Stephen P. St. Cyr & Associates
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January 7, 2019

Debra A. Howland
Executive Director & Secretary
Public Utilities Commission
21 S. Fruit Street, Suite 10
Concord, N. H. 03301-2429

DW 17-165 Abenaki Water Company – Rosebrook Division – Step II Report … water pressure problems and supporting documentation

Dear Ms. Howland:

On December 27, 2018 the New Hampshire Public Utilities Commission ("NHPUC") issued Order # 26,205 approving change in rates. As part of its approval, the NHPUC "Further Ordered, that Abenaki-Rosebrook shall submit a report, and supporting documentation, with the Commission within 10 days of the date of this order, that address three issues concerning possible solutions to the system's water pressure problem: the solutions considered before contracting with Horizons; the other possible options available to address the water pressure problems; and the reasons supporting the construction of a new water tank, as proposed by Horizons, as the best and most cost effective solution."

In response to the NHPUC order, see attached report which provides Background, Solutions considered, Other possible options and Reasons for the construction of a new tank. Also, see Attachments 1 – 3, various Horizon reports.

If you, the Commissioners and/or its Staff have any questions about the report and / or attachments, please contact me at 207-423-0215 or stephenpstcyr@yahoo.com.

Sincerely,

Stephen P. St. Cyr

Cc: Don Vaughan
Pauline Doucette
Marcia A. Brown

To: Stephen P. St. Cyr

From: Don Vaughan

Date: 1/4/19

Subject: Responses pursuant to DW 17-165, order No. 26,205; Regarding Rosebrook Pressure Problem.

In accordance with the above subject, Abenaki Water Company (AWC) herewith responds to the following:

a. The solutions considered by the Company before contracting with Horizons
b. The other possible options available to address the water pressure problem; and
c. The reasons supporting the construction of a new water tank, as proposed by Horizons, as the best and most cost effective solution.

For a better understanding of the Rosebrook Water System and the nature of its attendant pressure problem, the following information should be helpful. Much of what appears in the following has been taken from testimony and responses to data requests previously provided in this docket.

The Rosebrook Water System beginnings date back to the early 1970s. Owing to significant elevation differentials throughout the service area, system static pressures vary from 35 pounds per square inch (psi) at the higher elevations and up to 200 psi along the valley, certain OMNI Hotel properties, other residential homes at lower elevations, as well as AWC's well house and source of supply. As described in the Company's filing of June 21, 2018, and detailed below, these higher (excessive) pressures in the system have led directly to problems associated with wear and tear, water loss, premature failure of valves, fittings, pumps, treatment equipment, and other appurtenances. Together the issues post operational and safety challenges in the day-to-day operation of the system. These higher pressures greatly exceed normally accepted limits and caused F.X. Lyons to refuse to work on the system in August 2018 (See Abenaki's response to Staff Tech 1-4a).

Background

Noteworthy information previously provided, consequential of extreme pressure ranges or directly related effects follow:

- Immediately prior to AWCs acquisition, Rosebrook Water Company was informed that its commercial package and property policy running from 6/23/15 through 6/23/16 would not be renewed. This non-renewal was triggered by an extensive damage claim by Rosebrook following a water hammer incident which flooded several townhouses during a hydrant flushing operation.
- In 2010, a high pressure event during a repair at Abenaki's well house caused major damage to that facility and forced the Mt. Washington Hotel to close for three days.

- In its Sanitary Survey report dated August 4, 2014 NHDES concluded "...pressure in the distribution system, as a result of storage tank elevation, is much higher than necessary for adequate water service and fire flow. This pressure presents serious questions about power consumption and about safety of the operation when making pipe repairs. We urge the system owner to consider alternate ways of using the existing tank and adopting a lower pressure gradient".
- In January 2017, NHDES stated in a letter to AWC "We are in support of and recommend system modifications which will reduce the public health risk and will maintain pressures within the recommended range. Not only will this provide for a safer and less costly system to operate, it also creates the ability for the company to take back ownership of system maintenance from home and commercial owners who are currently maintaining their own PRVs."
- The Twin Mountain Fire Department is also concerned about the high pressures. In February, 2017 the department sent a letter to AWC in support of the project to reduce system pressure to a maximum of 100 psi. The department stated that they believe such a project will "...improve safety and reliability of the system."
- Due to the issues raised by AWC and other parties as described above, the No Action alternative is not viable as a long-term solution.

In order to minimize the reoccurrence of any of the above incidents, the Company determined the optimal solution would result in a maximum system pressure of about 100 psi.

A. Solutions considered by the Company before contracting with Horizons

1. Install a single pressure reducing valve (PRV) on the fill/distribution water main to the existing storage tank.
   This solution would require a dedicated main, approximately one mile long from the wells to the storage tank. While reducing pressure to lower elevations, it would also have the same reducing effect or not provide service at all to homes in a higher elevation. Importantly, it would not relieve the excessive pressure at the well house which would remain at 190 – 200 psi. For these reasons, this was not an acceptable solution.

2. Address high pressure at the well house only. The company evaluated this solution aimed at reducing the pressure to about 100 psi at the well house only. Under this solution, a new pump station and a dedicated water main (about ½ the length as in No. 1) would be required. Excessive pressures would still exist at other lower elevations as before. This solution provides the desired relief for the well house but, importantly, ignores regulatory compliance and acceptable operating standards for other parts of the distribution system in addition to not correcting pressure at the lower elevations. Therefore, if mandated to accept this solution, the Company would disclaim responsibility for such incidents as main breaks in areas exceeding 100 psi.
   While still under consideration, this is not a recommended solution because of the problems noted.

Generally, the Company's engineers considered various configuration scenarios which would accomplish the goal of distributing water system wide pressures ranging between approximately 35 and 100 psi. Because neither of the preceding solutions were either acceptable or optimal, the Company began considering a three pump station solution which included a dedicated length of water main, PRVs, and other fittings as well as a future storage tank.

To that end, in 2016, AWC contacted Horizons Engineering to evaluate the Rosebrook system and develop conceptual improvements for pressure reduction for AWC's consideration. Their report, dated July 7, 2016 (Attachment 1), included a technical analysis and cost estimates for the three pump station solution.

In 2017, AWC contracted Horizons to develop a hydraulic model of the Rosebrook system in order to further refine the three pump station solution. Their report, dated March 20, 2017 (Attachment 2), includes recommendations for additional system improvements to accommodate the pressure reduction scenario.

As the design, contract drawings, specifications, coordination of permits, easements and other particulars were beyond the time available or the scope of resources the Company had at its disposal, Horizons Engineers was preferred to provide the above services. The proposal was preceded by Horizons' 9/5/18 Analysis and Recommendations Summary which was provided in response to Staff Tech 1-4a. (Attachment 3) Horizons has also prepared a previous narrative referencing water hammer and submitted it to the prior owners of the Rosebrook system.

Horizons has a long history of familiarity with Rosebrook since its initial work in 1987.

B. Other possible options available to address the water pressure problem

AWC has used the hydraulic model prepared by Horizons to evaluate various pressure reduction alternatives. This evaluation has been ongoing concurrent with the 3 pump station solution referenced earlier. The Company has considered:

- Installation of multiple PRVs at various locations in addition to a pump station(s)
- Looping water mains to potentially reduce the occurrence of water hammer (but not extreme pressure)
- Other engineering designs considering a cost/benefit perspective

C. Reasons for the construction of a new water storage tank, as proposed by Horizons, as the best and most cost-effective solution

Although the new water storage tank can help address the pressure problem, it is also needed for non-pressure related reasons.

- The tank is inappropriately located in the middle of intersecting ski trails, thereby making the tank virtually inaccessible by utility trucks and construction equipment in winter snow conditions.
- The tank access trail, under any weather conditions, is very difficult to traverse.

- The new tank would be sited on a designated lot and easily accessed by Company personnel and vehicles.
- The new tank will ensure scalability, accommodate OMNI expansion, and provide more service reliability.
- The existing tank elevation and location actually contribute to extremely high water pressure, thereby warranting relocation.
- Presumably the original location was designed, as the resort was developed, to negate the need for construction of pump stations and related expense. Water systems in nearby ski areas that the Company has observed, have multiple pressure gradients and supporting pump stations.
- A new tank constructed where no ski areas exist on the north side of route 302 (and closer to the OMNI Hotel) and at a lower elevation would immediately reduce pressure to acceptable levels. This would be the last phase of the proposed staged construction schedule.

As a final note, a site visit and inspection of the facilities was conducted on December 14, 2018 accompanied by an OMNI representative and consultant. Much of the above was discussed and a general understanding of the issues and solutions was accomplished.

Attachment 1

horizons Engineering Inc.

SYSTEM EVALUATION FOR PRESSURE REDUCTION
Rosebrook Water Company
Bretton Woods, New Hampshire

34 SCHOOL STREET • LITTLETON, NH 03561 • PHONE 603-444-4111 • FAX 603-444-1343 • www.horizonsengineering.com

SYSTEM EVALUATION FOR PRESSURE REDUCTION
ROSEBROOK WATER COMPANY
BRETTON WOODS, NEW HAMPSHIRE
FOR
ABENAKI WATER COMPANY
PLAINVILLE, CT

JULY 2016

Project No. 16134
Horizons Engineering, Inc.

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Project No. 16134
July 15, 2016

Messrs. Donald Vaughan and Thomas Hansen
Abenaki Water Company
7 Northwest Drive
Plainville, CT 06062
(860) 747-1665

Subject: Rosebrook Water Company – System Evaluation for Pressure Reduction

Dear Mr. Vaughan and Mr. Hansen:

In accordance with our agreement dated May 11, 2016 and your Purchase Order #1926, we have completed an evaluation for the reduction in system pressures in the Rosebrook Water system in Bretton Woods, New Hampshire. This effort was completed to address significant concerns related to high system pressures and the effect those pressures have had on the system, including premature material and equipment failures and lengthy losses in potable water service and fire protection. System pressure reduction is important to improve system reliability and reduce risk for system operators, users, and the public at large.

If you have any questions or need any additional information, please feel free to call. Thank you for the opportunity to be of service.

Sincerely,

Stephen M. LaFrance, P.E.
Principal Engineer
Horizons Engineering, Inc.

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System Overview/Components

The Rosebrook Water Company, Inc. operates the Rosebrook Water System (PWS ID 0382010) to provide domestic water supply and fire suppression to users in Bretton Woods, New Hampshire. The system serves the Mount Washington Hotel and Bretton Woods Ski Resort complex as well as single and multi-family residential and small commercial customers within the service area. The Rosebrook Water System is designated by the New Hampshire Department of Environmental Services (NHDES) as a Large Community Water System (a public water system serving a population greater than 1,000 or providing flow for fire suppression). NHDES records indicate the system serves a population of 1,050 through 408 services connections. Major system components include two gravel packed production wells, a pump house, a 650,000 gallon atmospheric storage tank, and distribution piping and appurtenances.

Wells and Well Field

The system has two sand and gravel production wells located to the north of the Bretton Woods Base Lodge and to the south of Drummond Mountain Shop on Route 302.

Well #1 is a 43 foot deep gravel-packed production well with a reported yield of 322 gallons per minute and a static water level of approximately 6 feet below ground surface. Well #1 was installed in 1970 during the original construction of the water system and is located inside the pump station building. Currently Well #1 is equipped with an American Industrial 50 horsepower 10-stage vertical turbine pump. This pump has a reported pumping capacity of approximately 325 gallons per minute. As Well #1 was installed prior to adoption of NHDES Groundwater Withdrawal Rules Env-Ws 379 and 388, this well has not been assigned a permitted production volume.

Well #2 is a 52 foot deep gravel packed production well with a reported yield of 450 gallons per minute. The well is located approximately 90 feet to the southeast of the pump station. Well #2 was installed in the 1990s and received NHDES Conditional Approval in July of 2003. The well is currently equipped with a Goulds 60 horsepower, 480-volt, 3-phase pump set at 30 feet, with an estimated pumping capacity of 425 gallons per minute. NHDES has assigned Well #2 a daily permitted production volume of 540,000 gallons (375 gallons per minute based on continuous pumping)

Pump Station

The Rosebrook pump station consists of a single-story metal-framed building constructed on a concrete slab. The building is in good condition, having been rebuilt after a piping failure and flooding incident in 2008. The pump station does not contain any booster pumps or hydropneumatic storage. The well pumps are configured to operate based on water level in the atmospheric storage tank. These pumps provide the sole source of head for the system. The pump station building houses the Well #1 well head and drive motor along with a chemical feed pump for water treatment, system controls and alarms for both wells, and various tools, spare parts, and supplies.

Atmospheric Storage Tank

Atmospheric storage consists of a single partially buried cast in place concrete storage tank with a metal truss roof, constructed in the early 1970s. The tank is ninety feet in diameter and has a capacity of 650,000 gallons. The tank is located within the Bretton Woods Ski Area at an approximate elevation of 2,010 feet. Within the last 15 years the tank has undergone repairs to address deterioration of the roof, including installation of a new roof covering system of polystyrene insulation and EPDM membrane in 2012.

Distribution System

The system consists primarily of cement-lined ductile iron and C900 PVC water mains. The system contains a total of approximately 32,600 feet of water main. Service connections consist primarily of type "K" copper with brass fittings. System pressures reportedly range from 50 to 185 pounds per square inch. Service connections at lower elevations are equipped with individual pressure reducing valves. The system is equipped with fire hydrants for fire suppression and water mains appear to be adequately sized to provide fire flow. Some of the gate valves in the system (e.g. the 16 inch valve at the intersection of Route 302 and the Cog Railway Base Road) are inoperable.

System Demands

Pumping records are maintained for the two water supply wells and are provided in Appendix C. Average daily demand over the 2015 calendar year was approximately 110,000 gallons. The peak month was January with an average daily demand of 131,616 gallons and a peak pumping day of 279,900 gallons on January 31, 2015.

System Pressures

Due to the significant grade differential between the lower service areas and the operating level of the atmospheric storage tank, parts of the Rosebrook system have very high static and working pressures. As noted earlier, the storage tank is located at elevation 2010+/-. Elevations along Route 302 and the Base Road near the intersection with Route 302 are approximately 1,575, resulting in static water system pressures in excess of 180 psi. The elevation at the end of River's Edge Road, one of the lowest points on the system, is 1570, with static pressures of nearly 190 psi.

These high system pressures have caused issues in the past including failed hydrants, isolation valves, and service connections. Although there are design and operational considerations that must be addressed with any plan to reduce system pressures, there are legitimate concerns with current operations. The high pressures are a safety concern, result in excessive wear and tear on pumping equipment, piping, and appurtenances, and lead to premature equipment and material failures. There have been several severe leaks as a result of high system pressures, including a catastrophic failure of a fitting in the well pump station that resulted in loss of potable water and fire protection throughout the system for an extended period of time. The repairs were very costly (over $100,000) and not covered by insurance. There are also a number of valves in the

system that either do not function at all, or are only partially operable due to high system pressures.

These issues can be expected to continue and likely worsen as time goes on and system components age. These failures will at times lead to loss of potable water service and fire protection, which puts the users and residents at risk.

If system pressures can be effectively reduced, it will result in a system that is safer to operate, some operation and maintenance and pumping costs will be reduced, there will be less reliance on individual service pressure reducing valves (PRVs) for system control, and system leakage will be reduced.

