Village of Greenwood Lake
Orange County, New York

Water Infrastructure Plan and Rate Study

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1.0 INTRODUCTION

The Village of Greenwood Lake is located in the Town of Warwick, Orange County, New York, see Figure 1. The Village had a population of 3,154 according to the 2010 Census. Of the available occupied housing, 78% was owner-occupied and 22% renter-occupied. The median household income was $91,604, while 5.3% of families were below the poverty level.

The Village had its origins as a seasonal lake community, but the great majority of homes have been converted to year-round use. The Village's water system serves approximately 3,000 people through 1,200 service connections. Average daily flow (ADF) and Peak day flow (PDF) for 2017-2019 were as follows:

Table 1.1 – Flow Summary

YEAR	AVERAGE DAY FLOW (GAL/D)	DAILY USAGE BASED 1200-SERVICES (GAL/D)	PEAK DAY FLOW (GAL/D)
2017	257,000	214	385,000
2018	228,000	190	369,000
2019	210,000	175	281,000
BASIS OF DESIGN	**240,000**	**200**	**350,000**

The plant water production (3-day average) for 2017-201 is shown in Figure 2.

The water usage over these three years shows a marked reduction which was achieved through water conservation measures. Unfortunately, these measures were in part required by limitations in the capacity of the Village's wells. The Orange County Health Department (OCDOH) noted in their most recent inspection that the 2019 flows exceed metered sales and in their opinion the difference represents leakage.

Due to the local geologic conditions, water supply wells used by the Village tend to have high levels of natural manganese which must be removed prior to use. The wells also have been determined to be groundwater under the direct influence of surface water (GWUDI). Therefore, treatment must remove the naturally occurring manganese and also achieve turbidity limits as required for a surface water supply. The Village water supply currently meets all Health Based criteria and provides a safe and affordable water supply. This is particularly important since the closely spaced Village homes rely entirely on on-site wastewater systems.

Potable water is treated in a plant located on Elm Street at the DPW facility at the northern end of the Village. Water is pumped up to two nearby water storage tanks which supply the Village water distribution system by gravity flow.

The Village has commissioned this study as a means to budget for and complete necessary upgrades to the water system and as a means of adopting a proactive approach to maintenance of the Village water supply.

The Village drinking water treatment system is a valuable public benefit which requires a sustained investment in preventative maintenance and upkeep. Operation and maintenance of the infrastructure that makes up this system is an important component of Village management that is often “out of sight, out of mind”, therefore many villages struggle with setting a fair, equitable and effective means to finance these systems. However, the capacity and quality of these systems can affect a community’s ability to maintain sustainable growth and redevelopment, and their maintenance and upgrade are necessary.

The water system is in need of improvement that will increase resiliency as well as basic maintenance and upkeep. The Village should be planning for funding for the water system that would transparently and equitably distribute the overall financial burden for the community.

Recognizing this situation, the Village engaged in the preparation of a Water Master Plan as a valuable management and decision-making tool for the Village. The Village’s objective is to provide the community with the most value in terms of capital investment, control of user cost and infrastructure longevity; therefore, a strategy for a water system that will result in long term public support for investment in these systems is in order. Understanding the value of the water system to the Village residents not only in terms of ample, high quality water service, but also in terms of revenue generation capabilities will create a framework for the Village’s fiscal policy with respect to these systems.

The Master Plan is intended to provide a framework within which the Village of Greenwood Lake can plan, fund and execute maintenance of existing water system infrastructure and extend the useful life of existing equipment, providing safe and adequate service to all customers. Subsequent sections of this report provide direct observations of the existing water system.

Development of the Master Plan involved an analysis of existing conditions through review of available documentation and water system site visits. This review of existing conditions was facilitated by the Village staff and operators and represents a first step in moving forward with an infrastructure plan.

In summary, the following recommendations are made:

- The water system requires specific capital improvements;

- The current long and short term debt will be satisfied n 2024. Therefore, this is a good time to begin planning for needed water system improvements and the financing of those improvements. Overall costs could be significantly lowered if grant funding were sought and obtained;

- The billing system customer records are continually updated by the Village as property use and occupancy changes. If there are properties that are connected to water supply and not being charged the Village would be losing revenue.

- Recommendations for future capital improvement financing include options for meeting both the O&M budget and debt through a water use rate recommendation, and a water use rate with a service fee. An option is also outlined for meeting O&M costs through water use rates and service fee, while financing water system improvements through an Ad Valorem charge.

2.0 EXISTING WATER SYSTEM

The Village of Greenwood Lake was incorporated in 1924 and a village water system was first established around 1925. The Village grew rapidly after the War ended in 1945 and by 1954 much of the Village water system had been installed and a water plant had been constructed on the eastern lake shore at the south end of the Village. The Village of Greenwood Lake was once supplied by two screened wells 87'deep along the western side of the valley. These wells became plugged and their yields dropped off. A new large-diameter shallow screened "Caisson" well was installed for the Village about 2,000' northeast of the older wells. (USGS Water Supply Paper No. 1985). See Figure 3 for a water system map.

The present water plant was constructed in 1991 and consists mainly of the two 0.5-MGD treatment plants installed at the time. See Figure 4 for a map of the existing water plant and wells.

The Village of Greenwood Lake owns the water system and all facilities. The Water Department has relatively little debt and the operations appear to be adequately funded. The principal immediate problem is maintaining an adequate source of supply from wells. Longer term issues include addressing deterioration of the aging Water Treatment Plant, maintenance of steel storage tanks and establishing a plan for replacement of water mains, some of which are 70-years old or more.

The Village water system provides potable water to approximately 1,236 accounts, including 1,169 residential connections and 66 commercial accounts within the Village. Over the past 3 years (2017, 2018, and 2019), the Village sold 93,824,000, 83,376,000, and 76,725,000 gallons, respectively.

This report discusses the quantity and quality of existing and water resources available to the Village, and evaluates the ability of the existing water treatment plant to meet existing average and peak demands. It also discusses possible new approaches to the provision of water. 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. Project budgets are presented with the goal of extending the useful life of the existing facilities, maximizing quantity and ensuring regulatory compliance, while maintaining affordable rates.

2.1 EXTENT OF WATER WORKS SYSTEM

The Village water system serves the great majority of Village residents. An exception are those residents located in a small area at the southeast corner of the Village along Wah-Ta-Wah Drive and Rumsey Road. The water system has approximately 87,100’ of water mains, 137 valves and 102 fire hydrants. Most water mains date back to the 1950s and are 6-inch diameter cast iron. A portion of the mains were reportedly replaced over the past twenty years; however, the Village has limited engineering record plans and research is incomplete at this time on the actual extent of main replacement which occurred.

Homes in the vicinity of Wah-Ta-Wah Drive and Rumsey Road have only seasonal service and many homes rely on private wells. The Village presently invoices’ only 24 seasonal services, although some services may serve more than one home. This area has very steep slopes and shallow bedrock and the elevation of the upper streets is too high to be served by the water tanks at the Village plant.

2.2 WATER SOURCE OF SUPPLY

In early 2020, the Village relied entirely on two wells, Well E and Well D. Both wells are approximately 50-ft deep and are completed in sand and gravel. These wells are screened with a naturally developed gravel pack and each reportedly had an initial yield of 400 gallons per minute (GPM). As was the case with prior wells, the yield has diminished relatively rapidly over the past 10-15 years to 100 GPM or less despite efforts at redevelopment.

A new well (Well G) was drilled, tested, and permitted and eventually connected to the water plant as a new source of supply in May 2020. This well had an initial capacity of 240 GPM. This new well will, at least temporarily, alleviate the water supply shortages that the Village experienced in early 2020.

The existing well field is located north and east of the Water Plant and consists of a complex series of glacio-lacustrine sand and gravels approximately 100’ thick. The alluvial materials are likely recharged from upland sources as well as Greenwood Lake itself. The high levels of soluble (unoxidized) manganese would normally suggest that there is little direct communication with surface waters. Nevertheless, the NYS Department of Health has determined the wells are GWUDI. NYSDOH has conducted a Source Water Assessment and determined that the wells have a high to very-high susceptibility to contamination. This is due to the shallow depth of the wells, their proximity to residential and commercial development, the lack of a municipal sewer system, and the community’s reliance on on-site septic systems.

The Village of Greenwood Lake's consolidated water withdrawal permit (WWA #12,508) was modified by the NYS Department of Environmental Conservation (NYSDEC) to use one new water supply well (Well No. G) pumping up to 240 GPM. The consolidated permit authorized a total approved supply of 302,000 GPD. The Permit also authorized the Village to temporarily take up to 460,800 gallons per day until through the end of 2020 in order to meet the maximum day demand and to satisfy redundancy requirements. The Permit directed the Village to pursue an alternative source by the end of the year 2020.

