 150.75
Town and Bulk	$ 714.04	$ 930.16	$ 216.12	$ 171.06 $ 45.06