Over the years there have been discussions about system modifications to reduce operating pressures. Assuming that the wells, pump station, atmospheric storage tank, and transmission main(s) remain in their present locations because of the large capital investment and cost to relocate, the installation of PRVs has been considered the most viable alternative. The installation of PRVs would require one or more booster stations to re-pressurize the system to reach existing higher elevation service connections.

The backbone of the system is the existing 16 inch diameter ductile iron transmission main the connects the well pump house on the north side of the Ammonoosuc River behind the Drummond Mountain Shop to the atmospheric storage tank to the south at the Bretton Woods Ski Area. There are a number of interconnections off this transmission main that act both as direct service connections (e.g. the Ski Lodge), as well as distribution mains to the Crawford Ridge/Presidential View/Riverfront developments, Rosebrook Townhomes, and Forest Cottages. Just outside the pump house, there is a tee to a 16 inch diameter ductile iron main the passes under Route 302 and along the Cog Railway Base Road and services the residential developments to the west as well as the Mt. Washington Hotel complex.

Concerns Related to Reduction in System Pressure

There are three primary concerns related to reducing system pressures; summarized as follows:

<u>Impact on existing high elevation users</u>
There are several existing residential developments at higher elevations on the system. The uppermost residential building at the Mountain View development is at a ground elevation of 1,810, which equates to a current static pressure of 85 psi. The uppermost residential building at Dartmouth Ridge Homes is at a ground elevation of 1,825, which equates to a current static pressure of 80 psi. The uppermost residential unit at Presidential Views is at a ground elevation of 1,845, which equates to a current static pressure of 70 psi.

New Hampshire Department of Environmental Services Drinking Water & Groundwater standards require a typical minimum residual pressure of 35 psi and an absolute minimum operating pressure of 20 psi (typically under rare fire flow conditions). Assuming at present that Presidential Views is the controlling development, system pressures could be lowered approximately 25 psi and still meet NHDES standards without the need to re-pump. This

estimate is based simply on relative elevations and static pressure conditions and would need to be confirmed with flow testing and hydraulic modeling.

Impact on existing fire flows and sprinkler flows

Reduction in operating pressure will reduce available fire flows throughout the system. Reductions will likely not be of consequence at lower elevations with high operating pressures, but will become more significant at the higher elevations at the ends of the system. Should the decision be made to further evaluate reductions in system pressure, hydrant flow testing and hydraulic modeling of the system at key locations such as at Presidential View, Dartmouth Ridge Homes and Stone Hill is recommended to ensure adequate fire flows are maintained. Given the high service pressures at present and the intent to provide a 100-120 psi ceiling pressure, maintenance of sufficient fire flows is not expected to be difficult.

The larger commercial buildings on the system such as the Mt. Washington Hotel, the Bretton Arms, the Golf/Nordic Center, the Bretton Woods Ski Area Base Lodge, etc. are protected by sprinkler systems that rely on the Rosebrook system for supply. These systems were originally designed based on existing system pressures. The effect of reduced system pressures should be evaluated to ensure that adequate sprinkler flows are maintained. Several calls have been placed to Mr. Kolin Bailey, Director of Engineering at Omni Hotels, for information regarding the system designs and operating parameters. A return call has not been received to date.

Impact on future development at high elevation

The Rosebrook water system was originally constructed to support development of the Bretton Woods Ski Area and associated residential and commercial development. Water main extensions and system upgrades have been made periodically to extend service to new developments and in some cases such as the extension to the Mt. Washington Hotel, to existing developments and structures that abandoned previous water supplies.

A significant amount of undeveloped land remains within the likely service area of the Rosebrook system. Plans have been developed to extend service on Crawford Ridge Road beyond the existing Presidential Views residences into the Town of Bethlehem. This development could extend up to elevation 1900, which would require all the system pressure currently provided by the system.

Plans have also been prepared for residential development to the north of the Base Road, above Dartmouth Ridge Homes. A copy of a subdivision and phasing plan prepared for Bretton Woods Land Co., LLC in 2009 can be found in Appendix B. This development extended to high elevations that also would need system pressures as they exist today. The uppermost and most northerly lot in the proposed development (DB-141) was identified as a future atmospheric storage tank location. The tank was intended to be set at the same elevation as the existing storage tank (2,010+/-) to provide additional storage and fire protection. The first phase of the development was fully designed and permitted but was not constructed due to a downturn in the economy, and remains a possibility in the future.

Conceptual Improvements for Pressure Reduction

At the direction of the system owner, a conceptual plan has been developed to reduce system pressures to a target maximum of 100 psi static. The plan maintains key components of the existing system such as the two gravel production wells, the transmission and distribution mains, and the 650,000 gallon atmospheric storage tank in the present locations to minimize disruption and project cost. The key components of the improvements are shown on the site plan in Appendix D and outlined as follows:

- Replace existing well pumps in Well #1 and Well #2 with two new well pumps capable of the same flow rates (325 gpm for Well #1 and 425 gpm for Well #2) at a discharge pressure of 100 psi. This will reduce the system pressure at the pump station from approximately 185 psi to 100 psi at a new system grade line of 1,810 +/-. The well pumps will continue to be controlled by the water level(s) in the 650,000 gallon atmospheric storage tank.

- Construct a new booster station on the existing 16 inch diameter transmission main from the pump station to the storage tank (see Storage Tank Booster Station on plan in Appendix D). This booster station is necessary to boost water from the proposed system grade line of 1,810 up to the existing storage tank elevation of 2,010 +/-. The booster station would be located adjacent to the Rosebrook Townhomes residential development at an elevation of 1,680 +/-. The station must be located below the distribution mains to Rosebrook Townhomes and Mountain Views to allow those developments to utilize the 2,010 storage tank grade line. The station would have duplex centrifugal pumps capable of 425 gallons per minute to match the output of Well #2. The booster station would be controlled by water level(s) in the atmospheric storage tank and would start and stop in conjunction with the well pumps.

- Install a bypass line and pressure reducing valve (PRV) in the Storage Tank Booster Station to allow water from the storage tank to back feed and supply the Rosebrook system. The valve would have an inlet pressure of approximately 140 psi and an outlet pressure of approximately 55 psi.

- Install a PRV (Rosebrook Townhomes PRV) on the existing 10 inch diameter PVC main on Rosebrook Lane to reduce system pressures from the 2,010 storage tank grade line to the 1,810 well pump station grade line. The valve would have an inlet pressure of approximately 120 psi and an outlet pressure of approximately 35 psi.

- Construct a new booster station (Crawford Ridge Booster Station) on the existing 12 inch diameter distribution main along Crawford Ridge Drive. This booster station is necessary to boost water from the proposed system grade line of 1,810 up to the highest user(s) in the Presidential Views development. A grade line of approximately 1,950 would be required to provide a static pressure of 45 psi at the highest user. The booster station would be located adjacent to Crawford Drive at an elevation of 1,710 +/-. The station would include multi-plex VFD centrifugal pumps and small hydropneumatic tank capable of maintaining system pressure and meeting the peak instantaneous demand of

the residential units at Presidential Views and the higher elevations of Crawford Ridge. Since there is no storage downstream of the proposed booster station, an emergency generator and automatic transfer switch is recommended to maintain water supply in the event of a power outage. The booster station would be capable of fire flows with adequately sized pumps, and would be fitted with fire hydrants upstream and downstream for bypass as an additional safety measure.

- Construct a new booster station (Mt. Washington Place Booster Station) on the existing 8 inch diameter distribution main along Hannah Loop. This booster station is necessary to boost water from the proposed system grade line of 1,810 up to the highest user(s) in the Dartmouth Ridge Homes development. A grade line of approximately 1,945 would be required to provide a static pressure of 45 psi at the highest user. The booster station would be located adjacent to Hannah Loop at an elevation of 1,680 +/-. The station would include multi-plex VFD centrifugal pumps and hydropneumatic tank capable of maintaining system pressure and meeting the peak instantaneous demand of the residential units at Dartmouth Ridge Homes and the higher elevations of Mt. Washington Place. Like the Crawford Ridge station, there is no storage downstream, so an emergency generator and automatic transfer switch is recommended to maintain water supply in the event of a power outage. The booster station would be capable of fire flows with adequately sized pumps, and would be fitted with fire hydrants upstream and downstream for bypass as an additional safety measure.

- Construct a 350 linear foot eight inch diameter water main extension from the end of Mt. Adams Lane cross country to Dartmouth Ridge Lane to connect two dead end mains. This connecting water main will provide pressure from the proposed Mt. Washington Place Booster Station to the higher users on Mt. Adams Lane and also improve water quality by removing dead ends.

- Install a new PRV at the intersection of Mt. Adams Lane and Hartford Lane to reduce system pressures from the 1,945 grade line to the 1,810 grade line. The valve would have an inlet pressure of approximately 105 psi and an outlet pressure of approximately 45 psi.

Opinion of Probable Project Cost for Improvement Options

An opinion of probable project cost has been prepared and included in Appendix E. The opinion includes an estimate of construction cost as well as a 15% contingency and an allowance for soft costs including land, legal fees, administration, and engineering.

Conclusions and Recommendations

The Rosebrook system currently operates with working pressures that are excessive. The working pressures pose a potential safety hazard and lead to premature wear and failure of equipment, piping, and appurtenances. System pressures can be reduced to a maximum of 100-120 psi with the installation of pressure reducing valves in key locations in the system. Due to

the broad elevation changes in the service area, pressure reductions must be countered with booster stations to continue to adequately serve higher elevation service connections.

The conceptual design that has been prepared envisions new well pumps and controls to reduce the system pressure at the well pump station from 185 psi to 100 psi. In addition, three booster stations and three pressure reducing valves are proposed to provide a minimum of approximately 45 psi static pressure to all existing users on the system. Finally, a 350 linear foot water main extension/connection is proposed to provide service to high elevation users in Dartmouth Brook. The total estimated cost for the proposed improvements is $1,410,000 including contingency and soft costs.

As Rosebrook Water Company, Inc. evaluates the proposed project further, we recommend the following:

- Conduct a review of existing sprinkler system flow requirements and hydrant fire flow requirements at key locations in the system.
- Confirm interpolated elevations for the existing storage tank and proposed booster station and PRV locations.
- Determine allowable system pressure reduction through hydrant testing and hydraulic modeling.
- Investigate options for booster station locations and required land purchases.
- Prepare preliminary design for the well pumps, pressure reducing valves, booster stations, water main connection, etc. to provide desired system pressures and flows.
- Revise opinions of probable project cost for the proposed improvements based on the refined designs.

Scheduling of Improvements

The proposed improvements are inextricably linked and must be completed together for the system to function properly. The booster pump stations (Storage Tank Booster Station, Mt. Washington Place Booster Station, and Crawford Ridge Booster Station) must be installed and operational before system pressures are reduced with a change in well pumps or the installation of the PRVs. Once the stations are installed, system pressures can be maintained at the higher elevations and lowered to the maximum target pressure of 100 +/- psi in the lower elevations.

Design and permitting can be expected to take approximately 90 days to complete. Construction of the booster stations would require an additional 90 days. Well pumps and pump station modifications, PRV vault installations, and the proposed eight inch diameter water main connection on Mt. Adams Lane could be accomplished in approximately 45 days.

APPENDIX A
Rosebrook Water Company, Inc.
Customer Meter Size and Type

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type
COMMERCIAL:	200A BW Irving Store	Commercial	08664141	5/8"	Sensus
	201 Drummonds Ski Shop	Commercial	NO REMOTE	5/8"	Sensus-old
Total: 3	203 Real Estate Office/Peabody & Smith	Commercial	NO REMOTE	5/8"	Rockwell
HOTEL & ENTITIES:	202 Hotel-Omni Mt Wash Hotel	Hotel Entity	EBCS6EB	6"	Badger
	BW Admin Blg.	Hotel Entity	NO REMOTE	1"	Sensus
	BW Alpine Club-KITCHEN	Hotel Entity	NO REMOTE	1"	Sensus
	BW Apline Club-BATHRM TRAILER	Hotel Entity	73296636	5/8"	Sensus
	BW Arms	Hotel Entity	45862316	1"	Badger
	BW Caretakers Home	Hotel Entity	ANALOG	5/8"	
	BW Fabyans	Hotel Entity	NO REMOTE	5/8"	ICE?
	BW First Aid Blg	Hotel Entity	NO REMOTE	5/8"	Sensus
	BW Golf/Nordic Building	Hotel Entity	45862318	1"	Badger
	BW O/D Pool & Cabana	Hotel Entity	63408013	2"	Sensus
	BW Ski Area	Hotel Entity	NO REMOTE	2"	
	BW Ski Area-Maintenance Blg	Hotel Entity	35986259	5/8"	Badger
	BW Spa Building	Hotel Entity	02925660	3"	Sensus
	BW Sports Club/Rosebrook Rec Center	Blg. Closed removed meter			
	BW Stables	Hotel Entity	35986245	5/8"	Badger
	BW #337123 portable hydrant meter	Hotel Entity	337123	3"	Sportster
Total: 14 + 2 hydrant meters	BW #337124 portable hydrant meter	Hotel Entity	337124	3"	Sportster
CRAWFORD RIDGE:	CR01 Nelson, George & Kirsten	Active	51946552	5/8"	Sensus
	CR02 Banks, Clarence & Maria	Active	51946535	5/8"	Sensus
	CR03 Shumakin, Kosta & Helena	Active	51946534	5/8"	Sensus
	CR04 Revers, Daniel & Lise	Active	51946551	5/8"	Sensus
	CR05 Benoit, Michael & Donna	Active	51946537	5/8"	Sensus
	CR06 Smail, Peter & Maria	Active	51946554	5/8"	Sensus
	CR07 Milligan, Michael	Active	51946555	5/8"	Sensus
	CR08 Hanson, Michael & Janet	Active	51946550	5/8"	Sensus
	CR09 Relyea, Douglas & Kathleen	Active	57079494	5/8"	Sensus
	CR10 McGloin, Jonathan & Sherry	Active	ANALOG	5/8"	Sensus
	CR11 Foti, Alessandro	Active	63518471	5/8"	Sensus
	CR12 Thomas, Jo-Ellen	Active	06892404	5/8"	Sensus
	CR13 Potter, Brian & Robin	Active	55988888	5/8"	Sensus
	CR14 Baker, Scott	Active	55988889	5/8"	Sensus
	CR15 Southworth & Saisa	Active	13098704	5/8"	Sensus
	CR16 Toran, Richard & Ann	Active	13213198	5/8"	Sensus
	CR17 Falvey-Vantangoli, Karen	Active	09929294	5/8"	Sensus