2.3 WATER TREATMENT WORKS

The Village historically relied on a treatment plant which included a surface intake and associated disinfection at a facility built in 1954 on the east shore of Greenwood Lake at the south end of the Village. At some point the Village began to rely on a series of wells. A large diameter caisson well was reportedly abandoned after a float switch leaked mercury into the casing. Although the mercury was reportedly cleaned up, the caisson well was no longer used and is now in disrepair. Conventional wells were then drilled and after a determination that the shallow well water was GWUDI the present treatment plant was built in 1991.

2.3.1 CHEMICAL ADDITION

Influent from each of the wells enters the plant and is injected with:

1. Sodium permanganate: This oxidizes manganese and iron in the well water.
2. Polyaluminum chloride: This coagulates particulate matter and also aids in settling of the oxidized iron and manganese.

An in-line static mixer is installed in piping which flows to a package flocculator & clarifier unit which was manufactured by Meurer Research (MRI) and installed in 2009.

Two 5000 gallon pre-oxidation tanks were previously installed to allow the permanganate an additional 30 to 45 minutes contact time to oxidize soluble manganese from the wells. These tanks were bypassed during the 2009 upgrades. Since the NYSDOH Recommended Standards for Water Works (RSWW) requires that the permanganate be added as far upstream as possible to oxidize iron and manganese in the water it is not clear why the tanks were bypassed. The condition of the tanks should be assessed and consideration be given to incorporating them back into the treatment process.

2.3.2 FLOCCULATION AND SETTLING

In 2009 a project was completed which included, among other things, taking the old pre-oxidation tanks out of service and installing a new primary clarifier and a building expansion to house it.

2.3.3 PRIMARY CLARIFIER

In 2010 a primary clarifier unit was installed and the building expanded to house the equipment. The unit is a pre-engineered steel tank designed and manufactured by Muerer Research, INC (MRI). This unit incorporates a single train of paddle-type flocculators and a primary settling chamber with inclined plates to aid in the removal of manganese and improve overall water quality and operability of the plant. Overflow from the primary clarifier flows directly to the two clarification-filtration systems which were the main component of the original plant. The operators of the system report that at heavy summer flows in excess of 250 GPM, clarifier performance falls off rapidly, which in turn requires the original Roberts Filters to remove more solids, limiting production through these filters. The flocculation chamber has a capacity of 7500 gallons. RSWW specifies a minimum 30-minutes residence time in flocculation, suggesting flow capacity of 250 GPM. During the summer, filtration rates often exceed 250 GPM and the capacity of the primary clarifier. At these higher flows, more frequent backwash of the Roberts units is necessary, causing the plant production to fall behind the demand and depleting water in the storage tanks. Mechanical or other failure of the one primary clarifier would, at high flows, jeopardize the plant's overall capacity to meet the Village's water supply needs until repairs could be completed.

The plant presently has two separate clarifier systems operating in series: the newer primary Flocculator Clarifier followed by a Contact Media Clarifier in the front chamber of each Roberts unit. Both the MRI and Contact Clarifier are of a design type typically used to treat surface water. Surface water tends to have colloidal silt and clay and sometimes algae which must be removed. Both Contact Clarifiers and Dissolved Air Flotation (DAF) units take advantage of the low density of precipitated colloids and algae and float the solids out within a separate waste stream. Unlike most surface water treatment plants, the water at Greenwood Lake has little colloidal matter and no algae since the water comes from wells. In this case the precipitate is a higher density manganese and iron precipitate which settles much better than it floats. The MRI unit, with its conventional flocculator basin and plate clarifiers is a suitable technology for this plant given that the bulk of precipitate is a relatively dense iron/manganese hydroxide.

2.3.4 CLARIFICATION-FILTRATION

The original water plant consisted of two pre-engineered package plants manufactured by Roberts Water Technologies (Pacer II Model P-350P) and which remain in service. The units are rated for low to moderate turbidity surface water at a rate of 350 GPM (0.5 million gallons per day (MGD)) each. As previously discussed, there is very little conventional turbidity from suspended solids in the GWUDI wells. The wells do however, have high levels of iron and manganese, which essentially control and limit the operation of the filters. The operator reports that at flows in excess of 250 GPM performance deteriorates rapidly. It is also notable that:

- The floc from a surface water source tends to be light-weight and have high surface activity; whereas,
- In this instance, the iron and manganese precipitate in the form of hydroxide compounds (Fe-Mn(OH)x) which tend to be much denser and have a relatively low surface activity.

Each package system is housed in a steel tank and consists of a "Contaclarifier" or Adsorption Clarifier and a multimedia rapid sand filter (RSF).

<u>Clarifiers</u>

The clarifier operates in an up-flow mode and water passes up through the dense media, agglomerating on the media. The clarifier is periodically backwashed from beneath at 350 GPM with an aggressive air scour of 6 CFM/SF which lifts solids to the surface overflowing into a waste trough. Each clarifier is designed to hold 140 CF of media with a bed area of 35.25 SF; the Media Contact Time is 3 minutes and the surface loading rate is 9.9 GPM/SF.

Backwash cycles are triggered by the build-up of pressure on the inlet (bottom) of the media. Normally the clarifier overflows by gravity to a trough which discharges to the headwater of the multimedia filter. During a backwash cycle an automated waste valve in the overflow trough opens and the clarifier overflow goes to waste. Two 10-Hp blowers are installed for air scour.

As noted above, surface water floc behaves differently than Fe-Mn(OH)x precipitate. And contact clarifiers will tend to be less effective in removal of these heavier and less surface-active Fe-Mn(OH)x precipitates. These performance limitations are likely part of the reason the plant was modified to include a primary clarifier ahead of the Roberts units.

Multi-Media Filters

Each filter operates as a conventional Rapid Sand Filter. Water from the clarifiers flows to the head of the filter, passing down through the media which was designed as 50 inches of graded layers of Anthracite, Sand, Garnet and Gravel. The upper portions of the media (down to the gravel) in both filters has been changed within the past ten years and was replaced with Manganese Greensand to aid in iron and manganese removal. Flow through the filter media discharges to an underdrain system which collects the filtered water and discharges it to the Clear Wells under the plant floor. As the filter removes solids, the headwater level rises to a point where a float switch initiates a backwash cycle with air scour. The backwash, filter to waste and return-to-service steps are completed by a series of automated valves operated through the Plant SCADA. Each filter has a surface area of 70.25 SF, which at a filtration rate of 5 GPM/SF, has a capacity of 350 GPM.

2.3.5 CLEAR WELLS AND CONTACT TIME

The two plant Clear Wells are located beneath the filter units; each has a volume of 13,000 gallons and is constructed with concrete cross baffles to limit short-circuiting of the tank. A weir overflows to the pump chambers. The contact time (CT) at annual Peak Day Flow is calculated to be 96 which meets the requirements of RSWW as calculated in the Table below:

Table 2.1 – DISINFECTION CT CALCULATION

Peak Day Flow	350,000	GPD
Peak Day Flow	243	GPM
Clear Well Volume (2)	26000	GAL
HRT	107	MIN
Baffle Factor	0.75	
Effective HRT	80	MIN
Chlorine	1.20	mg/L
CT Provided	96	
TEMP	14	C
pH	7.0	SU
CT Required	83.6	

The Clear Wells each overflow into separate chambers where two 40-Hp Vertical Turbine High-Lift pumps rated for 250 GPM are installed. The high lift pumps fill the water storage tanks and also provide backwash flow to the filters. The high lift pumps were recently equipped with Variable Frequency Drives (VFDs) which increase the flexibility of operations, increase the life of the pump and save on energy costs, and which typically pay for themselves in a few years.

2.3.6 SOLIDS MANAGEMENT SYSTEM

Underflow from the primary settling tank, and backwash from the contact clarifiers and filters all discharge to two 20,000 gallon backwash tanks under the plant floor. Each backwash tank is equipped with mechanical sludge collector flights and a sludge pump which pumps thickened solids to four sludge holding tanks.

The overflow of the sludge holding tanks discharge under SPDES Permit (NY-027-2876) to a Class C tributary of Greenwood Lake. The permit requires daily monitoring of flow and pH and monthly monitoring for: iron manganese, Total Suspended Solids (TSS) and phosphorus. In 2019, the Average Daily Flow was 11,000 GPD with a Peak Day Flow of 29,000 GPD on November 5th. The plant is permitted for a maximum discharge of 43,200 GPD. No permit exceedances occurred in 2019, although July-August samples for TSS were 5.2 and 9.3 mg/L compared to a limit of 10-mg/L, which coincides with the highest water usage period. The waste flow is consistently 4-6% of the water production which is relatively low and may reflect the high settleability of the precipitates at this plant compared to most surface water treatment plants which often waste as much as 10% of the treated water.

2.3.7 ANCILARY PLANT FACILITIES

The plant is also equipped with a variety of typical equipment/facilities:

- Stand-by Generator – operable and serviced.
- Laboratory – functional and clean condition.
- Office on the second floor, functional but the roof leaks.
- A computerized SCADA system housed in the lab which monitors and controls plant operations and issue alarms. The SCADA was supplied by and is maintained by Aqualogics of Syracuse, NY.
- Heating systems which are largely inoperable at the time.

- Ventilation systems which are largely inoperable. The corrosive environment has made it difficult to maintain HVAC equipment in service and the lack of ventilation has contributed to significant decay of materials and equipment throughout the plant.

The Water Plant Building housing the operations is a frame building with steel siding and interior steel liner panels. The construction type and many of the details of construction and finishing are poorly suited to the housing of a water plant. Typical problems include:

- Interior steel liner panels are heavily corroded and in places have openings due to corrosion,
- The walls and frame extend to the floor resulting in water and humidity at the floor surface directly corroding the liner panels and base of the building's framing system,
- The original ventilation system was inadequate to exhaust the humidity from a water plant with open filters and the ventilation system appears to have failed entirely some years ago. The 2011 addition, a small room housing open water tanks, was also provided with limited ventilation which has also failed.
- Electrical enclosures are heavily corroded, even the stainless-steel panels installed in 2011. And any exposed wiring contacts in the building are corroded as evidenced by a deep green surface layer.

These problems are all indicative of widespread decay and suggest an eventual failure of the entire building system. This may be due in part to the heavy use of permanganate and chlorine to remove manganese, but the degree of building decay is remarkable in a facility of this age. While the concrete, pipes and pumps have some corrosion and decay, and some mechanical systems warrant upgrades or replacement due to age, they are largely intact due to continual service and maintenance. The building system however, is quite literally crumbling around the working parts of the plant.

2.4 WATER STORAGE TANKS

The two High Lift Pumps in the water treatment plant direct water up to two water storage tanks on an elevated area immediately to the west and at a higher elevation than the plant. One tank has a capacity of 1 million gallons (1 MG) and the second tank has a capacity of 200,000 gallons (0.2 MG). The tanks are painted steel ground storage tanks, 38' high with a floor elevation of 820' and an overflow elevation of 858'. The tank levels drive much of the plant operations and can be read from the plant SCADA. The tanks were last painted in 1999 and were most recently inspected in May 2017 by Underwater Solutions. The 1 MG tank coatings were found to be in acceptable condition although some evidence of corrosion was beginning to appear. Maintenance inspection should be scheduled for 2023 to assess the conditions. The 0.2 MG tank was found to have significantly more corrosion. Underwater Solutions recommended replacing the tank vent and cleaning and repainting all components of the tank except the floor. We agree with that recommendation except that, from a practical matter, we would recommend painting of the floor as well. This work and alternatives are described in Section 4.4.

2.4.1 MOUNTAINVIEW TANK

On the east side of the lake and south of NY Rt. 17A approximately 100 of the homes located above Lakelands Avenue are located at elevations too high to be reliably served by the tanks at the water plant. To serve this area, a Booster Pump Station (the Main Street Station) was constructed at 4 Main Street (SBL 310-8-20) and a 0.1 MG water tank was installed above Mountainview Road at an elevation of 920-ft. The tank and booster pump station were built in 1974. The pumps are operated using the original mechanical pressure switches, which so many years later, do not provide accurate control of the tank levels. The tank was repainted in 1999 and modifications made under a NYSDOH approved plan.

Approximately 15 homes located at a higher elevation than the pump station appear to pre-date the aforementioned pumps and tank and are connected to the “Low” side of the Pump Station. These homes effectively limit operation of the tanks at the water plant and prevent the tanks from being drawn down since that would result in low pressure to those homes.

2.4.2 SEASONAL SERVICE AREA

In the southeast part of the Village, homes have been built on two main roads leading up from the lake (Wah Ta Wah Drive and Rumsey Road). Water mains were extended up Wah Ta Wah but at Fourth Road the tank elevations no longer provide sufficient pressure. In 1999, a pump station and 2000-gallon tank were built at Wah Ta Wah Drive and Fourth Road (SBL 317-1-11&12) so that water could be pumped to the homes above. A line was extended to Rumsey Drive to serve homes on the upper end of that and adjoining streets. The lower end of Rumsey Road does not have municipal water service. The water mains, pump station and tank are all owned and operated by the Village. Many of the upper homes were constructed with above ground or shallow burial piping due to bedrock and cannot be operated through the winter. As a result, there are 24 customers billed on a seasonal basis. The upper system is drained each fall and put back into service in the spring. The operator reports that despite difficulties in the initial years of operation, the process of winterizing and restarting the system is now relatively trouble free most years.

2.5 WATER TRANSMISSION AND DISTRIBUTION SYSTEM

Water from the storage tanks flows through a 12-inch main which was recently replaced and then to the main Village distribution system. The distribution system consists primarily of 6 and 8-inch water mains which are reportedly in overall good condition. Small diameter galvanized lines on Water Stine and Rumsey were upgraded in 1996 and 1999 to 6-inch lines. No other information is vaialable on the original lines or subsequent improvements. The original water mains were installed between 1945 and 1954 and are cast iron pipe (CIP) with bell and spigot joints. At 70-years old, the mains are nearing the end of their service life but are still 30-50 years younger than mains in service in some other communities. In the event there are major road or utility projects occurring in the Village, the water mains should, if possible, be upgraded as opportunities arise. Without periodic upgrades, the Village could, in 30 years, find itself in a position where all the mains are 100-years old and chronic problems are increasingly becoming costly emergencies. Eventually, annual repair costs will exceed the amortized cost of wholesale replacement. At that point the Village would be left dealing with service interruptions and customer complaints in the face of a costly upgrade project.

Dead end lines tend to be restricted by the accumulation of corrosion which limits the completion of effective flushing. Water mains are flushed annually, but limited supply from the wells has in the past years limited the ability to thoroughly flush the system. And heavily corroded lines become harder to thoroughly clean due to the irregular way that corrosion forms in the pipe. The operator reports that most water mains opened in the course of service are not yet significantly reduced in size due to corrosion. Valves and hydrants are reportedly exercised on a regular basiss by the Village water department; this practice should be on a schedule and maintained if at all possible.

Water production at the plant was compared to the metered supply sold for the period March 6 through September 10, 2019.

Table 2.2 – Water Production Summary

Plant Water Production	41.2 MG	Deduct 10% Backwash (-4.12 MG)	Delivery 37.1 MG
		Metered Sales	26.9 MG
		Unmetered and Seasonal Services	2.3 MG
		Total Water Sales	29.2 MG
		Apparent Losses	7.9 MG
			Loss is 21%

DOH noted the discrepancy between water production and sales in their 2019 inspection report. The discrepancy can be a result of many things such as flow meter calibration, connection of unmetered water to a major public space (e.g. a beach or parks). These discrepancies are generally not detrimental or problematic. If, however a major water user is being under-charged (such as through inaccurate registration of a compound meter) then the Village is losing sales and the user is getting free water. If chronic leaks are present in the system, they will drive up operating costs and such leaks tend to worsen over time. An evaluation of usage by the largest customers should be made to identify potential metering problems. In addition, a professional leak detection survey should be completed on the entire distribution system. Such surveys are not costly and can easily pay for themselves in a year through leak repairs and the resulting reduced operating costs.

All water meters in the Village were replaced within the past five years with Badger Meters which employ a radio-read system that directly interfaces with the billing software.

A total of 1236 service connections exist. Of these, 24 are seasonal and 72 are unmetered. Seasonal services are provided on a summer only basis through Village water lines which are drained over the winter. The seasonal services are for homes at the southeast of the Village, which were built on the steep western slope coming up from the lake along Wah-ta-Wah Drive and Rumsey Roads. Hydrants are regularly exercised by the Water Department and serve primarily to flush the distribution system. Due to the proximity of Greenwood Lake to most properties the Fire Department is equipped to utilize the lake for excess water needed for firefighting.

The seasonal service area is at the southwest of the Village and is served by a booster pump system and small diameter lines which are drained over the winter and are disinfected and placed back in service each spring. The homes are not closely spaced, the terrain is steep, the elevation requires pumping, bedrock is shallow and the existing lines are shallow and subject to freezing. For these reasons, the Village considers improvements here as being unaffordable. The operators have made improvements to simplify start-up and winterization and report few problems in switching over these services.

2.6 WATER QUALITY

The finished water quality delivered to the customers of the Village of Greenwood Lake meets all State and Federal health guidelines and there are no compliance issues at this time. The water system applies orthophosphate to the water at very low levels in order to limit corrosion and maintain lead and copper as low as practicable. NYSDEC directed the Village to reduce the use of orthophosphate in an effort to reduce phosphate loadings to Greenwood Lake which result from backwash discharge. However, this change resulted in an increase in dissolved copper in the water distribution system. The plant has returned to using orthophosphate which has returned copper to low levels meeting all State and Federal guidelines.

Although the Village treats water to a high degree, the quality of source water drawn from the wells is problematic in a number of ways. The local geology results in naturally-occurring high levels of soluble manganese and iron which the plant must remove. In addition, the shallow unconfined wells are vulnerable to contamination particularly since they are close to the most densely populated parts of the Village which does not have centralized sewers. The mineral content of the water also leads to relatively rapid declines in the yield of wells. Wells permitted for 400-GPM decline over 10-15 years to yields of 70-GPM.