Meter Count
5/8" = 361
1" = 45
2" = 2
3" = 3
6" = 1
Total: 412

Rosebrook Water Company Inc.
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Association/Business+		Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
		CR18 McSherry, Stephen & Christine	Active	09980563	5/8"	Sensus	
		CR19 Farrell, Daniel & Sue	Active	63518475	5/8"	Sensus	
		CR20 Van Fleet, Bruce & Lisa	Active	09965987	5/8"	Sensus	
		CR21 Alphas Trust	Active	08635889	5/8"	Sensus	
	Total: **22**	CR22 Beauchesne, Bryan & Danielle	Active	08648465	5/8"	Sensus	
DARTMOUTH RIDGE:		DR01 Formisano, Ed & Mary Louise	Active	59616024	5/8"		
Single Family Homes		DR02 Birknes	Active	52214174	5/8"		
		DR03 Vaughan, Patrick & Kathleen L.	Active	52512379	5/8"		
		DR05 Oliver, Al & Connie	Active	09562834	5/8"		
		DR10 Perry & Gilmore	Active	09819852	5/8"		
		DR11 Schiess, Reed	Active	52862855	5/8"		
		DR12 Finn, Michael & Linda	Active	52214173	5/8"		
		DR13 Whitton, Richard & Barbara	Active	52214171	5/8"		
		DR16 Miller, Bode	Active	58207872	1"	Sensus	
		DR17 Manning, Robert & Donna	Active	52512383	5/8"		
		**DR17a Manning/2nd meter	Active	35986244	5/8"	Badger	
		DR20 Whalen, Charles	Active	35986241	5/8"	Badger	
		DR26 Infanti, James & Kathi	Active	62266802	1"	Sensus	
		DR27 Sullivan, Mark & Cheryl	Active	73296638	5/8"	Sensus	
	Total: **15**	DR29 Shea, Michael & Kathleen	Active	72933995	5/8"	Sensus	
FOREST COTTAGE:		FC01 Wirth, Cathy	Active	71003801	5/8"	Elster	
		FC02 Wirth, Theodore & Cathy	Active	ANALOG	5/8"		
		FC03 Hurley, David & Elaine	Active	57519013	5/8"		
		FC04 Torres & Foltz	Active	61135339	5/8"		
		FC05 Buras, Jennifer	Active	57519060	5/8"		
		FC06 Rose, Tony	Active	73296633	5/8"	Sensus	
		FC07 Grossman & Coyle	Active	ANALOG	5/8"		
		FC08 George, Philip & Denise	Active	7326632	5/8"	Sensus	
		FC09 Kloeblen, Steve	Active	ANALOG	5/8"		
		FC10 Luongo, Paul & Marilyn	Active	ANALOG	5/8"		
		FC11 Dunham, Donald & Joan	Active	ANALOG	5/8"		
		FC12 George, Philip & Denise	Active	ANALOG	5/8"		
		FC13 Crimmins & Robinson	Active	ANALOG	5/8"		
		FC14 George, Philip & Denise	Active	ANALOG	5/8"		
		FC15 Forrest, Michael & Janice	Active	ANALOG	5/8"		
		FC16 Dunham, Donald & Joan	Active	52512392	5/8"		
		FC17 Eland, Alan & Joanne	Active	ANALOG	5/8"		

Rosebrook Water Company Inc.
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Association/Business+		Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
		FC18 Wilson, Robert & Joan	Active	ANALOG	5/8"		
		FC19 Johnson, Karl & Paulette	Active	71003785	5/8"	Elster	
		FC20 Barous, Frank	Active	ANALOG	5/8"		
		FC21 McMorrow, Daniel & Marianne	Active	7003921	5/8"		
		FC22 Remondi, Stephen & Kristen	Active	ANALOG	5/8"		
		FC23 Grayson, John & Lori	Active	57079497	5/8"		
		FC24 Molleur, Danielle	Active	ANALOG	5/8"		
		FC25 Stevenson & Brewer	Active	ANALOG	5/8"		
		FC26 Charette, George & Karen	Active	ANALOG	5/8"		
		FC27 Gill, Kevin & Rita	Active	08659844	5/8"		
		FC28 Jones, Jay & Debra	Active	ANALOG	5/8"		
		FC29 Fournier/"F Camp Family Trust"	Active	54968898	5/8"		
		FC30 Giannelli, Tom & Andrea	Active	ANALOG	5/8"		
		FC31 Johnson, Gary	Active	ANALOG	5/8"		
		FC32 Losordo, Peter & Karen	Active	ANALOG	5/8"		
		FC33 Penacho Family Trust	Active	54968901	5/8"		
		FC34 Botsivales, Greg	Active	ANALOG	5/8"		
		FC35 Ferguson, Paul & Amy	Active	ANALOG	5/8"		
		FC36 Lees, John & Pam	Active	ANALOG	5/8"		
		FC37 Quinlan, Kevin & Joanna	Active	ANALOG	5/8"		
		FC38 Graves, John & Suzanne	Active	ANALOG	5/8"		
		FC39 Ricciardi, Bernadette	Active	ANALOG	5/8"		
		FC40 JJZM Investment Co. LLC	Active	ANALOG	5/8"		
		FC41 San Antonio, Richard & Pamela	Active	62018055	5/8"		
		FC42 Dwyer, Lawrence	Active	62018058	5/8"		
		FC43 Rani Realty Trust	Active	54968899	5/8"		
		FC44 Osborn, Jason & Karen	Active	ANALOG	5/8"		
		FC45 Mongeau, Paul & Deborah	Active	ANALOG	5/8"		
		FC46 Schaier, Warren & Sandy	Active	ANALOG	5/8"		
		FC47 Blanchard, Ronald & Diane	Active	ANALOG	5/8"		
		FC48 Murphy, Henry & Mary	Active	ANALOG	5/8"		
		FC49 Barr, James & Jane	Active	ANALOG	5/8"		
		FC50 McQueeney, Owen & Sue	Active	ANALOG	5/8"		
		FC51 Penner, Terry & Michele	Active	72933994	5/8"	Sensus	
		FC52 Miller, Jeffery & Cynthia	Active	ANALOG	5/8"		
		FC53 Squires, Bob & Robin	Active	ANALOG	5/8"		
	Total: 54	FC54 Hatch, William & Marguerite	Active	61135340	5/8"	Sensus	
FAIRWAY VILLAGE:		FV01 Monica & Horan	Active	07193974	5/8"	Sensus	

Rosebrook Water Company Inc.
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Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	FV02 Keane, Brian & Theresa	Active	06894980	5/8"	Sensus	
	FV03 Apple, Leslie	Active	ANALOG	5/8"	Rockwell	
	FV04 Harmon, Robert & Rose Ellen	Active	ANALOG	5/8"	Rockwell	
	FV05 Keyser, Donald & Anne	Active	54949860	5/8"	Sensus	
	FV06 Dolan & Connly	Active	54949865	5/8"	Sensus	
	FV07 Mueller, Andreas & Birgit	Active	08907595	5/8"	Sensus	
	FV08 Gibson, Jay & Mary Pat	Active	07172591	5/8"	Sensus	
	FV09 Mordecai & Robbins	Active	54949862	5/8"	Sensus	
	FV10 Dirsa, Albert & Elise	Active	54949863	5/8"	Sensus	
	FV11 Seager, John S. & Linda	Active	07048024	5/8"	Sensus	
	FV12 Daft, Ed & Lisa	Active	07189359	5/8"	Sensus	
	FV13 St. Sauveur, Ronald & Susan	Active	ANALOG	5/8"	Rockwell	
	FV14 Ashe, Terry & Megan	Active	ANALOG	5/8"	Rockwell	
	FV15 Early, Jim & Jane	Active	55988881	5/8"	Sensus	
	FV16 Cox, Gregory & Alisha	Active	55323173	5/8"	Sensus	
	FV17 Cary, Lee B.	Active	07208121	5/8"	Sensus	
	FV18 Cary, Lee B.	Active	07212535	5/8"	Sensus	
	FV19 Pasalic, Sandi & Sener	Active	55323169	5/8"	Sensus	
	FV20 Sweeney, John & Dianne	Active	55322348	5/8"	Sensus	
	FV21 KIGS Enterprises/Kammann	Active	ANALOG	5/8"	Sensus	
	FV22 Molloy, Tracey	Active	ANALOG	5/8"	Sensus	
	FV23 Apple, Roy & Sharon	Active	62018057	5/8"	Sensus	
	FV24 Renner & Kirsch	Active	54968897	5/8"	Sensus	
	FV25 Bauchspies, Barbara	Active	55323174	5/8"	Sensus	
	FV26 Blanche, Jeremy & Julie	Active	09519611	5/8"	Sensus	
	FV27 Poche, Michael & Marjorie	Active	ANALOG	5/8"	Rockwell	
	FV28 O'Brien, Joseph	Active	ANALOG	5/8"	Rockwell	
	FV29 Apple, Fred & Jan	Active	57518568	5/8"	Sensus	
	FV30 Grondine, Leo & Maryann	Active	57518572	5/8"	Sensus	
	FV31 Urban, Steven & Maria	Active	57409106	5/8"	Sensus	
	FV32 Polinger, Shirley	Active	54968902	5/8"	Sensus	
	FV33 Hague & Hanley	Active	ANALOG	5/8"	Rockwell	
	FV34 Hahesy, Paul & Geralyn	Active	57409105	5/8"	Sensus	
	FV35 Elwell, Leon & Carol	Active	ANALOG	5/8"	Rockwell	
	FV36 Caterine, John & Melinda	Active	73296637	5/8"	Sensus	
	FV37 Roy, David & Jessica	Active	57409109	5/8"	Sensus	
	FV38 Bencivenga, Anthony & Lynn	Active	ANALOG	5/8"	Rockwell	
	FV39 Koplow, Meyer	Active	ANALOG	5/8"	Rockwell	
	FV40 Koplow, Meyer	Active	ANALOG	5/8"	Rockwell	

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Association/Business+		Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
		FV41 Trott, John & Tracey	Active	ANALOG	5/8"	Rockwell	
		FV42 Long & Brewer	Active	35975334	5/8"	Badger	
		FV43 Fusco, Theresa	Active	ANALOG	5/8"	Rockwell	
		FV44 Heath, Jack & Patty	Active	ANALOG	5/8"	Rockwell	
		FV45 Spinello, John A.	Active	ANALOG	5/8"	Rockwell	
		FV46 Lawson, Richard & Barbara	Active	ANALOG	5/8"	Rockwell	
		FV47 Corkery, Tim & Linda	Active	73296635	5/8"	Sensus	
		FV48 Gaudette, Eugene	Active	ANALOG	5/8"	Rockwell	
		FV49 St. Peter, Robert	Active	ANALOG	5/8"	Rockwell	
	Total: 50	FV50 Latimer, Chris E. & Patricia	Active	ANALOG	5/8"	Rockwell	
MT. WASHINGTON HOMES:		MH01 Hegarty, Christopher & Joyce	Active	52862854	5/8"	Sensus	
Single Family Homes		MH03 Dopfel, Alan	Active	62266803	1"	Sensus	
		MH08 Rhodes, Matthew & Cindy	Active	62033392	1"	Sensus	
		MH12 Reynolds, Donald & Donna	Active	02623851	5/8"		
		MH14 Strasser, Allen	Active	56143451	1"	Sensus	
		MH16 Xue, Mei	Active	52862856	5/8"	Sensus	
		MH19 Woods, William & Lila	Active	52862859	5/8"	Sensus	
		MH20 Glendon, David	Active	52862857	5/8"		
	Total: 9	MH21 Atkinson, Gaynor	Active	62033391	1"	Sensus	
MT. MADISON:		MM01 Griner, Gregg & Maria	Active	54884729	1"	Sensus	
		MM02 Gaton, Richard J.	Active	54884728	1"	Sensus	
		MM03 Cargill, William & Alicia	Active	54413057	1"	Sensus	
		MM04 Koplow, Meyer	Active	54413058	1"	Sensus	
		MM05 Weisman, Robert & Vanessa	Active	61116194	1"	Sensus	
		MM06 Berger, James & Lisa	Active	58207873	1"	Sensus	
		MM07 Tang & Kainz	Active	58207875	1"	Sensus	
		MM08 O'Shea, Timothy & Corinne	Active	58207876	1"	Sensus	
		MM09 Borek, Robert & Beth	Active	54884736	1"	Sensus	
	Total: 10	MM10 Collins, Christoper & Sandra	Active	54884735	1"	Sensus	
MOUNTAIN VIEW:		MV101 Festa, Michael & Martha	Active	09658680	5/8"	Sensus	
fka: Rosebrook Club		MV102 Skilton, Brian & Deirdre	Active	09572422	5/8"	Sensus	
		MV103 Mueller, Paul & Deborah	Active	09572419	5/8"	Sensus	
		MV104 Atkinson, Gaynor	Active	09574445	5/8"	Sensus	
		MV201 Sullivan, Michael	Active	12949758	5/8"	Sensus	
		MV202 Ryan, Michele	Active	12811289	5/8"	Sensus	
		MV203 Donahue, John & Patricia	Active	12953265	5/8"	Sensus	

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Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	MV204 Waugh, Scott & Kimberly	Active	12877800	5/8"	Sensus	
	MV301 Alphas, John & Sharon	Active	30267357	5/8"	Sensus	
	MV302 Smith, Joseph & Mary Jo	Active	63518480	5/8"	Sensus	
	MV303 Morris, Peter & Heather	Active	63518479	5/8"	Sensus	
	MV304 Leeman & McLaughlin	Active	30267368	5/8"	Sensus	
	MV401 Pappalardo, Karen	Active	51946553	5/8"	Sensus	
	MV402 Casey, Mark	Active	51946532	5/8"	Sensus	
Total: 15	MV403 Page & Trahan	Active	51367085	5/8"	Sensus	
MT. WASHINGTON PLACE:	MW01 PiSierra & O'Connor	Active	55751688	5/8"		
	MW02 Falkenberry, Stephen & Allison	Active	08635770	5/8"		
	MW03 Coffman, David & Barbara	Active	57518666	5/8"		
	MW04 Korona, John & Kathleen	Active	ANALOG	5/8"		
	MW05 Scheidemantel & Boatwright	Active	ANALOG	5/8"		
	MW06 Taylor, Kim	Active	52512396	5/8"		
	MW07 Mullins, James & Eileen	Active	ANALOG	5/8"		
	MW08 McGoldrick, Neil & Amy	Active	ANALOG	5/8"		
	MW09 Rose, Matthew & Katherine	Active	57518665	5/8"		
	MW10 Toomey, William	Active	ANALOG	5/8"		
	MW100 Smith, Winthrop	Active	09027657	5/8"		
	MW101 Wyatt, Peter & Nancy	Active	07193086	5/8"		
	MW102 Alvarez, Austin & Carol	Active	07185267	5/8"	Sensus	
	MW103 Schwartz, James	Active	07048027	5/8"	Sensus	
	MW104 McCarthy, George & Nancy	Active	ANALOG	5/8"	Sensus	
	MW104A Viens, Arthur	Active	ANALOG	5/8"	Sensus	
	MW105 Roome, Ted & Cathy	Active	ANALOG	5/8"	Sensus	
	MW106 DePierro, Peter & Christine	Active	ANALOG/CUBIC	5/8"		
	MW11 Raouf, Firas	Active	52512393	5/8"		
	MW12 Vargas	Active	ANALOG	5/8"		
	MW13 Coache, Robert & Jane	Active	ANALOG	5/8"		
	MW14 Schiess, Reed	Active	35986255	5/8"	Badger	
	MW15 Strom, Judith	Active	ANALOG	5/8"		
	MW16 Berkowitz & Cote	Active	35975279	5/8"	Badger	
	MW17 Raposa & Rothenbuhler	Active	61135341	5/8"		
	MW18 Shapiro, Ken	Active	ANALOG	5/8"		
	MW19 Turcotte, Norman & Pat	Active	ANALOG	5/8"		
	MW20 Browne, Edward & Linda	Active	ANALOG	5/8"		
	MW21 Naylor, Robert & Patricia	Active	ANALOG	5/8"		
	MW22 Gray, John	Active	ANALOG	5/8"		