3.0 WATER SYSTEM NEEDS

The Village's water facilities are ageing and their capacity and reliability decays with each passing year. To plan and budget for the future and maintain a high quality of water service at affordable rates the Village commissioned this Master Plan to address:

1. The general condition of the Village Water Supply;
2. To identify immediate, short-term and long-term needs;
3. Allow for establishment of adequate reserve funds;

Identify strategic capital improvement projects to best position the Village to meet the needs of the coming years at rates affordable to the residents.

3.1 WATER SOURCE OF SUPPLY

The challenge of maintaining an adequate supply of water continues to be a problem for the Village. The natural mineral content of water in aquifers around the Village is problematic due to high levels of iron and manganese which significantly reduces the life of the wells. Most wells have a life on the order of decades. These wells decline significantly within less than 10-years and require costly rehabilitation to maintain a fraction of their capacity. Even though a new well is being put in service in 2020, Village officials question how soon they will need to begin planning the "next" well. A new well will eventually be required and it will invariably require land and infrastructure as well as time-consuming testing and permitting steps before construction can even begin.

A significant effort is also expended in treating the water. The well water is GWUDI and requires filtration. However, many such GWUDI wells are treated simply by disposable NSF approved cartridge media. Drawing from the wells eliminates the potential issue of disinfection byproducts. However, in every other way the source water quality requires a plant every bit as extensive and costly as if the Village were taking water directly from the lake.

The Village needs to look at alternate supplies or develop a better way to manage and maintain the three wells it now has in service.

3.2 WATER TREATMENT PLANT

The water plant is approaching 30-years old. While the concrete structures and many of the more durable components have held up well, signs of decay and failure are evident throughout the facility. In many instances, the problems are beginning to affect the ability of the plant to meet treatment standards and left unattended the decay will result in compliance issue within the next 5 to 10 years.

3.2.1 BUILDING ISSUES

The principle areas that are most problematic are as follows:

1. The plant is a frame building with interior steel liner panels and exterior metal siding. Some of the details of construction were not always the best for maintaining a durable structure. For example, steel walls were extended flush to the level of the plant operating floor. As a result, the inevitable water leakage and condensation at the floor line has significantly degraded the lower section of walls – which is obviously critical to supporting the entire structure.
2. Heating and ventilation systems have failed at some time in the past resulting in the unnecessary build-up of humidity which corrodes the building and the plant equipment.
3. Corrosion has significantly decayed electrical equipment, conduits and wiring throughout the plant. Conduits are falling off the walls, any exposed wiring in enclosures is corroded a deep green and even stainless-steel enclosed control panels only 10-years old are already significantly corroded. The degree and extent of the corrosion is already causing power problems and will tend to worsen unless the building components and HVAC are addressed.

4. Major components of the plant such as high lift pumps, blowers and equipment drives have reached the end of their service life.

3.2.2 TREATMENT PLANT CAPACITY

The single Primary Clarifier does not adequately treat higher flows and provides no redundancy in the event of mechanical breakdown. The old pre-oxidation tanks should be assessed and brought back in service with internal mixing to optimize the use of permanganate.

3.2.3 EQUIPMENT UPGRADES

Much of the process equipment in the plant is 25-years old and in need of service or replacement. Components should be individually evaluated and replaced or serviced as needed, including:

1. High Lift Pumps and Motor Drives.
2. Blowers and Drives.
3. Electrically operated valves; original Bray Valves are being replaced as they fail with new Limitorque valves.
4. Flow meters and pressure transducers.
5. Turbidity and chlorine analyzers.
6. Chemical feed equipment.

3.3 PLANT WATER STORAGE TANKS

The two existing water storage tanks provide 4 to 5 days of storage for the entire Village which is more than adequate. Additional storage capacity would actually be detrimental in that summer conditions would result in loss of chlorine residual and winter conditions would cause freezing. The 0.2 MG tank has corrosion to a degree that planning should begin for renovation of the tank within the next five years. The coatings likely contain lead paint which will significantly increase costs for rehabilitation. The life-cycle costs for rehabilitation of this tank and its value to the water system at its present location (next to a tank which already provides adequate storage capacity) should be assessed prior to the costly work of rehabilitation.

3.4 WATER DISTRIBUTION FACILITIES

The water distribution system consists of approximately 87,100’ of main, with many of the original mains laid in the 1950s approaching 80-years of age. Many of the mains on side streets in residential areas are already somewhat restricted by corrosion. The Village should be looking to replace much of the older distribution piping within the next 20-40 years, by which time many of the mains will be 100-years old. The distribution system also includes a pump station and water storage tank on Mountainview Road as well as a smaller seasonal pump station and tank on Wah-Ta-Wah Drive.

3.4.1 WATER MAINS

Some of the approximately 13,000’ of main trunk lines on NYS Route 210 and Route 17A have been replaced within the past two years. Those mains which have not been replaced will require a significant and organized construction effort to coordinate traffic control, protect other utilities and maintain water service throughout the Village. However, gradual replacement of water infrastructure on the side streets using local contractors or Village forces may be possible with advance planning. In-situ rehabilitation techniques such as “pigging” the lines or pipe bursting are not viable alternatives given the small size of lines; the only means of replacing this infrastructure at this time is opening streets and laying new mains.

Information available from the water department and Health Department does not presently allow an accurate assessment of the age or condition of most water mains. But, based on the age of homes, it is estimated that half of the lines are less than 40-years old, leaving 42,000’ of old mains. Anecdotal evidence suggests that perhaps 12,000’ of these mains were replaced within the past thirty years. This would leave approximately 30,000’ of mains in need of replacement over the next 40-years. It is recommended that a Capital Fund be established to gradually replace mains.

3.4.2 MOUNTAINVIEW SYSTEM

The Main Street pump station and Mountainview Tank serve an estimated 80 homes and became Village properties in 1974 at the time when homes in this area were constructed. The pump station is in serviceable condition. No records exist for inspection of the Mountainview Tank. At a minimum this tank should be inspected. If no painting has been performed since 1974 then rehabilitation of the tank and pump station may be required in the next ten years.

3.4.3 WAH-TA-WAH (SEASONAL) SYSTEM

The Seasonal system includes a booster pump station and a hydropneumatic tank and serves approximately 30 homes. The system became Village property in 1999. The Water Department has, in the past, completed significant improvements in this system. At this time, annual draining and re-opening of the water system is relatively straightforward. Many, if not most homes, also have individual wells which are used seasonally or year-round. Due to the steep slopes, narrow roads, and shallow bedrock, improvements in this area would be disproportionately costly. There is reportedly little need or demand for improvements by the residents, many of whom rely on the seasonal system in the summer when well yields are diminished.

4.0 WATER SYSTEM RECOMMENDATIONS

4.1 PLANT FACILITY IMPROVEMENTS AND RENOVATIONS

While the concrete structures under the Filter Plant are in good condition, there has been significant decay of the treatment and pumping equipment as well as the plant facilities which house and support the equipment. Replacement of the entire plant is estimated to cost in excess of $8.0 million. Rehabilitation of the plant however, would be much more affordable.

4.1.1 BUILDING RENOVATIONS

The plant walls are frame construction which extend to the floor line. The effects of water, humidity and poor ventilation have resulted in significant decay. Based on an assessment of the facilities it is now necessary to complete significant renovations to preserve the functionality of the plant and to arrest decay before no option exists but replacement of the entire plant. The principal components of these renovations would be: rebuilding plant walls with masonry block units, replace roof sheathing and metal, upgrade the HVAC system, and provide gravity ventilation.

As described above, the exterior and many interior walls have decayed and continued neglect will result in structural failure if left unchecked. The outside bearing walls of the building are frame construction with an interior steel liner panel, fiberglass insulation and purlins with steel siding on the exterior. Sections of the wall would be supported sequentially and the existing wall removed and replaced with a masonry block system with exterior rigid insulation and EFIS or fiber-cement siding. The interior walls of the plant now have a large amount of attached wiring conduits and equipment directly attached to the decayed steel liner panel. As described below, replacement of the walls will necessitate repair and/or replacement of essentially all the attached electrical, controls and HVAC. This will be tedious and costly but is necessary to “clean-up” the results of past years of corrosion. Ultimately the building will be more energy efficient and far more durable, extending the life of the plant by decades.

4.1.2 MECHANICAL EQUIPMENT (REHABILITATION AND UPGRADES)

The primary clarifier functions well and has reduced filter loading significantly. The single Primary unit does not provide capacity for peak flows, nor does it provide redundancy in the event the single clarifier breaks down. It is recommended that a second primary clarifier unit be installed to operate in parallel with the existing unit.

The two Roberts Filters were installed in 1976 and have been in service for 24 years. The visible portions of the steel tanks show areas of paint loss and corrosion. But media has been replaced and the filter units themselves are performing well and the operators report no conditions that suggest the need for more comprehensive re-building of the filters. The Filters are rated for 350 GPM and, with planning, it has been possible in the past to operate on one filter allowing for major service of the units if required. As an alternative, the installation of a third filter in a new building would be evaluated to facilitate maintenance of the two existing units and provide added capacity for peak use periods.

The pre-oxidation tanks which were taken off-line when the new primary clarifier was installed should be re-assessed. Provided the tanks can operate given other hydraulic systems, it would be beneficial to install mixing and/or sludge draw-off mechanisms in the tanks and place them back in service to provide additional time for permanganate to effectively oxidize minerals in the well water prior to other treatment.

As discussed in Section 3.2.3 above, other equipment should be assessed and either upgraded as a capital project or funds should be set aside annually to upgrade and replace the oldest and most critical components.

4.2 WELL REHABILITATION AND IMPROVEMENTS

Wells in and around Greenwood Lake have a long history of clogging due to high levels of manganese and iron naturally present in the water.

4.2.1 WELL SERVICE AND OPERATIONS

The Village has for some years relied on systems which inject carbon dioxide into the wells and the geologic formation to periodically restore well flow. The carbon dioxide is viewed as an environmentally "safe" alternative which forms carbonic acid which depresses the pH and tends to dissolve some of the well encrustation. However, these wells have unique problems in that unusually high levels of manganese and iron are present in the water. These minerals present unique challenges. First, the mineral deposits are not readily dissolved by weak carbonic acid. Second, both manganese and iron in well water, when exposed to oxygen, allow the development of facultative biological organisms which "feed" off the minerals and tend to clog wells. For these reasons, it is recommended that a much more aggressive approach be taken in well rehabilitation. Traditional rehabilitation methods have utilized a combination of acid application, mechanical scrubbing of the screen and the use of heavy surge blocks to push the cleaning solution outside the well screen. Muriatic acid of a grade approved for potable water is typically used for such cleaning operations. Muriatic acid (HCl) is neutralized during cleaning and simply lowers pH and adds chloride to the well. These materials have no harmful byproducts and can be thoroughly flushed out prior to the well being placed back in service.

In addition to improved cleaning methods, operational changes may also be effective in slowing the clogging of wells and the decline in yield. As well pumps are turned on and off the water levels fluctuate, subjecting the screen and formation to draining and re-wetting cycles which promote scaling of the well screen and clogging of the formation. Level transducers can be installed in wells and variable frequency drives can be installed to run pumps at a speed which results in stable drawdown of the wells.

4.2.2 SURFACE WATER SUPPLY

Questions have been posed over the years as to why the Village pumps from wells and must deal with treatment of the high mineral content in wells, when the Village is situated around a lake with relatively good water quality. The use of lake water directly would require treatment of true surface water as opposed to groundwater which is only influenced by surface water.

There are a number of factors which usually suggest that surface water be used only as a last resort. Among these factors are:

- Increased operator training and staffing requirements;
- Increased sampling and analysis;
- Increased chemical usage;
- Water quality problems including taste and odor;
- Disinfection by-products may exceed drinking water standards and require treatment; and,
- Algae blooms may limit usability of the water.

4.2.3 ALTERNATE GROUNDWATER SOURCES

The US Geological Survey published Ground-Water Resources of Orange and Ulster Counties, New York, Water Supply Paper #1985 (1972). This survey concluded that, "A large subsurface spring discharges close to the west shore of the lake, about 1100 feet north of the intersection of Route 17A and Lake Road. In the winter, when ice forms on the lake, this spring area remains free of ice." The paper went on to estimate a potential yield of 4 MGD and noted that for the prior 46 years the average daily overflow of the Lake at Awosting, NJ was 32 MGD. Even assuming that 4 MGD is an exaggeration of the spring discharge, this still would be a significant source of supply which is derived from upland areas. The spring is likely to have better quality than the wells and is less subject to the development pressures around the Village wells which place the quality of these sources at risk.

An initial assessment of this source could be completed by sampling of thermal and water quality in and around the springs discharge point. Despite significant costs for development of intake structures to draw from the spring source and the need to pipe water 3500' to the treatment plant, this could prove to be a much better long-term source of water for the Village. A spring supply would not be susceptible to THM formation, would be removed from the Village center and would be expected to have better water quality, significantly reducing treatment costs at the plant.

4.3 WATER STORAGE TANK REHABILITATION

The existing 1.0 MG and 0.2 MG water tanks have reached the point where painting or replacement of the structures is warranted within five to ten years. Both tanks are steel and coated with lead paint which should be removed before painting. Unfortunately, the cost for lead abatement and re-painting steel tanks often approaches the cost of a new tank. In addition, the new epoxy coatings, even when carefully applied, typically have a life of 30-years or less. Rather than painting the tank(s), it is recommended that at alternate tank material be used. Glass-Fused Steel tanks (by Aquastore) or a Pre-stressed Concrete tank both typically have a life of 50-years or more. Offsetting the added cost of these type tanks against the likely need to repaint steel after 30 years, the life cycle costs for these other tank materials are less than steel.

Given the average day water usage in the Village, the 1.2 MG of current storage is more than is typically provided. But considering the history of maintaining a supply from the wells, we would not recommend reducing the capacity below 1.0 MG. For planning purposes, it is assumed that the Village would erect two 0.5 MG concrete tanks side by side to allow for regular cleaning of the tanks. As an alternative, the Village could elect to take a less costly route and repaint the two existing tanks.

4.4 WATER MAIN UPGRADES

Based on the analysis is Section 3.4.1 above, an estimated 30,000' of water main should be replaced over the next 40-years. It is recommended that the Village work to replace one-third of the mains (10,000') under a capital project focused on State roads and the more difficult piping. This would leave, on average, 500' of main to be replaced each year. At present day rates this would be a budgeted cost of $150,000 per year. By budgeting this on an annual basis the Village would accumulate a replacement fund that could be used in conjunction with other street maintenance activities and economize on restoration and paving.

5.0 PRIORITY LIST AND RECOMMENDED BUDGET

The improvements described above have been organized into the following project scenario:

Table 5.1 – $5.5M Project
WTP Upgrades, Supply Development Tank and Watermain Replacement

Improvement	Budget	Purpose	Priority
WTP REHABILITATION/UPGRADES			
Building Improvements	$744,500	Improve Plant Longevity and Treatment Performance	Near Term
Equipment Rehab/Replace	$584,000		
Plant Addition	$564,000		
Electrical	$461,500		
HVAC	$240,000		
Plumbing	$96,000		
Subtotal	**$2,690,000**		
WATER SUPPLY SOURCE DEVELOPMENT			
Redevelop Wells	$60,000	Increase Capacity and Reliability	Intermediate Term
Investigate & Test Spring Source	$250,000		
Construct Caisson Well	$300,000		
Electrical	$100,000		
Piping to Plant	$450,000		
Subtotal	**$1,160,000**		
DISTRIBUTION STORAGE			
Tank Repairs & Controls	$150,000	Peak Demand	Intermediate Term
Subtotal	**$150,000**		
DISTRIBUTION SYSTEM IMPROVEMENTS			
Water Main Replacement	**$150,000**	Flow and Pressure	Long Term

Subtotal of All Recommendations	**$4,150,000**
Engineering, Permitting and Administration (20%)	$818,000
Loan Closing, EFC Charges, Legal and Other (3%)	$288,000
Contingency (10%)	$244,000
TOTAL OF ALL RECOMMENDATIONS	**$5,500,000**

6.0 WATER SYSTEM OPPORTUNITIES AND CONSTRAINTS

The Village of Greenwood Lake is fortunate to have the asset of a public water supply system to support the Village. 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.

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

- There is a naturally high mineral content in the water supply of the local aquifer, which requires treatment;
- The groundwater supply has been determined to be Ground Water Under the Direct Influence of Surface Water (GWUDI) which requires filtration as if it were a direct surface water source;
- Water tanks will require costly maintenance in the coming years; and,
- Many of the water mains will be reaching the end of their service life in coming years and, absent a planned replacement program, the costs will at some point become very difficult to afford.

7.0 RATE STUDY

7.1 METHODOLOGY

New York State Village Law provides for the establishment of water rents for use of water (Village Law Article 11-1118).

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. Information from the Village, water system operators and engineering walk-throughs were utilized to provide recommendations with respect to capital plans for the water system improvements. Annual repair and maintenance was also considered with respect to potential future debt obligations.

Once this information was gathered and analyzed, a rate model was developed to evaluate the current fiscal situation as well as potential rate scenarios. First, the rate model was created to represent current fiscal conditions including current revenues and expenses. Then, the model was extended 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, and apply a benefit charge based on assessed property value, etc.). The rate modeling is presented in Appendix B.

7.2 SUMMARY RESULTS

Village Code Article III Water Rates and Charges, Chapter 114, last updated in 1984, states that all residential and commercial properties are to be metered with the exception of seasonal water service. Seasonal residences and unmetered customers are charged a flat rate. Two-family and other multifamily residential properties are to be metered with a single meter for the entire premises, or the owner may elect to have separate meters for each family unit. Metered rates are established by resolution of the Village Board of Trustees.