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Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	MW23 Lussier, Wayne & Karen	Active	61135342	5/8"		
	MW24 Gaff, Doug & Brenda	Active	ANALOG	5/8"		
	MW25 Keegan, Howard	Active	57518565	5/8"		
	MW26 Minahan, Madeline	Active	ANALOG	5/8"		
	MW27 Bracken, David & Katherine	Active	ANALOG	5/8"		
	MW28 Giglio Family	Active	ANALOG	5/8"		
	MW29 Barous, Dennis	Active	ANALOG	5/8"		
	MW30 Barrett, Richard & Nancy	Active	ANALOG	5/8"		
	MW31 DeChristoforo & Denictolis	Active	63518533	5/8"		
	MW32 Brownell, Thomas	Active	ANALOG	5/8"		
	MW33 Ewing, Thomas J./DEMT LLC	Active	ANALOG	5/8"		
	MW34 Camerlin, Larry & Ruth	Active	ANALOG	5/8"		
	MW35 Horrigan, James	Active	52512395	5/8"		
	MW36 Balliro-Speer, Daveen	Active	63518478	5/8"		
	MW37 Deveau, John & Loren	Active	ANALOG	5/8"		
	MW38 Hart, Sarah	Active	57519056	5/8"		
	MW39 Gagne, Roger & Deborah	Active	ANALOG	5/8"		
	MW40 Paquette, Victor & Amy	Active	ANALOG	5/8"		
	MW41 Dow & Tarter	Active	07010688	5/8"		
	MW42 Czekanski, Antoinette	Active	57519020	5/8"		
	MW43 Souza, David & Tatyana	Active	57519019	5/8"		
	MW44 Woo, Julianne	Active	ANALOG	5/8"		
	MW45 DiGregorio, John & Beverly	Active	ANALOG	5/8"		
	MW46 Churchill, Thomas	Active	ANALOG	5/8"		
	MW47 Everett, Robert & Eleanor	Active	ANALOG	5/8"		
	MW48 Formisano, Ed & Mary Louise	Active	ANALOG	5/8"		
	MW49 Sawyer, Rick & Ellen	Active	ANALOG	5/8"		
	MW50 Kendall, Kennett	Active	ANALOG	5/8"		
	MW50A Napoli & Bilotta	Active	57519016	5/8"		
	MW51 Grabeau, Ken & Ruth	Active	ANALOG	5/8"		
	MW52 Rastiello, Connie (James)	Active	ANALOG	5/8"		
	MW53 Bryant, Richard & Joanna	Active	57518570	5/8"		
	MW54 Kaufman & Kloos	Active	57518567	5/8"		
	MW55 Davies, Peter	Active	ANALOG	5/8"	Rockwell	
	MW56 Kammann & Sweeney	Active	ANALOG	5/8"		
	MW57 Towne, Leland & Judith	Active	ANALOG	5/8"		
	MW58 Yorke, Marilyn	Active	ANALOG	5/8"		
	MW59 Costello, Walter & Donna	Active	57518566	5/8"		
	MW60 Fischer, Robert & Sherry	Active	ANALOG	5/8"		

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Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	MW61 Ricci, Thomas	Active	ANALOG	5/8"		
	MW62 Warren, Zachary & Laura	Active	ANALOG	5/8"		
	MW63 Intriere, Lisa	Active	ANALOG	5/8"		
	MW64 Santosuosso, Lewis & Sharon	Active	ANALOG	5/8"		
	MW65 Griffin, Stephen & Susana	Active	ANALOG	5/8"		
	MW66 McCarthy, Paul & Janet	Active	ANALOG	5/8"		
	MW67 Presti, Richard & Audrey	Active	ANALOG	5/8"		
	MW68 Friedman, Lee & Helen	Active	ANALOG	5/8"		
	MW69 Lee, Kevin & Priscilla	Active	ANALOG	5/8"		
	MW70 Lowe, Donald	Active	ANALOG	5/8"		
	MW71 Twohig, Mike & Laurie	Active	ANALOG	5/8"		
	MW72 Tupper, Sherry	Active	ANALOG	5/8"		
	MW73 Rubin, Steven & Kerrie	Active	71003456	5/8"	Elster	
	MW74 Pothuru & Darulova	Active	71003759	5/8"	Elster	
	MW75 Knowles, Ann	Active	ANALOG	5/8"		
	MW76 Porreca, Gregory & Jamie	Active	35975336	5/8"	Badger	
	MW77 Lane, Peter & Victoria	Active	ANALOG	5/8"		
	MW78 Jacob, Daniel & Janice	Active	52512391	5/8"		
	MW79 Knowles, Jim & Jane	Active	07185266	5/8"		
	MW80 Weber, Peter & Karen	Active	ANALOG	5/8"		
	MW81 Gregory, Nicholas & Athena	Active	07774892	5/8"		
	MW81A Hornick, James	Active	07734579	5/8"		
	MW82 Thomas, Greg & Carra Elise	Active	07792996	5/8"		
	MW83 Walsh, Michael & Betty	Active	07766582	5/8"		
	MW88 Merrill & Rosenberg	Active	ANALOG	5/8"		
	MW89 Nicoll, Robert	Active	ANALOG	5/8"		
	MW90 Lyras, Gene & Tracey	Active	ANALOG	5/8"		
	MW91 Godfrey, Tom Linda	Active	ANALOG	5/8"		
	MW92 Weir, Robert & Georgann	Active	ANALOG	5/8"		
	MW93 Konsin, John P. & Barbara Ann	Active	ANALOG	5/8"		
	MW94 Grappel & Cohen	Active	ANALOG	5/8"		
	MW95 Johnston/Rann	Active	ANALOG	5/8"		
	MW96 Lyons, Richard	Active	57518674	5/8"		
	MW97 Russell, Bob & Laura	Active	57518669	5/8"		
	MW98 Knight, Michael	Active	57518672	5/8"		
Total: 105	MW99 Kavanaugh, Peter & Mary	Active	57518673	5/8"		
PRESIDENTIAL VIEW:	PV01 Goettler, Peter & Cynthia	Active	54884733	1"	Sensus	
	PV02 Neslusan, Dennis & Jane	Active	54884730	1"	Sensus	

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Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	PV03 PV3, LLC	Active	54884727	1"	Sensus	
	PV04 Murphy, Peter	Active	54884734	1"	Sensus	
	PV05 Pres View HOA	Active	65331928	1"	Sensus	
	PV06 Maldon, Jonathan & Andrea	Active	62033383	1"	Sensus	
	PV07 Donaghey, John & Cathy	Active	61116193	1"	Sensus	
	PV08 Falk, Alexander & Nora	Active	58207874	1"	Sensus	
	PV09 Spearman, Patrick & Jane	Active	58207877	1"	Sensus	
	PV10 Milligan & Ward	Active	59536752	1"	Sensus	
	PV11 Muise, Jason & Cristina	Active		1"	Sensus	
	PV12 Muise, Jason & Cristina	Active	71004447	1"	Elster	
	PV13 Allen, Derek & Cecilia	Active	62266804	1"	Sensus	
	PV14 Rose, Matthew & Katherine	Active	71438123	1"	Sensus	
Total: 15	PV15 Friel, Matthew & Lesli	Active	62033376	1"	Sensus	
ROSEBROOK TOWNHOMES:	RB01 O'Hearn, Shaun	Active	08659797	5/8"	Sensus	
	RB02 Caouette, Barry & Julie	Active	ANALOG	5/8"	Badger	
	RB03 Fuller, Peter & Mary	Active	ANALOG	5/8"	Badger	
	RB04 Jones, Mike & Linda	Active	ANALOG	5/8"	Badger	
	RB05 Van Hulle & Bunanta	Active	ANALOG	5/8"	Badger	
	RB06 Eldred, Todd & Kim	Active	10810759	5/8"	Sensus	
	RB07 Jones, Mike & Linda	Active	ANALOG	5/8"	Badger	
	RB08 Jones, Mike & Linda	Active	ANALOG	5/8"	Badger	
	RB09 Hausladen, Jennifer & Derek	Active	ANALOG	5/8"	Badger	
	RB10 Patel, Anit & Rebecca	Active	ANALOG	5/8"	Badger	
	RB11 Robie, Douglas & Dana	Active	ANALOG	5/8"	Sensus	
	RB12 DeVito, Lawrence	Active	07003922	5/8"	Sensus	
	RB13 Chung, Michael & Ava	Active	10793181	5/8"	Sensus	
	RB14 Irving, Mason & Ann	Active	ANALOG	5/8"	Badger	
	RB15 Roberts, Ernie & Paula	Active	07005133	5/8"		
	RB16 Spiller, Bert & Maria	Active	07010646	5/8"	Sensus	
	RB17 Schiller & Walrath	Active	07048029	5/8"	Sensus	
	RB18 McClenathan, Michael & Todd	Active	ANALOG	5/8"	Badger	
	RB19 Benz & Stan	Active	10798768	5/8"	Sensus	
	RB20 Jones, Mike & Linda	Active	71274465	5/8"	Badger	
	RB21 Morrow, Claudia	Active	ANALOG	5/8"	Badger	
	RB22 Rosenbaum, Brett & Heather	Active	10791994	5/8"	Sensus	
	RB23 McClenathan, Todd & Michael	Active	ANALOG	5/8"	Badger	
	RB24 Morton, David	Active	ANALOG	5/8"	Badger	
	RB25 Wilson, Tom & Vikki	Active	ANALOG	5/8"	Badger	

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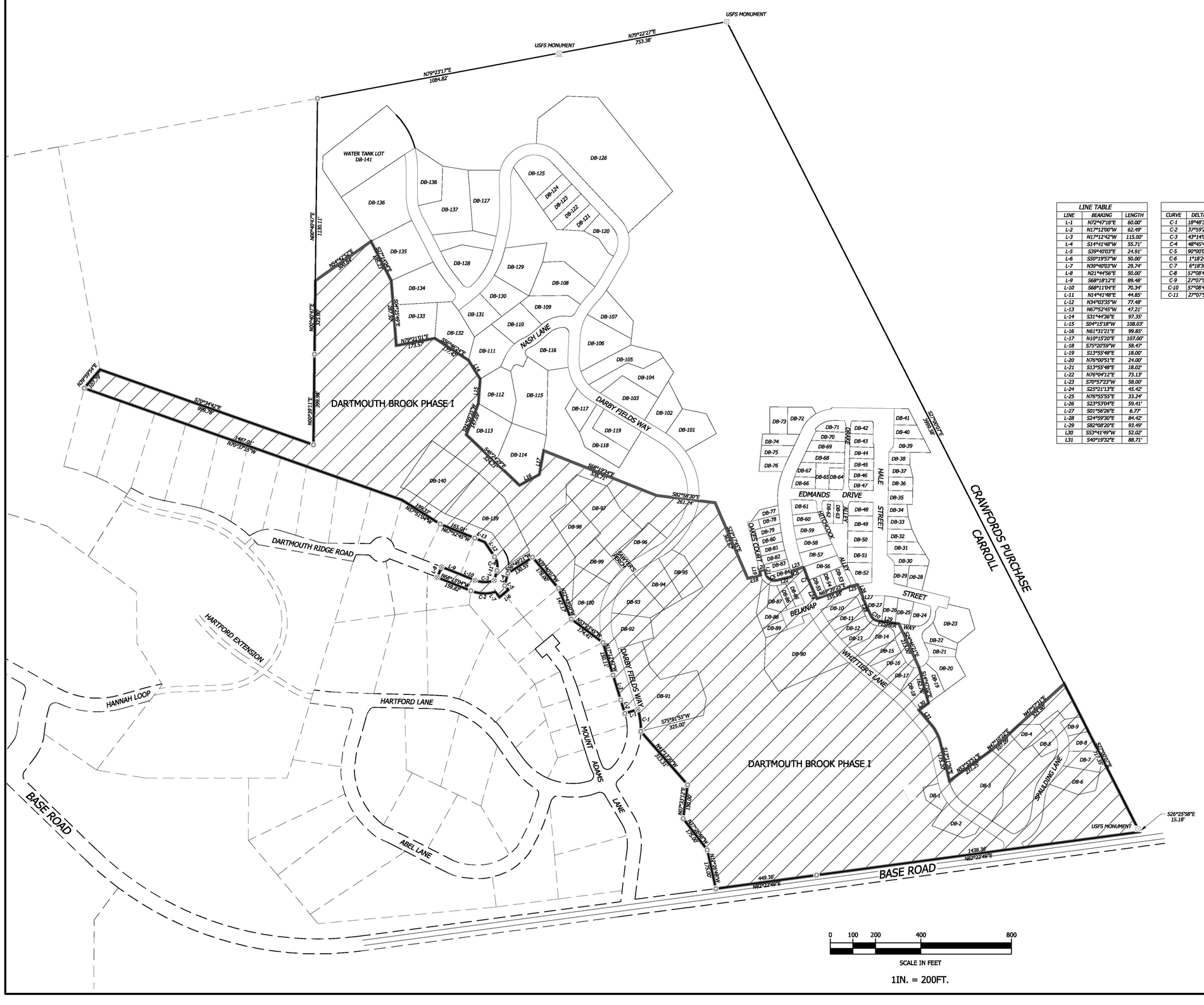
Association/Business+		Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
		RB26 Sousa, Joseph	Active	ANALOG	5/8"	Badger	
		RB27 Sylvestre, Sara	Active	ANALOG	5/8"	Badger	
	Total: 28	RB28 Lane, Christopher & Deirdre w/Grace	Active	73296634	5/8"	Sensus	
RIVER FRONT:		RF01 Bergum, Erik & Leslie	Active	52862858	5/8"	Sensus	
Single Family Homes		RF02 Genimatas, Dale	Active	62018065	5/8"		
		RF03 Allen, Derek & Ceciilia	Active	ANALOG	5/8"	Sensus	
		RF04 Roper, James & Lynne	Active	08658755	5/8"		
		RF05 Hardaway & Peterson	Active	71103680	5/8"	Elster	
		RF06 Wolf, Margot	Active	09507351	5/8"	Sensus	
		RF07 Kraabel, Stephen & Susan	Active	07197279	5/8"	Sensus	
		RF11 McIntire, Heidi	Active	57518670	5/8"		
	Total: 9	RF12 Martin, Steven & Elizabeth	Active	52512382	5/8"	Sensus	
STICKNEY CIRCLE:		SC01 Stevenson, Todd & Janel	Active	44780878	5/8"	Badger	
		SC02 Roy, David	Active	35975230	5/8"	Badger	
		SC03 Dinneen & McGuiggan	Active	35986252	5/8"	Badger	
		SC04 Rothery, Louise	Active	36986251	5/8"	Badger	
		SC05 Smith, Jim & Barbara	Active	73296639	5/8"	Sensus	
		SC06 Sheehan, Richard & Carole	Active	35975277	5/8"	Badger	
		SC07 Sheehan, Richard & Carole	Active	35975268	5/8"	Badger	
		SC08 Bungard, Donald & Jane	Active	35986262	5/8"	Badger	
		SC09 Abramovitch, Arlene	Active	ANALOG	5/8"	Sensus	
		SC10 Bruns, Michael & Amy	Active	ANALOG	5/8"	Sensus	
		SC11 11 Stickney Circle, LLC	Active	ANALOG	5/8"	Sensus	
		SC12 Miscione, Vincent & Elizabeth	Active	ANALOG	5/8"	Sensus	
		SC13 Blanco, Ramon & Sophie	Active	02645199	5/8"	Sensus	
		SC14 Hines, David & Deborah	Active	35986246	5/8"	Badger	
		SC15 Robie, Brad	Active	ANALOG	5/8"	Sensus	
		SC16 Yamajala, Sivaram	Active	35986249	5/8"	Badger	
		SC17 Louttit, Jonathan & Marion	Active	35975215	5/8"	Badger	
		SC18 Dolan, Jim & Joan	Active	37068849	5/8"	Sensus	
		SC19 Andriolo, Joseph & Dianne	Active	35986257	5/8"	Badger	
		SC20 Gamache & Lynch	Active	37068852	5/8"	Sensus	
		SC21 Hebert, Stephen M.	Active	35986261	5/8"	Badger	
		SC22 Neville, Kevin & Lisa	Active	63518535	5/8"	Sensus	
		SC23 Owen, William & Ann Marie	Active	35789417	5/8"	Badger	
		SC24 Kelley, Michael & Dianne	Active	13099136	5/8"	Sensus	
		SC25 Balmforth, Maxon	Active	09572087	5/8"	Sensus	