The current flat rate is $280, with 94 unmetered customers August to February, and 75 unmetered customers February to August. A property may be unmetered if it was not physically possible to insert a water meter into the water piping. A flat rate may be applied to a seasonal property for the season of use, with water service shut down during the off-season.

Village water rates were increased in 2018, and the water use billing structure changed and Administration Fee increased in 2019 in response to necessary repairs. The Rate Study indicates that the current system of billing includes a $70 administrative fee and users are charged differing rates based on five water volume usage “bins”. There is no distinction in the rates between residential and commercial users within the Village. Meters are read and bills charged every six months; March and September.

Based on the number of customer accounts, the volume of water sold, and the rate structure, a blended rate of $7.25 per 1000 gallons was used to determine existing costs to the typical Village residential or commercial customer. According to this model, the average customer paid a total water usage and Administration Fee of approximately $467 annually for the last two billing periods. The average annual cost calculated from the actual billing was $437 for water usage and Admin Fee. The modelled average annual cost is slightly higher than the actual billing calculation due to the error in the current billing software.

Debt services charges of $75 for the water filtration plant (satisfied 5/1/2024) and $30 for the water main repair (satisfied 2024) are also charged every billing cycle. Therefore, customers pay an annual $210 toward debt service, in addition to water usage and administration fees.

In the March 2020 Pending Billing Report there were 1037 metered residential accounts, 61 metered commercial accounts and 1236 billing accounts over all. Of the 1236 accounts in the billing, 94 were flat rate customers and there were 44 customers with no charges. Customers with no water use may be vacant properties or seasonal users.

Current use rate “bins” fairly well match patterns of customer water use per billing period. Twenty-five percent of customers used less than 7,000 gallons, 50% used 15,000 gallons or less, and 75% used 26,000 gallons or less. However, only 15 customers used 100,000 gallons or more. Of those large volume users, three were multi-family residences or apartment, one was a school, and 11 were commercial properties. A variety of alternate fee structures employing flat rates and ad-valorem charges were evaluated and presented to the Village. However, the consensus of the reviewers was that the current rate “Bin” structure worked well. This also equitably distributes costs and benefits. Therefore, the overall structure will be maintained. If capital costs are necessary, they will be added as a discrete user charge.

The imposition of the usage fee and debt service fees in combination with the short-term borrowing has balanced revenues to expenses for the present operation of the water system, especially if the water use calculation is corrected. Furthermore, it is noted that several existing debt obligations will be satisfied by 2024, creating an opportunity to invest in extending the useful life of the water system with very little change in existing annual costs.

Recommendations for water system improvements are not expected to lead to increased costs for O&M. The cost of debt services for the $5.5M recommended improvements derived from the Water Master Plan was modeled. In assessing rate impacts, conservative terms for bonding the improvements (4.0% for 30 years net level debt) was used in the model. It is possible the Village could obtain lower rates but bonds such as this typically are limited to 10 years amortization. At which point remaining debt would have to be refinanced, possibly at a much higher rate, so efforts to manage debt through shorter term bonds is not recommended.

It is also recommended that the Village establish, and annually budget for a Dedicated Capital Fund for replacement of water mains. Such a fund would allow for gradual replacement of mains in the most cost-effective manner possible.

A Rate Analysis for the $5.5M recommended improvements is provided in Appendix B. If it is not possible to obtain a NYS Water Infrastructure Improvement Act (WIIA) grant to offset some of the project costs, the annual rates would increase by 21%. Part of this increase comes from the addition of a $100,000 funding line for a Capital Reserve account. If this account were not established the rate increase would only be 8%. If a WIIA grant were awarded to the project for the maximum amount of $3.0 million, the rates would not increase and would still allow for the establishment of the Annual Capital Fund line.

8.0 CAPITAL FINANCING OPPORTUNITIES AND STRATEGIES

Given the regulatory status, capital improvement needs identified, demographic profile and economic opportunities in the Village of Greenwood Lake, the Village is well positioned to take advantage of a variety of state and federal long-term financing and grant programs. Key to maximizing these opportunities is understanding the full scope of all improvements and matching the financing that will result in the lowest user cost to each project.

Each grant program is operated by an agency under a program specific timeline for announcements of availability of funds, application due dates, award notices and execution of agreements for assistance which allows the grantee to obtain funds from the grantor. To assist in understanding the opportunities available to the Village, a brief description of the programs and timeframes for each aspect of relevant is presented in this section.

- ***State Revolving Loan Fund (Loan and Grant Program)***

  The Drinking Water and Clean Water State Revolving Loan Funds (DWSRF and CWSRF) programs fund the vast majority of municipal water and sewer infrastructure in the State for which outside sources of funds are sought. The programs function on a Federal Fiscal Year (FFY) calendar, with an Intended Use Plan (IUP) published effective on October 1 of each year listing projects for which funds may be encumbered during the following fiscal year. In order to receive program funds, a project must be listed on the Annual List which requires submission of a listing form, a Preliminary Engineering Report (PER), and a Smart Growth Assessment generally in late August.

  Once a project is listed on the Annual List and a community determines it will proceed with the project, an application for financing is submitted by late June of the following year.

  The application for financing must include an application form, documentation that the State Environmental Quality Review Act (SEQRA) has been conducted, the State Historic Preservation Office has been consulted, and any special districts have been created among other requirements. If a Special District is required to be formed, documentation that the district has been formed, including review by the Office of the State Comptroller if necessary, is required. And, a bond resolution with referendum period concluded is also required.

If a complete application is submitted by late June, financing can usually be closed before the end of the same year. Short term financing is available to support project development and construction costs at no cost or very low interest rate for two to three years after which long term financing is established with interest rates ranging from zero percent interest through market rate financing. To the extent that the community qualifies for a grant (based on environmental/public health need and ability to pay), the community borrows less over the long term, reducing annual debt service and impacts to the customer rates.

The SRF program accommodates adjustments to project cost and scope through submission of engineering amendments and budget updates. If project costs change beyond anticipated contingency, it may be necessary for the community to issue short term borrowing; however, all eligible, approved project costs are rolled into long term financing and any additional short-term borrowing is defeased.

Generally, the SRF process requires approximately 18 months from initiation any given spring (preparation of an engineering report and associated documents) through to the late end of the following year. Because the program has hard deadlines, there is no opportunity to speed the application process.

- ***State Water Infrastructure Improvement Program (Grant)***

The NYS Legislature initially committed $400 million in grant funds in the State Budget towards the Water Infrastructure Improvement Program over three fiscal years spanning 2015, 2016 and 2017. In 2017, the Legislature expanded the program through the Water Infrastructure Improvement Act (WIIA) and Intermunicipal Grant (IMG) programs to $2.5 billion over a five-year period for a variety of programs focused on water quality. The WIIA program works in concert with the SRF programs discussed herein with application materials for projects intending to make use of SRF funds for the balance of project costs mirroring the SRF financing requirements. However, communities may also submit applications for grant without SRF financing if other sources of funds will be used to

For funding rounds to date, up to 60% or $3 million of eligible drinking water project costs and up to 25% or $5 million of eligible wastewater project costs have been awarded to recipients. While public health, environmental impact and consumers ability to pay for improvements are considered, this grant program is unique in that it may be awarded to projects that do not achieve a high ranking based on IUP scoring criteria but that are vital to the long-term sustainability of public infrastructure.

- ***US Department of Agriculture Rural Development (Loan and Grant Program)***

The USDA accepts pre-applications for loan and grant packages to support community infrastructure on a rolling, invitation basis. Submission of a pre-application incorporates an application form, engineering report, environmental review and other fiscal and legal documentation. Upon receipt of a completed pre-application, the USDA will invite submission of a full application. Once a complete application is submitted and accepted, closing on financing occurs within several month time.

The overall process to obtain USDA RD funding is a multi-step process without hard timeframes, so it can be difficult to predict the timeframe for agency reviews. The agency's workload fluctuates but staffing does not and staffing is geographically assigned, so if there are many projects being submitted in the same geographic area, it can take time for the agency to review all materials.

The USDA RD program does not accommodate project cost and budget costs per se. Minor modifications within the overall scope and contingency are acceptable, but significant changes in scope or budget are generally not accommodated by the RD program. Therefore, appropriate and detailed project planning is key to a successful USDA RD project.

- ***Consolidated Funding Applications:*** *DOS Local Waterfront Revitalization, OCR Community Development Block Grants, DEC Water Quality Improvement Program, DEC Green Infrastructure Grant Program, OPRHP Parks Grant Program, ESD Infrastructure Investment, New York State Energy Research and Development (NYSERDA)*

The Consolidated Funding Application (CFA) process originated when the State combined the grant activities of over ten state agencies administering nearly 30 grant programs into a single, annual action, directed by regional councils and under the review and approval of the agencies and the Governor's Office. This process has operated for a number of years, aggregating between $800 million and nearly $1 billion dollars annually in state aid through various programs. Many of the Grant opportunities here are targeted for low- and moderate-income populations for which the Village would not be eligible.