Rosebrook Water Company Inc.
Customer Meter Size & Type
June 17, 2016

Association/Business+	Customer	Customer Type	Register ID:	Meter Size	Meter Type	Meter Count
	SC26 Guerin, Taylor & Carol	Active	10771404	5/8"	Sensus	
	SC27 Wright, Alan & Yoshiko	Active	10854546	5/8"	Sensus	
	SC28 Rosa, Ron & Kim	Active	35986260	5/8"	Badger	
	SC29 Coache, Robert	Active	10799097	5/8"	Sensus	
	SC30 McBunch, Bill & Jane	Active	10952311	5/8"	Sensus	
	SC31 Savini, John & Mary Kathleen	Active	35975338	5/8"	Badger	
	SC32 Chisholm, Claire	Active	35975236	5/8"	Badger	
	SC33 Juzwic, William & Mary Lou	Active	35986247	5/8"	Badger	
	SC34 Bartolini, Wilmin & Kathleen	Active	60896181	5/8"	Sensus	
	SC35 Michell, Patricia	Active	73296631	5/8"	Sensus	
	SC36 Wilson & Thompson	Active	35789415	5/8"	Badger	
	SC37 Doyle, Mary	Active	35986250	5/8"	Badger	
	SC38 Socransky, June	Active	63518476	5/8"	Sensus	
	SC39 Hartung, Kirk & Diane	Active	63518534	5/8"	Sensus	
	SC40 Stankiewicz, Jane	Active	71003716	5/8"	Elster	
	SC41 Walker, Donna	Active	35986253	5/8"	Badger	
	SC42 Raspuzzi, Christine	Active	35986243	5/8"	Badger	
	SC43 Osbahr, John & Carolyn	Active	63518477	5/8"	Sensus	
	SC44 Caterine, John & Melinda	Active	35986264	5/8"	Badger	
	SC45 Rizzolo, Anthony & Josephine	Active	35986256	5/8"	Badger	
	SC46 Costello, Matthew & Kathleen	Active	35986254	5/8"	Badger	
	SC47 Hart, Sarah	Active	35986248	5/8"	Badger	
	SC48 Yuan, Olive	Active	35986242	5/8"	Badger	
	SC BLG B WATER METER	HOA spigot	63518474	5/8"		
	SC BLG C WATER METER	HOA spigot	35975335	5/8"	Badger	
Total: 48 Cust + 3 spigots	SC BLG F WATER METER	HOA spigot	30267358	5/8"	Sensus	
STONE HILL:	SH01 Pinstein & Dassule	Active	56585496	1"	Sensus	
	SH02 Little, Brett & Cory	Active	56585495	1"	Sensus	
	SH03 Samtani & Leslie	Active	54851044	1"	Sensus	
	SH04 Smith, Tony & Chris	Active	54851043	1"	Sensus	
	SH05 Bajer Josephine	Active	54884726	1"	Sensus	
	SH06 Komari, Tony & Suzanne	Active	54884725	1"	Sensus	
	SH07 Burt, Larry & Joanna	Active	59536751	1"	Sensus	
	SH08 Oldroyd & Cronin	Active	59616023	1"	Sensus	
	SH09 Stone, Malcolm & Carol	Active	61116196	1"	Sensus	
Total: 10	SH10 Doherty, Dermot & Christine	Active	61116195	1"	Sensus	

TOTAL METERS 412 (410 CONNECTIONS & 2 PORTABLE)

APPENDIX B
Site Plan
Dartmouth Brook Residential Area
For
Bretton Woods Land Co., Inc.



LINE TABLE		
LINE	BEARING	LENGTH
L-1	N72°47'18"E	60.00'
L-2	N17°12'00"W	62.49'
L-3	N17°12'42"W	115.00'
L-4	S14°41'48"W	55.71'
L-5	S39°40'03"E	24.91'
L-6	S50°19'57"W	50.00'
L-7	N39°40'03"W	29.74'
L-8	N21°44'56"E	50.00'
L-9	S68°18'12"E	89.48'
L-10	S68°11'04"E	70.34'
L-11	N14°41'48"E	44.85'
L-12	N3°40'35"W	77.48'
L-13	N67°52'45"W	47.21'
L-14	S31°44'36"E	97.35'
L-15	S04°15'18"W	108.03'
L-16	N61°31'21"E	99.85'
L-17	N10°15'20"E	107.00'
L-18	S75°20'59"W	58.47'
L-19	S13°55'48"E	18.00'
L-20	N76°00'51"E	24.00'
L-21	S13°55'48"E	18.02'
L-22	N76°04'12"E	73.13'
L-23	S70°57'23"W	58.00'
L-24	S25°21'13"E	45.42'
L-25	N76°55'55"E	33.24'
L-26	S23°53'04"E	59.41'
L-27	S01°56'26"E	6.77'
L-28	S24°59'30"E	84.42'
L-29	S82°08'20"E	93.49'
L30	S53°41'49"W	52.02'
L31	S40°19'32"E	88.71'

CURVE TABLE					
CURVE	DELTA	RADIUS	LENGTH	CHORD BEARING	CHORD
C-1	18°48'39"	298.00'	97.84'	N07°48'22"W	97.40'
C-2	37°59'22"	164.85'	109.30'	S81°11'58"E	107.31'
C-3	43°14'00"	114.85'	86.66'	S89°48'04"E	84.62'
C-4	48°45'47"	75.21'	64.01'	N09°40'59"W	62.10'
C-5	90°00'00"	40.00'	62.83'	S58°55'48"E	56.57'
C-6	1°18'24"	1025.50'	23.39'	S19°41'49"E	23.39'
C-7	6°18'36"	967.50'	106.55'	S22°11'55"E	106.50'
C-8	57°08'49"	39.00'	38.90'	S53°33'55"E	37.31'
C-9	27°07'55"	175.00'	82.87'	N26°45'34"W	82.10'
C-10	57°08'49"	39.00'	38.90'	S53°33'55"E	37.31'
C-11	27°07'55"	175.00'	82.87'	N26°45'34"W	82.10'

GRID NORTH

horizons Engineering PLLC
34 School Street
Littleton, NH 03561
Phone 603.444.4111 - Fax 603.444.1343

DARTMOUTH BROOK RESIDENTIAL AREA

FOR BRETTON WOODS LAND CO., LLC

210 MOUNT WASHINGTON DRIVE, BRETTON WOODS, NH 03575
TOWN OF CARROLL, MAP 210 LOT 5
COOS COUNTY, NEW HAMPSHIRE

PHASE I LIMITS

NO.	DATE	REVISION DESCRIPTION	ENG	DWG

DATE: 1-14-09	PROJECT #: 07157
SURV'D BY: SH/RL	DRAWN BY: AJN
CHECK'D BY: AJN	ARCHIVE #: H - 4644
SHEET 1 OF 1	

APPENDIX C
Well Pumping/Water Usage Records 2015/2016

ROSEBROOK WATER SYSTEM **MONTH** January **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Thu	900	NO	10.74	5.28	106,000	3.37	90,100	196,100	200	-	-
2	Fri	900	NO	10.53	5.23	102,700	4.58	122,100	224,800	200	-	-
3	Sat	920	NO	10.78	4.34	85,700	2.63	70,100	155,800	190	-	-
4	Sun	915	NO	10.57	2.78	56,700	2.87	76,300	133,000	190	-	-
5	Mon	700	BS	11.24	0.79	15,600	1.9	50,400	66,000	190	-	-
6	Tue	700	BS	10.61	3.12	62,600	2.62	69,900	132,500	190	-	-
7	Wed	700	BS	11.08	3.04	60,900	0.38	10,200	71,100	190	-	-
8	Thu	700	BS	10.72	2.84	58,600	2.48	65,300	123,900	190	-	-
9	Fri	700	BS	11.07	1.05	19,900	4.06	107,900	127,800	190	-	-
10	Sat	730	BS	10.87	4.73	92,400	2.55	66,400	158,800	190	-	-
11	Sun	735	BS	10.65	4.8	93,000	2.28	61,800	154,800	190	-	-
12	Mon	700	BS	11.06	4.65	91,300	1.28	34,000	125,300	190	-	-
13	Tue	700	BS	11.42	2.58	51,500	0.7	17,900	69,400	190	4	12
14	Wed	700	BS	10.57	4.62	99,800	1.57	41,900	141,700	190	-	-
15	Thu	900	NO	10.78	2.79	57,300	2.44	64,900	122,200	190	-	-
16	Fri	700	BS	10.97	0.77	15,400	4.86	128,600	144,000	190	-	-
17	Sat	930	NO	10.58	6.33	131,500	3.29	87,200	218,700	190	-	-
18	Sun	940	NO	10.85	3.52	69,800	3.28	87,200	157,000	190	-	-
19	Mon	630	BS	10.59	7.2	146,800	0.46	12,300	159,100	190	-	-
20	Tue	700	BS	11.01	4.83	97,300	0.79	20,700	118,000	190	-	-
21	Wed	700	BS	11.35	3.06	62,000	0	-	62,000	190	-	-
22	Thu	700	BS	10.78	6.22	123,300	0	-	123,300	190	-	-
23	Fri	715	BS	11.22	3.66	72,200	2.17	57,600	129,800	190	-	-
24	Sat	700	BS	10.63	7.59	149,900	0.55	14,200	164,100	190	-	-
25	Sun	730	BS	10.74	6.19	123,500	0.97	25,600	149,100	190	-	-
26	Mon	735	BS	10.99	5.95	120,000	0	-	120,000	190	-	-
27	Tue	700	BS	11.26	3.36	63,200	0	-	63,200	190	5	12
28	Wed	630	BS	10.74	3.68	64,200	0	-	64,200	190	-	-
29	Thu	600	BS	10.58	5.57	102,000	0.85	22,500	124,500	190	-	-
30	Fri	640	NO	11.17	0	-	0	-	-	195	-	-
31	Sat	915	BS	8.4	14.56	279,900	0	-	279,900	195	-	-
											9	24
	Totals				135.13	2,675,000	62.94	1,405,100	4,080,100			24

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ROSEBROOK WATER SYSTEM MONTH February YEAR 2015

	DAY	TIME	INITIALS	REBERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	926	NO	10.47	7.16	143,400	0	-	143,400	190	-	-
2	Mon	700	BS	11.26	3.01	59,000	0	-	59,000	190	-	-
3	Tue	700	BS	10.6	4.34	87,600	0	-	87,600	190	-	-
4	Wed	700	BS	10.8	4.95	98,100	0	-	98,100	190	-	-
5	Thu	700	BS	11.03	4.35	86,000	0	-	86,000	190	-	-
6	Fri	700	BS	11.11	8.24	149,300	0	-	149,300	190	-	-
7	Sat	730	BS	10.78	10.4	183,800	0	-	183,800	190	-	-
8	Sun	735	BS	11.01	4.89	91,100	0	-	91,100	190	-	-
9	Mon	700	BS	11.24	2.74	54,000	1.6	41,700	95,700	190	5	12
10	Tue	700	BS	11.24	2.82	56,500	1.44	38,400	94,900	190	-	-
11	Wed	700	BS	11.37	0	-	2.45	64,100	64,100	190	-	-
12	Thu	700	BS	10.87	3.38	65,000	2.08	54,900	119,900	190	-	-
13	Fri	840	NO	11.11	4	77,200	2.24	58,900	136,100	190	-	-
14	Sat	940	NO	10.88	4.53	89,800	2.77	73,200	163,000	190	-	-
15	Sun	925	NO	10.49	5.1	102,300	3.1	82,000	184,300	190	-	-
16	Mon	631	BS	10.65	5.36	109,700	3.06	80,500	190,200	190	-	-
17	Tue	730	BS	10.73	4.49	95,100	3.21	84,700	179,800	190	-	-
18	Wed	700	BS	10.63	5.2	105,000	3.11	82,300	187,300	190	-	-
19	Thu	700	BS	10.55	3.95	81,200	3.27	86,400	167,600	190	-	-
20	Fri	700	BS	10.64	8.41	164,700	3.53	82,000	246,700	190	5	12
21	Sat	730	BS	10.95	5.34	104,100	2.61	79,800	183,900	190	-	-
22	Sun	735	BS	10.91	2.61	52,800	2.47	65,100	117,900	190	-	-
23	Mon	700	BS	11.11	3.46	69,800	2.1	55,200	125,000	190	-	-
24	Tue	700	BS	11.11	3.17	66,400	2.07	54,600	121,000	190	-	-
25	Wed	700	BS	11.19	3.56	71,000	2.27	59,800	130,800	190	-	-
26	Thu	705	BS	11.42	3.64	74,900	1.62	42,800	117,700	190	-	-
27	Fri	830	NO	10.88	3.88	80,300	3.9	102,500	182,800	190	-	-
28	Sat	930	NO	11.06	4.16	90,100	3.58	93,900	184,000	195	-	-
	Totals				127.14	2,508,200	52.48	1,382,800	3,891,000		10	24

ROSEBROOK WATER SYSTEM **MONTH** March **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	900	NO	10.9	2.72	56,100	2.46	64,800	120,900	195	-	-
2	Mon	700	BS	10.94	4.06	83,600	0	-	83,600	195	4	12
3	Tue	700	BS	10.65	2.79	57,200	2.64	69,600	126,800	195	-	-
4	Wed	700	BS	11.15	0.95	19,200	2.49	65,200	84,400	190	-	-
5	Thu	700	BS	10.76	2.65	53,300	2.42	63,500	116,800	190	-	-
6	Fri	700	BS	10.61	3.64	72,900	2.53	66,300	139,200	190	-	-
7	Sat	730	BS	10.93	4.97	99,100	3.09	81,000	180,100	190	-	-
8	Sun	900	BS	10.53	4.8	95,300	2.34	61,600	156,900	190	-	-
9	Mon	700	BS	11.09	3.17	65,100	0.5	13,000	78,100	190	-	-
10	Tue	825	BS	10.69	2.58	52,800	2.06	54,200	107,000	190	-	-
11	Wed	700	BS	11.27	0	-	2.33	60,900	60,900	190	-	-
12	Thu	700	BS	10.89	3.14	64,200	2.07	54,100	116,300	190	3	8
13	Fri	1015	NO	10.88	4.21	77,900	2.2	58,000	135,900	195	-	-