The application schedule involves a call for applications in the early summer each year, with applications due towards the end of summer. Grant awards have been announced in December, with State Assistance Agreements executed in the spring or summer of the following year and funds available thereafter in the same year. The overall schedule from application to funding is about a year, driven by the state's process.

FIGURES

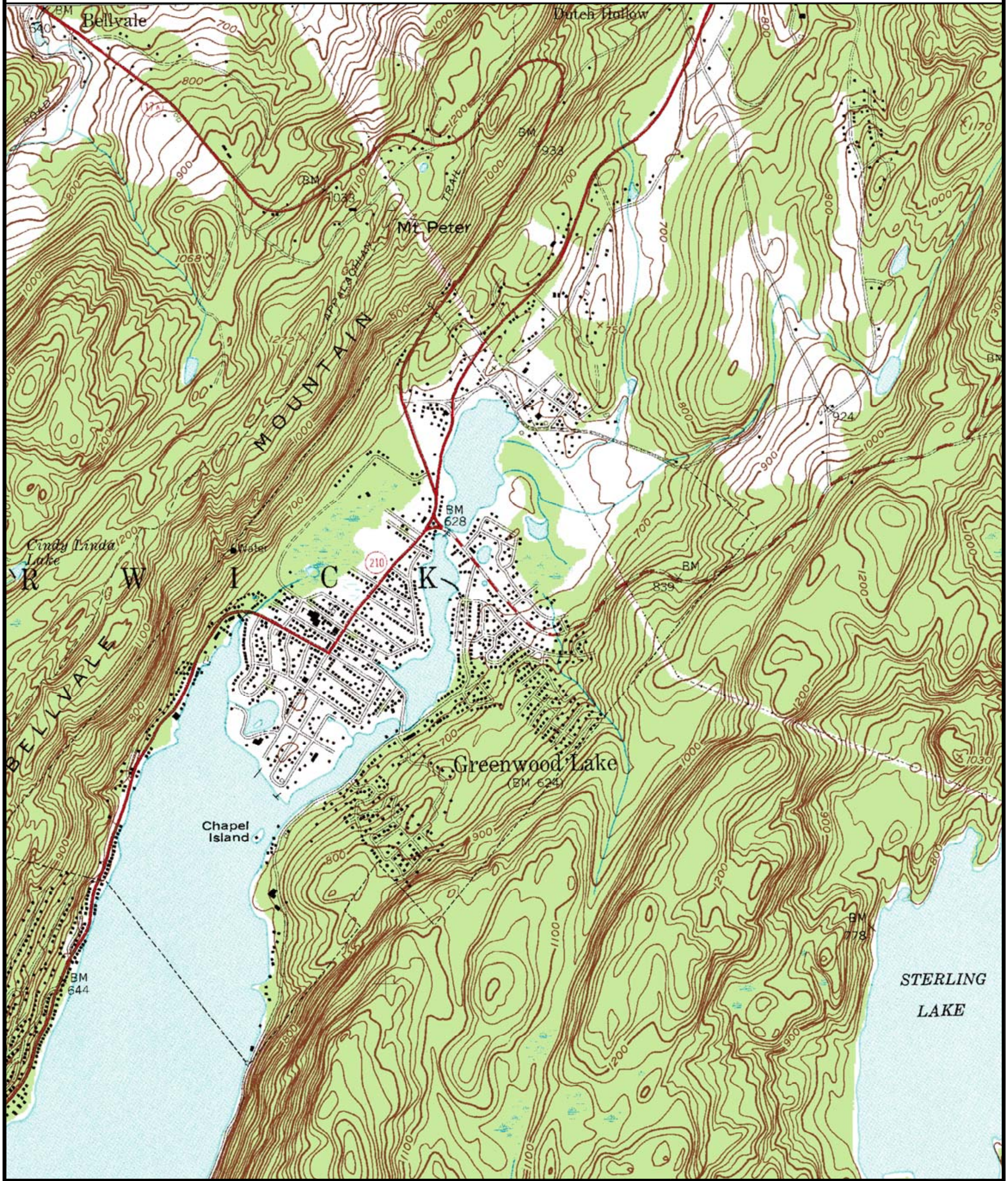

FIGURE 1	LOCATION MAP	WATER MASTER PLAN VILLAGE OF GREENWOOD LAKE ORANGE COUNTY, NY	DELAWARE ENGINEERING, D.P.C. ALBANY: 28 Madison Avenue Extension - Albany, NY 12203 Phone: (518) 452-1290 - Fax: (518) 452-1335 ONEONTA: 55 South Main Street - Oneonta, NY 13820 Phone: (607) 432-8073 - Fax: (607) 432-0432

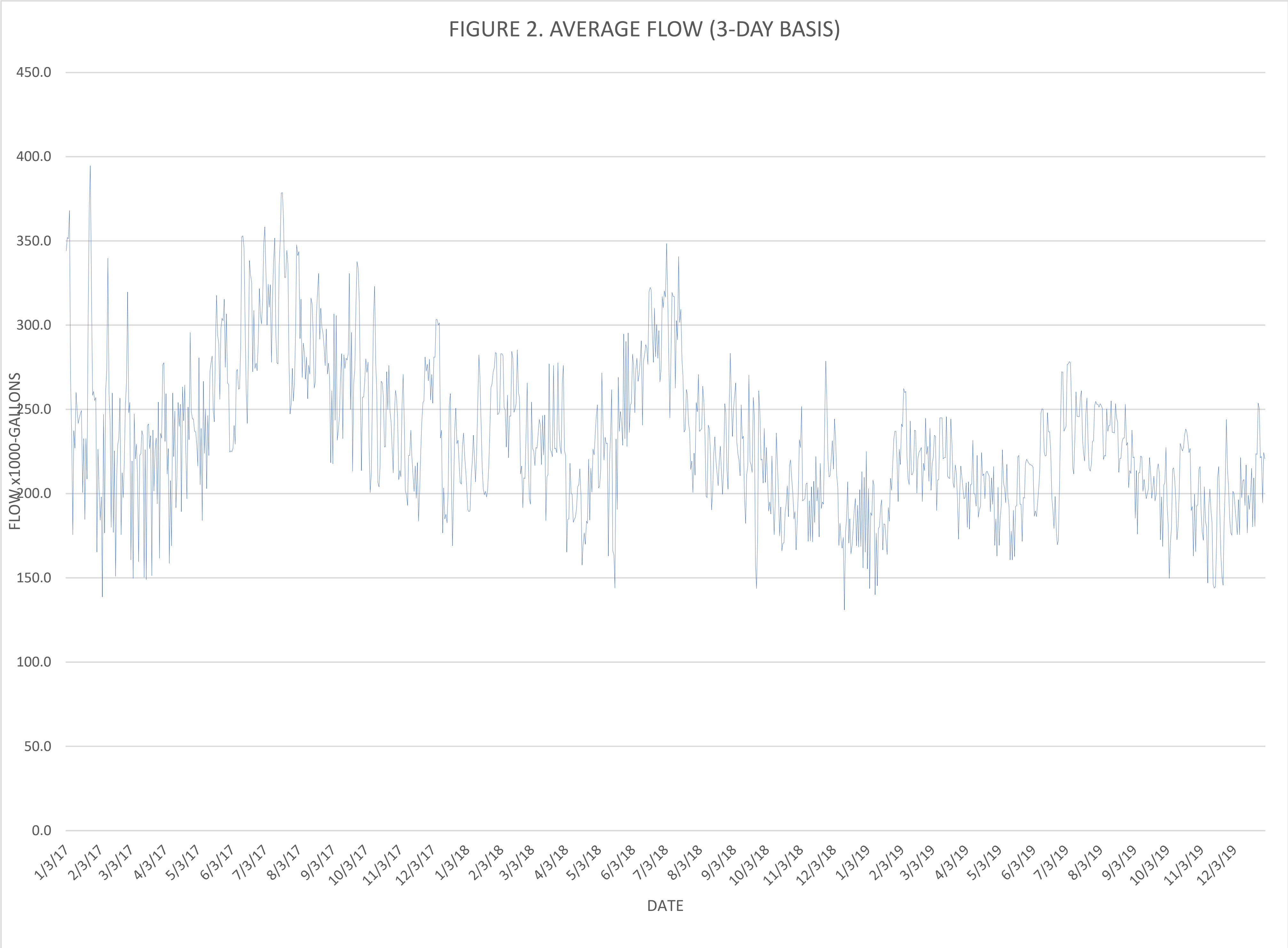
FIGURE 2. AVERAGE FLOW (3-DAY BASIS)
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
FLOW x1000-GALLONS
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2/3/17
3/3/17
4/3/17
5/3/17
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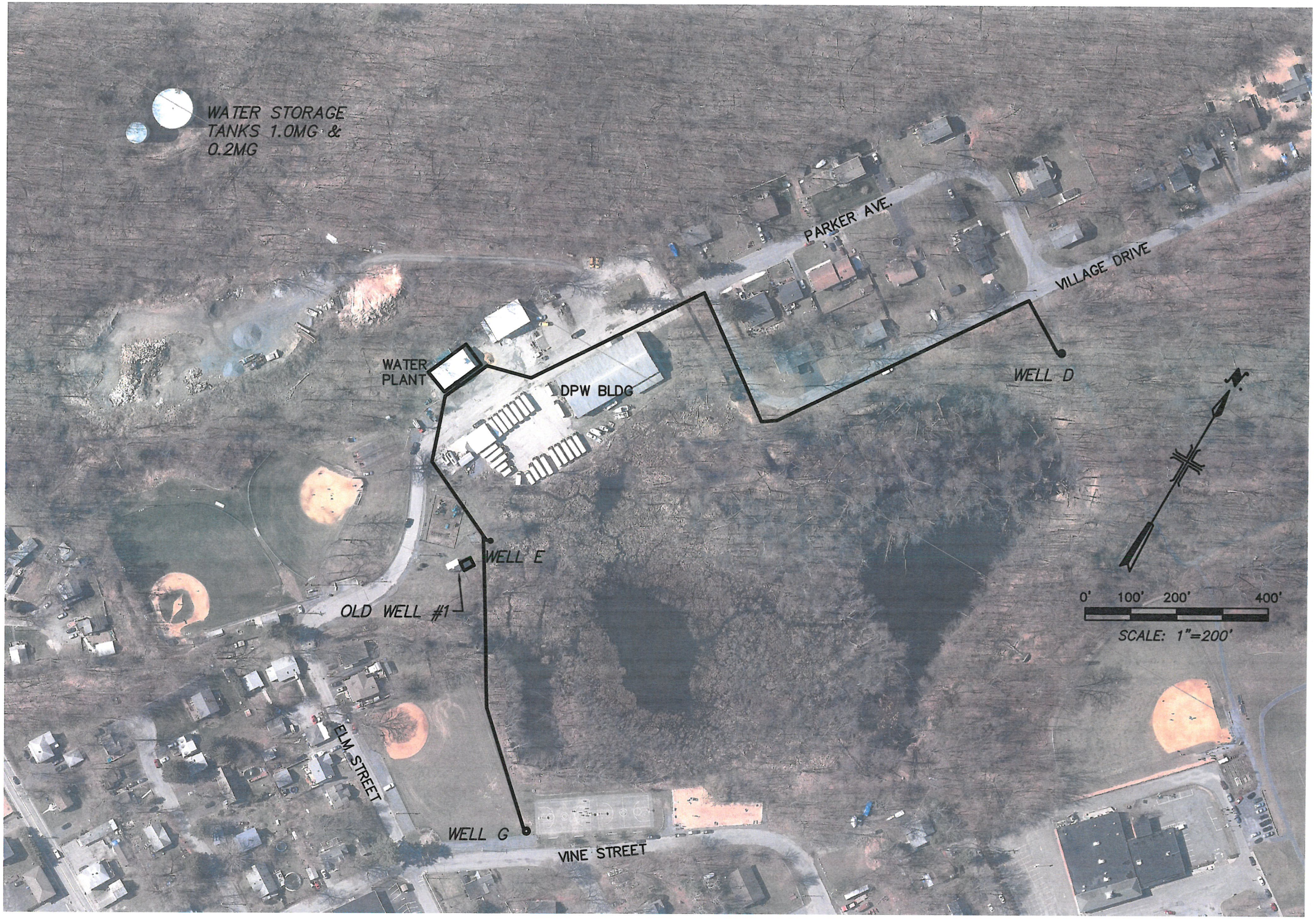
5/3/19
6/3/19
7/3/19
8/3/19
9/3/19
10/3/19
11/3/19
12/3/19
DATE