ROSEBROOK WATER SYSTEM **MONTH** April **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Wed	700	BS	10.72	2.87	58,400	2.33	60,300	118,700	190	-	-
2	Thu	850	NO	11.1	2.53	51,500	0	-	51,500	195	-	-
3	Fri	730	BS	11.38	0.87	17,900	2.51	66,100	84,000	190	-	-
4	Sat	730	BS	10.72	3.65	64,200	2.66	69,800	134,000	190	-	-
5	Sun	8700	BS	10.88	4.06	75,800	0	-	75,800	190	-	-
6	Mon	810	BS	10.52	3.37	54,600	2.48	64,600	119,200	190	4	12
7	Tue	850	NO	11.19	0.79	13,400	2.42	63,100	76,500	195	-	-
8	Wed	730	BS	11.17	3.89	62,900	0	-	62,900	190	-	-
9	Thu	700	BS	10.91	0.5	9,000	2.38	62,300	71,300	190	-	-
10	Fri	945	NO	10.63	4.39	71,500	2.62	42,200	113,700	190	-	-
11	Sat	850	NO	11.39	0.48	7,500	1.42	63,300	70,800	190	-	-
12	Sun	930	NO	10.53	4.45	72,900	0	-	72,900	190	-	-
13	Mon	700	BS	10.68	0	-	2.2	57,400	57,400	190	-	-
14	Tue	730	BS	10.73	3.49	60,100	0	-	60,100	190	-	-
15	Wed	840	NO	10.83	1	-	2.03	52,700	52,700	195	-	-
16	Thu	700	BS	11.11	2.3	54,300	0	-	54,300	190	-	-
17	Fri	660	BS	11.33	0	-	2.29	60,300	60,300	190	-	-
18	Sat	715	BS	11.21	3.54	67,100	0	-	67,100	190	-	-
19	Sun	520	BS	10.96	3.03	53,100	2.43	63,400	116,500	190	-	-
20	Mon	705	BS	11.38	0	-	2.33	60,900	60,900	190	-	-
21	Tue	730	BS	11.03	2.97	56,200	0	-	56,200	190	-	-
22	Wed	650	BS	11.03	0	-	2.34	61,300	61,300	190	-	-
23	Thu	644	BS	10.65	0.45	9,100	2.79	72,200	81,300	190	3	10
24	Fri	739	BS	10.69	3.64	62,200	0.89	23,200	85,400	190	-	-
25	Sat	1000	NO	10.85	3.12	54,100	1.5	39,200	93,300	190	-	-
26	Sun	1000	NO	11.01	0	-	2.26	59,000	59,000	195	-	-
27	Mon	715	BS	10.69	3.16	58,700	0	-	58,700	190	-	-
28	Tue	628	BS	10.81	0	-	1.96	51,300	51,300	190	-	-
29	Wed	655	BS	10.89	0.1	1,800	2.1	55,000	56,800	190	-	-
30	Thu	740	BS	10.95	3.62	61,900	0	-	61,900	190	-	-
	Totals				62.27	1,098,200	43.94	1,147,600	2,245,800		>	22

Docket No. DW 17-165
Exh. 20

ROSEBROOK WATER SYSTEM **MONTH** May **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Fri	642	BS	10.79	0	-	2.27	59,000	59,000	190	-	-
2	Sat	700	BS	10.51	4.06	70,600	2.1	55,000	125,600	190	-	-
3	Sun	710	BS	11.27	3.18	59,200	0	-	59,200	190	-	-
4	Mon	700	BS	10.72	0	-	2.29	59,900	59,900	190	-	-
5	Tue	630	BS	11.4	2.74	56,500	2.24	58,100	114,600	190	-	-
6	Wed	650	BS	10.79	4.13	67,200	2.2	57,900	125,100	190	-	-
7	Thu	805	NO	11.38	2.72	56,200	0.27	7,100	63,300	195	-	-
8	Fri	700	BS	11.15	1.01	19,900	2.36	62,300	82,200	190	-	-
9	Sat	910	NO	10.75	3.41	60,800	1.93	50,500	111,300	190	-	-
10	Sun	910	NO	10.84	0	-	2.27	59,800	59,800	195	-	-
11	Mon	650	BS	10.67	3.42	63,500	0	-	63,500	190	-	-
12	Tue	620	BS	10.63	2.67	53,500	2.19	57,600	111,100	190	-	-
13	Wed	631	BS	11.39	0	-	2.37	62,500	62,500	190	-	-
14	Thu	615	BS	11.21	2.97	61,700	0	-	61,700	190	-	-
15	Fri	550	BS	10.83	2.16	44,700	2.44	63,900	108,600	190	4	11
16	Sat	630	BS	11.27	0.72	14,800	2.28	59,700	74,300	190	-	-
17	Sun	700	BS	10.95	4.16	65,300	0	-	65,300	190	-	-
18	Mon	700	BS	10.61	0	-	2.27	59,700	59,700	190	-	-
19	Tue	700	BS	10.69	3.91	62,900	0	-	62,900	190	-	-
20	Wed	650	BS	10.61	2.76	52,100	2.42	63,300	115,400	190	-	-
21	Thu	656	BS	11.25	0.71	12,300	2.39	62,500	74,800	190	-	-
22	Fri	820	NO	10.69	2.5	48,100	2.48	65,100	113,200	190	-	-
23	Sat	930	NO	10.53	3.43	69,300	2.5	65,300	134,600	190	-	-
24	Sun	945	NO	10.69	6.65	106,700	0.91	23,900	130,600	195	-	-
26	Mon	900	BS	10.89	1.33	24,900	2.2	57,300	82,200	195	-	-
26	Tue	640	BS	10.95	2.14	37,200	2.55	66,100	103,300	190	-	-
27	Wed	715	BS	10.51	3.11	61,200	2.23	58,300	119,500	190	-	-
28	Thu	700	BS	10.95	5.61	90,100	0	-	90,100	190	4	11
29	Fri	600	BS	10.56	2.86	58,400	2.53	66,400	124,800	190	-	-
30	Sat	730	BS	11.19	0	-	2.41	33,000	33,000	190	-	-
31	Sun	735	BS	10.53	4.93	76,000	2.07	84,000	160,000	190	-	-
	Totals				77.19	1,392,900	54.17	1,418,200	2,811,100		8	22

ROSEBROOK WATER SYSTEM **MONTH** June **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 60 # BAGS
1	Mon	700	BS	11.41	9.98	153,900	0	-	153,900	190	-	-
2	Tue	720	BS	11.07	3.59	66,000	1.71	44,700	110,700	190	-	-
3	Wed	900	NO	10.63	0	-	0	-	-	180	-	-
4	Thu	700	BS	9.51	8.45	144,600	0	-	144,600	190	-	-
5	Fri	700	BS	10.75	3.6	62,300	0	-	62,300	190	-	-
6	Sat	930	NO	10.06	10.19	176,700	0	-	176,700	195	-	-
7	Sun	1050	NO	11.46	3.28	56,200	0	-	56,200	190	-	-
8	Mon	700	BS	11.27	0	-	0	-	-	90	4	9
9	Tue	700	BS	9.67	6.46	121,900	0	-	121,900	190	-	-
10	Wed	630	BS	10.56	5.2	90,400	0	-	90,400	190	-	-
11	Thu	640	BS	10.88	4.28	73,400	0	-	73,400	190	-	-
12	Fri	700	BS	10.63	5.83	100,300	0	-	100,300	190	-	-
13	Sat	700	BS	10.73	6.82	127,200	0	-	127,200	190	-	-
14	Sun	630	BS	11.23	4.19	66,200	0	-	65,200	190	-	-
15	Mon	645	BS	10.77	3.47	65,700	0	-	65,700	190	-	-
16	Tue	655	BS	10.64	6.25	117,900	0	-	117,900	190	-	-
17	Wed	700	BS	11.24	3.93	64,300	0	-	64,300	190	-	-
18	Thu	745	BS	10.7	6.49	116,700	0	-	116,700	190	-	-
19	Fri	930	NO	11.1	4.61	85,600	0	-	85,600	195	-	-
20	Sat	730	BS	10.97	3.82	58,200	0	-	58,200	190	-	-
21	Sun	720	BS	10.57	7.08	137,600	0	-	137,600	190	-	-
22	Mon	700	BS	11.31	4.05	63,700	0	-	63,700	190	-	-
23	Tue	630	BS	11.26	3.65	64,400	0	-	64,400	190	-	-
24	Wed	740	BS	10.81	5.21	86,300	0	-	86,300	190	-	-
25	Thu	700	BS	10.75	2.94	52,400	0	-	52,400	190	5	12
26	Fri	645	BS	9.71	25.58	414,000	0	-	414,000	190	-	-
27	Sat	730	BS	13.41	0	-	0	-	-	195	-	-
28	Sun	730	BS	11.17	0	-	0	-	-	190	-	-
29	Mon	700	BS	9.04	11.29	182,200	0	-	182,200	190	-	-
30	Tue	630	BS	10.81	0	-	0	-	-	195	-	-
	Totals				160.24	2,747,100	1.71	44,700	2,791,800			21

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ROSEBROOK WATER SYSTEM **MONTH** July **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Wed	645	BS	8.96	3.28	68,500	0	-	68,500	190	-	-
2	Thu	700	BS	8.28	6.41	127,400	0	-	127,400	190	-	-
3	Fri	740	NO	8.62	8.34	154,300	0.43	-	154,300	195	-	-
4	Sat	840	NO	8.42	0	-	0	-	-	195	-	-
5	Sun	905	NO	5.44	6.6	119,700	0	-	119,700	190	-	-
6	Mon	700	BS	5.7	9.66	165,100	0	-	165,100	190	-	-
7	Tue	600	BS	9.18	0	-	0	-	-	190	-	-
8	Wed	700	BS	6	11.39	195,100	0	-	195,100	190	-	-
9	Thu	630	BS	7.24	2.44	44,900	3.45	73,200	118,100	190	-	-
10	Fri	630	BS	7.38	0.67	11,700	7.37	196,500	208,200	195	-	-
11	Sat	700	BS	9.1	4.84	83,500	2.68	71,000	154,500	190	-	-
12	Sun	725	BS	9.02	5.3	85,000	2.16	57,500	142,500	190	-	-
13	Mon	700	BS	9.98	4.51	71,600	0	-	71,600	190	-	-
14	Tue	700	BS	9.36	3.83	62,000	2.28	60,700	122,700	190	-	-
15	Wed	700	BS	9.8	0	-	2.55	68,000	68,000	190	-	-
16	Thu	640	BS	9.07	4.12	82,500	2.47	66,000	148,500	190	3	10
17	Fri	825	NO	9.35	5.19	74,400	2.19	58,500	132,900	190	-	-
18	Sat	930	NO	9.26	4.78	80,300	2.44	65,200	145,500	195	-	-
19	Sun	910	NO	9.08	5.03	85,700	2.11	56,300	142,000	190	-	-
20	Mon	700	BS	9.66	4.17	69,100	1.09	29,400	98,500	190	-	-
21	Tue	630	BS	9.35	0	-	4.84	121,400	121,400	190	-	-
22	Wed	700	BS	9.42	4.45	74,100	2.21	59,200	133,300	195	-	-
23	Thu	635	BS	9.75	4.74	76,800	2.36	63,500	140,300	195	-	-
24	Fri	700	BS	9.98	5.13	83,300	1.35	36,200	119,500	190	-	-
25	Sat	620	BS	9.46	5.28	85,400	3.21	86,000	171,400	190	-	-
26	Sun	830	BS	9.56	4.02	65,400	1.16	30,400	95,800	190	-	-
27	Mon	630	BS	9.8	3.86	62,500	2.32	62,500	125,000	190	4	12
28	Tue	645	BS	9.82	4.62	76,600	2.45	65,800	142,400	190	-	-
29	Wed	650	BS	9.65	3.9	62,900	2.69	71,900	134,800	190	-	-
30	Thu	650	BS	9.74	5.48	90,200	1.51	40,700	130,900	190	-	-
31	Fri	900	NO	9.52	5.83	94,300	1.34	35,800	130,100	195	-	-
	Totals				137.87	2,352,300	56.36	1,476,700	3,828,000		7	22

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ROSEBROOK WATER SYSTEM **MONTH** August **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Sat	900	NO	9.02	1.47	24,900	4.88	131,100	156,000	190	-	-
2	Sun	915	NO	9.18	4.99	81,000	2.17	58,300	139,300	195	-	-
3	Mon	700	BS	9.63	4.9	80,300	2.1	57,300	137,600	190	-	-
4	Tue	655	BS	9.77	6.27	102,300	0	-	102,300	190	-	-
5	Wed	700	BS	9.1	6.3	100,700	2.79	74,300	175,000	190	-	-
6	Thu	630	BS	9.6	3.43	56,100	2.63	70,800	126,900	190	5	12
7	Fri	700	BS	9.85	4.05	66,400	3.92	105,600	172,000	190	-	-
8	Sat	930	BS	9.53	8.66	90,000	1.43	38,300	128,300	195	-	-
9	Sun	630	BS	9.82	2.01	80,900	2.7	72,500	153,400	190	-	-
10	Mon	700	BS	9.63	4.13	66,300	2.47	66,400	132,700	190	-	-
11	Tue	700	BS	9.76	4.24	68,900	2.83	68,200	137,100	190	-	-
12	Wed	832	BS	9.89	0	-	2.41	64,800	64,800	190	-	-
13	Thu	700	BS	9.26	5.18	84,900	2.62	70,800	155,700	190	2.5	6
14	Fri	835	NO	9.94	6.3	102,500	0.04	1,000	103,500	200	-	-
15	Sat	915	NO	9.8	6.55	108,400	2.76	74,400	182,800	195	-	-
16	Sun	930	NO	9	4.34	73,500	2.73	73,600	147,100	195	-	-
17	Mon	700	BS	9.62	4.23	72,300	2.39	64,200	136,500	190	-	-
18	Tue	700	BS	9.63	4.06	69,800	2.83	75,700	145,500	190	-	-
19	Wed	630	BS	9.6	3.82	64,500	2.88	78,200	142,700	190	-	-
20	Thu	730	BS	9.47	4.3	72,600	2.66	71,300	143,900	190	-	-
21	Fri	635	BS	9.7	4.63	78,200	2.69	72,500	150,700	190	-	-
22	Sat	730	BS	9.2	5.19	87,400	2.63	70,200	157,600	190	4	12
23	Sun	730	BS	9.18	4.5	76,200	2.86	69,300	145,500	190	-	-
24	Mon	700	BS	9.76	3.54	58,400	2.48	66,900	125,300	190	-	-
25	Tue	700	BS	9.82	0.93	16,100	2.4	65,200	81,300	190	-	-
26	Wed	650	BS	9.22	4.04	68,000	2.45	67,300	135,300	190	-	-
27	Thu	700	BS	9.51	4.35	72,500	2.34	62,600	135,100	190	-	-
28	Fri	900	NO	9.71	4.96	84,400	0.61	13,700	98,100	195	-	-
29	Sat	900	NO	9.16	4.74	81,200	2.09	56,600	137,800	195	-	-
30	Sun	910	NO	9.28	2.05	34,200	2.62	67,400	101,600	195	-	-
31	Mon	700	BS	9.58	6.35	105,900	0.02	3,800	109,700	195	-	-
	Totals				134.51	2,228,800	71.73	1,932,300	4,161,100		11.5	30