FIGURE 3
GREENWOOD LAKE WATER SYSTEM
VILLAGE OF GREENWOOD LAKE, NY



DATE: 6/24/2020
DRAWN BY:
SCALE: 1" = 50'
REVIEWED BY: ABC
PROJECT NO.: XX-XXXX
FILE:

DELAWARE ENGINEERING, D.P.C.
CIVIL AND ENVIRONMENTAL ENGINEERING
28 MADISON AVENUE EXTENSION, ALBANY, NY 12203 - 518.452.1290
55 SOUTH MAIN ST, ONEONTA, NY 13820 - 607.432.8073
31 NORTH MAIN STREET, LIBERTY, NY 12754 - 845.747.9952
6 TOWNSEND STREET, WALTON, NY 13856 - 607.865.9235
16 EAST MARKET ST., RED HOOK, NY 12571 - 518.452.1290
548 BROADWAY, MONTICELLO, NY 12701 - 845.791.7777

REVISIONS		
NO.	DATE	DESCRIPTION

WATER MASTER PLAN
VILLAGE OF GREENWOOD LAKE
ORANGE COUNTY, NY

WATER SUPPLY WELLS, PLANT AND STORAGE

FIGURE 4

APPENDIX A

2020 Budget and Rates

GREENWOOD LAKE WATER BUDGET AND EXPENSES (2017-2020)

BUDGET LINE	ITEM	2017 BUDGET	2018 BUDGET	2019 BUDGET	2020 BUDGET
F1000	Satrting Income	$0	$176,315	$30,000	
F2140	Metered Sales	$396,332	$390,000	$407,217	$534,213
F2144.100	Service Charges	$304,900	$165,000	$180,900	$180,900
F2144.102	Water Main Repair/Svc Charges	$0	$60,280	$72,360	$72,000
F2148	Penalty on Water Rents	$20,000	$20,000	$20,000	$20,000
F2401	Interest/Earnings	$200	$300	$300	$300
	WATER REVENUES	$721,432	$811,895	$710,777	$807,413
BUDGET LINE	ITEM	2017 BUDGET	2018 BUDGET	2019 BUDGET	2020 BUDGET
1440	Engineering	$2,000	$10,000	$20,000	$50,000
1910	Insurance	$22,000	$22,000	$22,000	$20,000
8310	Administration	$252,755	$259,630	$273,112	$273,112
8320	Source Supply & Pumping	$77,950	$274,450	$87,950	$156,150
8330	Purification	$61,800	$59,000	$56,000	$57,000
8340	Water Trans & Distr	$26,600	$21,500	$19,400	$16,000
9030 - 9040	Social Security/Medicare/Worker Comp	$327	$315	$315	$351
9790	State Loans	$278,000	$165,000	$232,000	$234,800
9795	Interfund Loans	$0	$0	$0	$0
9950	Transfer to Capital Projects	$0	$0	$0	$0
	WATER EXPENSES	$721,432	$811,895	$710,777	$807,413
	OPERATING COSTS (EXPENSES - DEBT)	$443,432	$646,895	$478,777	$572,613

APPENDIX B

Cost Analysis Models

PROJECT RATE ANALYSIS

ASSESSED VALUE	$39,837,800	
No. Services	1200	
Metered Water Sales	29.2	MG/Year
	80000	Gal/Day
	67	Gal/Service/Day
	6000	
Quarterly Water Usage	10000	GAL
Equivalent Dwelling Units (EDU)	2920	UNITS

CAPITAL PROJECT COSTS		Plant & Source
PLANT UPGRADES		$2,690,000
WATER TANK REPAIRS & CONTROL UPGRADES		$150,000
SOURCE DEVELOPMENT		$1,160,000
WATER MAIN REPLACEMENT		$150,000
CONSTRUCTION TOTAL		**$4,150,000**
Contingency	10%	$399,200
Engineering Services	12%	$498,000
Permits & Project Administration	8%	$320,000
Loan Closing & EFC Charges	1.2%	$49,800
Legal and Other	2%	$83,000
CAPITAL PROJECT TOTAL		**$5,500,000**

	CURRENT	LOAN ONLY	LOAN & WIIA
Water Infrastructure Improvement Act (WIIA)*		$0	$3,000,000
DWSRF Loan		$5,500,000	$2,500,000
Total Project Cost		$5,500,000	$5,500,000
Interest Rate - New Debt		4.00%	4.00%
Finance Term (Years)		30	30
Existing Debt Principle & Interest	$231,780	$0	$0
Added Debt Principle & Interest	$0	$318,066	$144,575
New Total Debt & Interest	$231,780	$318,066	$144,575
Current Operating & Maintenance Cost	$572,613	$572,613	$572,613
Added Operating & Maintenance Cost	$0	-$20,000	-$20,000
Water Main Replacement Dedicated Fund	$0	$100,000	$100,000
New Operating & Maintenance Cost	$572,613	$652,613	$652,613
Annual District Expenses (Debt + O&M)	$804,393	$970,679	$797,188
Average Annual Rate Per EDU	*$275*	*$332*	*$273*
Percentage (%) Increase		21%	-1%