ROSEBROOK WATER SYSTEM **September 2015**

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Tue	700	BS	9.76	0	-	2.22	60,200	60,200	190	5	12
2	Wed	700	BS	9.18	5.42	91,800	0	-	91,800	190	-	-
3	Thu	700	BS	9.28	3.65	62,700	2.6	70,500	133,200	190	-	-
4	Fri	700	BS	9.71	4.06	69,100	2.54	68,700	137,800	190	-	-
5	Sat	730	BS	9.63	3.96	66,900	2.95	79,600	146,500	190	-	-
6	Sun	735	BS	9.06	5.16	88,700	3.04	82,000	170,700	190	-	-
7	Mon	900	NO	9.26	0	-	2.66	72,300	72,300	195	-	-
8	Tue	600	BS	9.04	4.67	80,500	1.67	45,100	125,600	190	-	-
9	Wed	700	BS	9.7	3.69	62,800	0.86	23,200	86,000	190	-	-
10	Thu	700	BS	9.76	0.7	12,200	2.31	62,400	74,600	190	3	8
11	Fri	900	NO	9.16	3.54	61,000	2.08	56,200	117,200	190	-	-
12	Sat	915	NO	9.42	5.16	86,200	0.98	26,900	112,100	195	-	-
13	Sun	910	NO	9.34	3.44	57,500	1.6	43,100	100,600	195	-	-
14	Mon	700	BS	9.77	0.02	-	2.44	65,900	65,900	190	-	-
15	Tue	720	BS	9.33	4.3	72,000	0.87	23,500	95,500	190	-	-
16	Wed	700	BS	9.36	3.93	66,700	2.02	54,700	121,400	190	-	-
17	Thu	705	BS	9.56	3.96	66,300	0	-	66,300	190	-	-
18	Fri	1054	BS	9.06	3.63	61,300	4.71	126,600	187,900	190	-	-
19	Sat	730	BS	9.71	4.03	67,900	2.49	67,600	135,500	190	-	-
20	Sun	740	BS	9.37	0	-	2.4	64,800	64,800	190	-	-
21	Mon	700	BS	9.14	5.59	95,200	2.26	61,600	156,800	190	5	12
22	Tue	700	BS	9.6	17.46	88,000	0	-	88,000	190	-	-
23	Wed	700	BS	9.48	0.05	700	4.06	109,100	109,800	190	-	-
24	Thu	700	BS	9.77	4.21	75,900	1.4	38,200	114,100	195	-	-
25	Fri	1100	NO	9.56	3.89	66,000	1.11	29,800	95,800	195	-	-
26	Sat	1020	NO	9.2	3.84	65,900	2.42	65,600	131,500	195	-	-
27	Sun	910	NO	9.21	2.22	38,400	2.44	72,200	110,600	195	-	-
28	Mon	700	BS	9.53	2.48	41,600	2.23	54,500	96,100	190	-	-
29	Tue	700	BS	9.71	4.55	78,400	0	60,000	138,400	190	-	-
30	Wed	700	BS	9.21	0	-	2.36	4,000	4,000	190	-	-
	Average				3.58	54,090	1.96	52,943	107,033			
	Totals				107.51	1,622,700	59	1,588,300	3,211,000		13	32

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ROSEBROOK WATER SYSTEM **MONTH** October **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Thu	700	BS	9.03	4.06	70,800	2.08	56,700	127,500	190	-	-
2	Fri	700	BS	9.71	4.4	75,600	2	53,700	129,300	190	-	-
3	Sat	750	BS	9.62	4.61	81,500	0.97	27,100	108,600	190	-	-
4	Sun	800	BS	9.08	3.57	59,800	2.57	70,000	129,800	190	-	-
5	Mon	700	BS	9.71	0	-	2.41	65,100	65,100	190	-	-
6	Tue	700	BS	9.03	4.67	78,800	2.09	56,600	135,400	190	-	-
7	Wed	700	BS	9.77	4.09	68,900	0	-	68,900	190	-	-
8	Thu	630	BS	9.31	3.34	57,700	2.26	61,000	118,700	190	-	-
9	Fri	830	NO	9.65	2.43	42,800	2.52	68,100	110,900	195	5	12
10	Sat	940	NO	9.31	4.88	83,300	2.73	73,500	156,800	190	-	-
11	Sun	915	NO	9.1	5.23	88,200	2.5	67,500	155,700	200	-	-
12	Mon	800	BS	9.42	4.65	78,900	2.12	57,100	136,000	195	-	-
13	Tue	700	BS	9.77	3.76	64,700	0	-	64,700	190	-	-
14	Wed	620	BS	9.26	3.44	58,200	2.38	64,100	122,300	190	-	-
15	Thu	700	BS	9.83	0	-	2.47	66,500	66,500	190	-	-
16	Fri	645	BS	9.27	4.58	77,100	2.14	57,800	134,900	190	-	-
17	Sat	700	BS	9.73	5.17	86,800	1.03	27,700	114,500	195	-	-
18	Sun	730	BS	9.35	4.2	71,000	1.96	52,300	123,300	190	-	-
19	Mon	700	BS	9.01	1.36	21,900	2.63	70,800	92,700	190	-	-
20	Tue	700	BS	9.33	4.24	71,300	0	-	71,300	190	-	-
21	Wed	700	BS	9.1	0.41	7,400	2.76	74,300	81,700	195	-	-
22	Thu	700	BS	9.12	4.46	74,400	2.18	58,900	133,300	190	-	-
23	Fri	830	NO	9.9	4.14	70,000	0.51	14,100	84,100	195	-	-
24	Sat	900	NO	9.43	2.15	36,900	2.81	76,400	113,300	190	-	-
25	Sun	910	NO	9.4	3.19	53,300	1.06	28,400	81,700	195	-	-
26	Mon	700	BS	9.463	3.83	64,200	1.67	46,300	109,500	190	-	-
27	Tue	700	BS	10	0.22	3,700	2.43	65,100	68,800	190	-	-
28	Wed	700	BS	9.63	4.15	68,800	0	-	68,800	190	-	-
29	Thu	700	BS	9.51	0	-	2.57	68,300	68,300	195	-	-
30	Fri	715	BS	9.73	4.49	76,700	0	-	76,700	195	-	-
31	Sat	730	BS	9.18	4.5	81,000	2.52	63,200	144,200	190	5	12
	Totals				104.21	1,773,700	55.37	1,489,600	3,263,300		10	24

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ROSEBROOK WATER SYSTEM **MONTH** November **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	1030	BS	9.98	0.3	5,300	2.42	64,300	69,600	190	-	-
2	Mon	700	BS	9.9	4.11	72,600	0	-	72,500	190	-	-
3	Tue	600	BS	9.76	0	-	2.64	69,500	69,500	195	-	-
4	Wed	700	BS	9.36	4.03	71,000	0.97	25,600	96,600	190	-	-
5	Thu	815	NO	9.37	0	-	1.76	46,400	46,400	195	-	-
6	Fri	700	BS	9.11	4.62	87,500	2.42	63,600	151,100	195	-	-
7	Sat	910	NO	9.6	3.85	74,800	1.87	49,600	124,400	190	-	-
8	Sun	910	NO	9.63	0	-	1.2	31,900	31,900	195	-	-
9	Mon	700	BS	9.08	4.34	58,600	0	-	58,600	190	-	-
10	Tue	925	BS	9.03	0	-	2.34	62,000	62,000	195	-	-
11	Wed	700	BS	9.33	3.86	76,200	0	-	76,200	190	-	-
12	Thu	700	BS	9.41	0	-	2.5	66,100	66,100	195	-	-
13	Fri	640	BS	9.63	4.22	81,400	0	-	81,400	195	-	-
14	Sat	730	BS	9.31	3.03	57,200	2.69	71,400	128,600	195	-	-
15	Sun	730	BS	9.56	1.68	34,600	0	-	34,600	195	-	-
16	Mon	700	BS	9.2	0	-	2.45	65,100	65,100	190	-	-
17	Tue	740	BS	9.37	4.04	81,300	0	-	81,300	195	-	-
18	Wed	700	BS	9.45	0	-	2.58	68,500	68,500	195	-	-
19	Thu	700	BS	9.35	4.07	66,400	0	-	65,400	195	3	9
20	Fri	840	NO	9.31	0.13	1,200	2.6	68,700	69,900	195	-	-
21	Sat	1000	NO	9.02	4.52	93,000	2.37	62,900	155,900	195	-	-
22	Sun	910	NO	9.66	4.11	86,100	0	-	86,100	190	-	-
23	Mon	700	BS	9.65	3.55	6,200	3.03	80,000	86,200	195	-	-
24	Tue	700	BS	9.69	1.95	11,800	2.95	78,200	90,000	190	-	-
25	Wed	700	BS	9.06	5.03	42,700	2.37	62,700	105,400	190	-	-
26	Thu	705	BS	9.65	5.56	106,400	0	-	106,400	190	-	-
27	Fri	700	BS	9.03	4.66	90,900	3.18	83,900	174,800	190	-	-
28	Sat	730	BS	9.46	4.11	72,100	3.26	85,600	157,700	190	-	-
29	Sun	630	BS	9.03	5.12	31,300	2.8	73,600	104,900	190	-	-
30	Mon	700	BS	9.49	4.93	14,400	2.56	67,100	81,500	190	-	-
	Totals				85.84	1,321,900	60.96	1,346,700	2,668,600		3	9

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ROSEBROOK WATER SYSTEM **MONTH** December **YEAR** 2015

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Tue	730	BS	9.58	0	-	2.48	64,800	64,800	190	-	-
2	Wed	700	BS	9.5	3.87	77,200	0	-	77,200	190	-	-
3	Thu	700	BS	9.63	0	-	2.49	65,600	65,600	190	-	-
4	Fri	900	NO	9.56	5.15	102,700	0.2	5,400	108,100	195	-	-
5	Sat	1000	NO	9.1	4.1	82,900	2.58	67,800	150,700	195	-	-
6	Sun	950	NO	9.28	0	-	2.89	76,100	76,100	200	-	-
7	Mon	630	BS	9.21	4.01	73,000	0	-	73,000	190	-	-
8	Tue	700	BS	9.18	0	-	2.84	74,500	74,500	190	5	12
9	Wed	700	BS	9.01	4.52	80,300	2.36	61,800	142,100	190	-	-
10	Thu	700	BS	10.03	3.6	71,300	0	-	71,300	195	-	-
11	Fri	700	BS	10	0	-	2.69	70,500	70,500	195	-	-
12	Sat	640	BS	9.63	4.84	99,800	2.8	75,200	175,000	195	-	-
13	Sun	730	BS	9.98	4.15	80,700	0.06	400	81,100	190	-	-
14	Mon	700	BS	9.76	0	-	2.46	64,000	64,000	190	-	-
15	Tue	705	BS	9.58	3.67	74,600	0	-	74,600	195	-	-
16	Wed	730	BS	9.65	0	-	2.4	63,300	63,300	190	-	-
17	Thu	730	BS	9.69	3.81	79,900	0	-	79,900	190	-	-
18	Fri	900	NO	9.51	1.07	14,300	2.72	71,800	86,100	195	-	-
19	Sat	900	NO	9.09	9.75	183,200	2.93	77,500	260,700	190	-	-
20	Sun	925	NO	9.09	5.32	87,600	3.03	83,600	171,200	195	-	-
21	Mon	700	BS	9.26	4.98	76,100	2.06	58,500	134,600	190	-	-
22	Tue	730	BS	9.94	4.65	86,800	0	-	86,800	195	-	-
23	Wed	700	BS	9.51	3.7	67,700	3.74	90,500	158,200	190	-	-
24	Thu	700	BS	10.45	4	66,100	0.64	17,200	83,300	190	-	-
25	Fri	800	BS	9.05	8.31	164,700	3.06	80,600	245,300	190	-	-
26	Sat	930	BS	10.55	5	101,700	0	-	101,700	195	-	-
27	Sun	730	BS	10.01	4.81	95,200	4.56	120,300	215,500	190	5	12
28	Mon	630	BS	9.69	3.23	68,800	6.82	180,100	248,900	190	-	-
29	Tue	630	BS	9.56	7.5	152,800	3.75	98,800	251,600	190	-	-
30	Wed	635	BS	10.1	6.23	127,000	3.97	104,700	231,700	195	-	-
31	Thu	700	BS	10.09	7.04	139,800	4	104,900	244,700	195	-	-
	Totals				117.21	2,254,200	67.51	1,777,900	4,032,100		10	24

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ROSEBROOK WATER SYSTEM **MONTH** January **YEAR** 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Fri	1000	NO	9.65	5.73	118,500	4.65	122,400	240,900	195	-	-
2	Sat	1000	NO	9.62	5.6	114,800	3.48	91,300	206,100	195	-	-
3	Sun	930	NO	9.69	5.49	114,900	3.39	89,000	203,900	190	-	-
4	Mon	815	NO	9.58	7.08	140,000	3.35	87,900	227,900	195	-	-
5	Tue	720	BS	9.51	6.96	138,000	3.58	94,200	232,200	195	-	-
6	Wed	700	BS	9.58	0	-	3.77	99,000	99,000	190	-	-
7	Thu	645	BS	9.74	0	-	5.2	137,300	137,300	190	-	-
8	Fri	700	BS	10.59	0	-	2.84	75,400	75,400	195	-	-
9	Sat	730	BS	9.51	0	-	7.19	190,300	190,300	195	-	-
10	Sun	730	BS	9.81	0	-	2.18	57,500	57,500	190	-	-
11	Mon	615	BS	9.6	0.07	1,000	8.53	225,600	226,600	195	5	12
12	Tue	700	BS	9.69	0	-	7.84	206,900	206,900	190	-	-
13	Wed	710	BS	10.49	0	-	2.49	65,900	65,900	190	-	-
14	Thu	700	BS	9.86	0	-	9.07	237,800	237,800	190	-	-
15	Fri	645	NO	10.31	0	-	5.27	138,200	138,200	195	-	-
16	Sat	930	NO	10.02	0	-	6.96	182,700	182,700	190	-	-
17	Sun	940	NO	9.71	0	-	6.14	160,200	160,200	190	-	-
18	Mon	700	BS	9.51	0	-	6.22	162,500	162,500	195	-	-
19	Tue	700	BS	9.94	0	-	4.4	123,000	123,000	195	-	-
20	Wed	700	BS	10.22	0	-	5.63	139,400	139,400	190	-	-
21	Thu	700	BS	10.36	0	-	2.63	68,900	68,900	190	-	-
22	Fri	725	BS	9.61	0	-	5.73	149,300	149,300	190	-	-
23	Sat	730	BS	9.54	0	-	9.04	214,800	214,800	190	-	-
24	Sun	740	BS	10.14	0	-	3.84	119,800	119,800	190	-	-
25	Mon	710	BS	9.83	0	-	4.91	127,500	127,500	190	5	12
26	Tue	530	BS	9.99	0	-	4.69	122,100	122,100	190	-	-
27	Wed	700	BS	10.37	0	-	3.02	60,500	60,500	195	-	-
28	Thu	705	BS	9.87	0	-	3.01	96,200	96,200	190	-	-
29	Fri	850	NO	10.06	0.07	1,000	5	129,900	130,900	195	-	-
30	Sat	910	NO	9.92	0	-	6.37	164,700	164,700	190	-	-
31	Sun	915	NO	9.81	0	-	4.91	127,100	127,100	195	-	-
	Average								151,468			
	Totals				31	628,200	155.33	4,067,300	4,696,600		10	24

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ROSEBROOK WATER SYSTEM **MONTH** February **YEAR** 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Mon	710	BS	9.69	0	-	3.88	100,500	100,500	195	-	-
2	Tue	730	BS	10	0	-	3.68	95,800	95,800	190	-	-
3	Wed	650	NO	10.13	0	-	1.73	45,100	45,100	195	-	-
4	Thu	700	BS	10.01	0	-	1.9	49,400	49,400	195	-	-
5	Fri	630	BS	9.58	0	-	6.79	175,700	175,700	195	-	-
6	Sat	800	BS	10.08	0	-	6.32	163,300	163,300	190	-	-
7	Sun	740	BS	9.92	0	-	2.71	90,600	90,600	190	-	-
8	Mon	735	BS	9.53	0	-	4.91	106,400	106,400	190	-	-
9	Tue	700	BS	9.74	0	-	6.07	157,200	157,200	190	-	-
10	Wed	520	BS	9.9	0	-	1.22	45,300	45,300	190	-	-
11	Thu	700	BS	10.04	1.43	8,400	4.21	95,100	103,500	190	3	10
12	Fri	840	NO	9.74	0	-	5.04	130,300	130,300	190	-	-
13	Sat	900	NO	9.69	0	-	9.66	250,500	250,500	195	-	-
14	Sun	900	NO	9.71	0	-	7.39	190,200	190,200	195	-	-
15	Mon	700	BS	9.96	0	-	7.71	199,000	199,000	190	-	-
16	Tue	640	BS	10.05	0	-	7.21	186,600	186,600	190	-	-
17	Wed	635	BS	10.13	0	-	6.85	177,100	177,100	190	-	-
18	Thu	700	BS	10.37	0	-	6.15	158,400	158,400	190	-	-
19	Fri	700	BS	9.92	5.19	90,100	4.97	128,100	218,200	190	-	-
20	Sat	730	BS	9.71	10.69	186,900	2.58	68,700	255,600	190	-	-
21	Sun	720	BS	9.98	3	50,700	2.15	55,400	106,100	195	-	-
22	Mon	700	BS	10.29	5.39	90,700	0.62	16,000	106,700	195	-	-
23	Tue	700	BS	9.67	4.83	81,200	2.48	63,700	144,900	190	5	12
24	Wed	700	BS	9.85	3.81	64,500	2.11	67,400	131,900	190	-	-
25	Thu	700	BS	10.17	3.4	58,200	2.71	57,200	115,400	190	-	-
26	Fri	900	NO	10.06	3.21	55,200	0	-	55,200	195	-	-
27	Sat	910	NO	9.59	0	-	9.52	245,300	245,300	195	-	-
28	Sun	850	NO	9.65	0.44	7,600	6.26	135,500	143,100	190	-	-
29	Mon	700	BS	10.01	4.38	74,100	0.19	5,000	79,100	190	-	-
	Totals				45.97	769,600	126.01	3,256,800	4,026,400		8	22

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ROSEBROOK WATER SYSTEM **MONTH** March **YEAR** 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL_2 GAL	SODA ASH # OF 50 # BAGS
1	Tue	700	BS	9.56	3.71	62,300	2.17	66,300	128,600	190	-	-
2	Wed	700	BS	10.22	0	-	2.47	64,100	64,100	195	-	-
3	Thu	700	BS	9.56	4.62	76,900	2.18	56,300	133,200	190	-	-
4	Fri	700	BS	10.14	5.29	88,600	2.54	66,000	154,600	190	-	-
5	Sat	730	BS	10.16	7.57	176,500	1.21	28,800	205,300	190	-	-
6	Sun	740	BS	9.78	3.47	24,700	2.24	60,400	85,100	190	-	-
7	Mon	700	BS	9.98	2.59	26,400	2.38	61,200	87,600	190	5	14
8	Tue	700	BS	9.85	3.02	50,100	2.17	56,100	106,200	190	-	-
9	Wed	700	BS	10.28	3.92	64,400	0	-	64,400	190	-	-
10	Thu	700	BS	10.03	0	-	2.41	62,200	62,200	190	-	-
11	Fri	810	NO	9.6	4.81	80,100	2.31	59,400	139,500	195	-	-
12	Sat	910	NO	9.66	5.44	89,100	2.5	64,300	153,400	190	-	-
13	Sun	950	NO	9.96	5.45	89,300	2.22	57,100	146,400	190	-	-
14	Mon	700	BS	10.44	4.46	73,000	0	-	73,000	195	-	-
15	Tue	700	BS	9.93	0	-	2.38	61,300	61,300	190	-	-
16	Wed	700	BS	9.62	4.48	73,000	0	-	73,000	190	-	-
17	Thu	520	BS	9.63	3.58	58,800	2.65	68,200	127,000	190	-	-
18	Fri	700	BS	10.44	0.26	4,000	2.64	65,300	69,300	190	-	-
19	Sat	730	BS	9.56	4.6	67,500	2.56	65,900	153,400	190	-	-
20	Sun	719	BS	9.63	5.58	77,400	2.25	58,100	135,500	190	-	-
21	Mon	655	BS	10.37	3.86	62,700	0	-	62,700	190	-	-
22	Tue	630	BS	10.15	0	-	2.2	56,400	56,400	190	-	-
23	Wed	700	BS	9.56	4.22	68,700	0	-	68,700	190	-	-
24	Thu	700	BS	9.67	3.77	61,300	2.41	61,800	123,100	190	5	12
25	Fri	900	NO	10.37	0.24	3,900	2.59	66,800	70,700	195	-	-
26	Sat	910	NO	9.63	5.49	89,300	2.24	57,500	146,800	195	-	-
27	Sun	930	NO	9.69	4.75	77,100	0	-	77,100	195	-	-
28	Mon	705	BS	9.66	1.45	24,100	2.27	58,700	82,800	190	-	-
29	Tue	910	NO	9.87	2.54	41,100	0	-	41,100	195	-	-
30	Wed	630	BS	9.51	0	-	2.43	62,200	62,200	190	-	-
31	Thu	630	BS	9.67	3.92	64,000	0	-	64,000	190	-	-
	Totals				103.07	1,694,300	53.32	1,384,400	3,078,700		10	26

ROSEBROOK WATER SYSTEM **MONTH** April **YEAR** 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Fri	700	BS	9.62	1.8	30,100	2.23	57,900	88,000	190	-	-
2	Sat	730	BS	9.96	2.31	37,500	2.22	57,000	94,500	190	-	-
3	Sun	735	BS	9.92	4.03	65,200	0	-	65,200	190	-	-
4	Mon	700	BS	10.03	0	-	2.15	55,300	55,300	190	-	-
5	Tue	700	BS	10.12	3.69	59,500	0	-	59,500	190	-	-
6	Wed	640	BS	9.99	0	-	2.02	52,400	52,400	190	-	-
7	Thu	700	BS	9.9	3.76	61,100	0	-	61,100	190	-	-
8	Fri	900	NO	9.92	0.05	700	2.29	59,300	60,000	195	-	-
9	Sat	1100	NO	9.49	3.8	61,600	2.38	60,900	122,500	195	-	-
10	Sun	900	NO	10.44	3.55	57,500	0.11	3,000	60,500	195	-	-
11	Mon	700	BS	10.45	0	-	1.02	26,100	26,100	190	-	-
12	Tue	630	BS	9.94	0	-	1.38	35,500	35,500	190	-	-
13	Wed	700	BS	9.83	0	-	2.15	55,600	55,600	190	-	-
14	Thu	700	BS	9.9	3.79	61,300	0	-	61,300	190	-	-
15	Fri	710	BS	10.17	0	-	2.28	58,600	58,600	190	-	-
16	Sat	730	BS	10.09	4.36	70,100	0	-	70,100	190	-	-
17	Sun	745	BS	9.67	0	-	3.46	89,200	89,200	190	5	14
18	Mon	900	NO	9.92	3.75	60,700	0	-	60,700	195	-	-
19	Tue	900	NO	10.01	0	-	2.15	55,200	55,200	190	-	-
20	Wed	900	NO	9.71	0	-	3.59	92,300	92,300	195	-	-
21	Thu	900	NO	10.06	0	-	3.01	77,600	77,600	195	-	-
22	Fri	930	NO	10.22	0	-	2.24	57,800	57,800	195	-	-
23	Sat	1010	NO	9.79	3.97	64,500	2.14	54,800	119,300	195	-	-
24	Sun	925	NO	10.37	3.54	56,600	0.35	9,000	65,600	195	-	-
25	Mon	900	NO	10.45	0.14	2,300	0	-	2,300	195	-	-
26	Tue	850	NO	9.58	0	-	2.26	58,200	58,200	195	-	-
27	Wed	850	NO	9.74	3.61	57,500	0	-	57,500	195	-	-
28	Thu	855	NO	9.83	0	-	2.15	54,900	54,900	190	-	-
29	Fri	900	NO	9.75	3.9	62,100	2.37	61,300	123,400	190	-	-
30	Sat	1010	NO	10.45	3.67	58,400	0.09	2,000	60,400	195	-	-
	Totals				53.72	866,700	44.04	1,133,900	2,000,600		5	14

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ROSEBROOK WATER SYSTEM **MONTH** May **YEAR** 2016

	DAY	TIME	INITIALS	RESERVOIR LEVEL	PUMP # 1 HOURS	Pump #1 Gallons	PUMP # 2 HOURS	Pump #2 Gallons	Totalizer Both Pumps	STATIC PSI	CL2 GAL	SODA ASH # OF 50 # BAGS
1	Sun	1010	NO	9.91	0	-	2.27	58,400	58,400	195	-	-
2	Mon	855	NO	9.65	4.34	69,400	2.52	65,000	134,400	190	-	-
3	Tue	1050	NO	10.4	3.7	59,300	0	-	59,300	190	-	-
4	Wed	900	NO	10.47	0.11	1,600	2.22	57,100	58,700	190	-	-
5	Thu	900	NO	10.27	3.63	58,200	0	-	58,200	195	-	-
6	Fri	855	NO	10	0	-	2.19	56,500	56,500	190	-	-
7	Sat	1010	NO	9.53	3.86	62,200	1.68	43,400	105,600	190	-	12
8	Sun	1005	NO	9.99	0	-	2.36	61,300	61,300	190	-	-
9	Mon	925	NO	9.74	3.79	61,300	0	-	61,300	190	5	-
10	Tue	830	NO	9.85	0	-	2.21	57,100	57,100	190	-	-
11	Wed	900	NO	9.63	3.93	62,800	1.21	31,300	94,100	190	-	1
12	Thu	855	NO	10.03	3.85	61,300	1.1	28,400	89,700	195	-	-
13	Fri	915	NO	10.45	0	-	2.11	54,500	54,500	195	-	-
14	Sat	1005	NO	9.92	4.19	67,600	0	-	67,600	195	-	1
15	Sun	1010	NO	9.61	11.84	191,600	5.13	133,000	324,600	193	-	-
16	Mon	730	NO	10	0	-	4.61	119,100	119,100	195	-	-
17	Tue	825	NO	10.27	0	-	5.08	131,400	131,400	195	-	-
18	Wed	950	NO	10.13	0	-	3.43	89,000	89,000	195	-	-
19	Thu	950	NO	10.47	0	-	2.18	56,300	56,300	195	-	-
20	Fri	935	NO	9.98	3.84	61,600	0	-	61,600	193	-	-
21	Sat	950	NO	9.351	3.44	55,400	2.41	62,400	117,800	193	-	-
22	Sun	905	NO	10.03	0	-	2.3	59,500	59,500	193	-	13
23	Mon	900	NO	9.81	3.38	53,800	0	-	53,800	195	5	-
24	Tue	850	NO	9.81	0	-	2.18	56,300	56,300	193	-	-
25	Wed	900	AG	9.77	3.54	56,800	0	-	56,800	195	-	-
26	Thu	900	AG	9.65	0.35	5,800	2.26	59,200	65,000	195	-	-
27	Fri	915	AG	9.53	3.95	64,000	2.23	58,000	122,000	195	-	1
28	Sat	915	NO	9.67	4.73	76,600	2.21	57,500	134,100	190	-	-
29	Sun	940	NO	9.821	5.66	91,700	1.73	45,500	137,200	190	-	-
30	Mon	840	NO	10.13	3.75	61,500	1.02	26,400	87,900	190	-	-
31	Tue	830	AG	10.1	0.06	200	2.27	58,100	58,300	190	-	-
	Totals				75.94	1,222,700	58.91	1,524,700	2,747,400		10	28

APPENDIX D
Rosebrook Water Company, Inc. - Conceptual System Improvements for Pressure Reduction

APPENDIX E
Opinion of Probable Project Cost

OPINION OF PROBABLE PROJECT COST
Rosebrook Water Company
System Improvements For Pressure Reduction
Prepared by Horizons Engineering, Inc.
Jul-16

ITEM	UNITS	NO. UNITS	UNIT COST	TOTAL COST
General Conditions/Mobilization	LS	1	$5,000.00	$5,000
Well Pump Replacement				
Well #1 Vertical Turbine Pump	EA	1	$15,000.00	$15,000
Well #2 Submersible Pump	EA	1	$15,000.00	$15,000
Electrical/Controls	LS	1	$15,000.00	$15,000
Mechanical/Piping	LS	1	$5,000.00	$5,000
			Subtotal	$50,000
Storage Tank Booster Station				
Building (16 ft. x 18 ft.)	SF	288	$200.00	$57,600
Site Work/Grading	LS	1	$35,000.00	$35,000
Driveway/Access	LS	1	$20,000.00	$20,000
Electric Service	LS	1	$25,000.00	$25,000
Pumps/Mechanical	LS	1	$45,000.00	$45,000
Electrical	LS	1	$20,000.00	$20,000
Emergency Generator	LS	1	$35,000.00	$35,000
Piping/Valves	LS	1	$35,000.00	$35,000
Telemetry/Controls	LS	1	$20,000.00	$20,000
Connection to Existing	EA	2	$2,500.00	$5,000
Surface Restoration	LS	1	$7,500.00	$7,500
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$306,100
Crawford Ridge Booster Station				
Building (14 ft. x 16 ft.)	SF	224	$200.00	$44,800
Site Work/Grading	LS	1	$30,000.00	$30,000
Driveway/Access	LS	1	$10,000.00	$10,000
Electric Service	LS	1	$15,000.00	$15,000
Pumps/Mechanical	LS	1	$35,000.00	$35,000
Electrical	LS	1	$20,000.00	$20,000
Emergency Generator	LS	1	$35,000.00	$35,000
Piping/Valves	LS	1	$35,000.00	$35,000
Telemetry/Controls	LS	1	$15,000.00	$15,000
Connection to Existing	EA	2	$2,500.00	$5,000
Surface Restoration	LS	1	$5,000.00	$5,000
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$250,800
Mt. Washington Place Booster Station				
Building (14 ft. x 16 ft.)	SF	224	$200.00	$44,800
Site Work/Grading	LS	1	$20,000.00	$20,000
Driveway/Access	LS	1	$10,000.00	$10,000
Electric Service	LS	1	$15,000.00	$15,000
Pumps/Mechanical	LS	1	$35,000.00	$35,000
Electrical	LS	1	$20,000.00	$20,000
Emergency Generator	LS	1	$35,000.00	$35,000
Piping/Valves	LS	1	$35,000.00	$35,000
Telemetry/Controls	LS	1	$15,000.00	$15,000
Connection to Existing	EA	2	$2,500.00	$5,000
Surface Restoration	LS	1	$5,000.00	$5,000
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$240,800
Mt. Adams Lane Water Main Extension				
8 Inch Ductile Iron Water Main	LF	350	$90.00	$31,500

Ledge Removal	CY	75	$150.00	$11,250
8 Inch Gate Valves	EA	2	$2,500.00	$5,000
Connection to Existing	EA	2	$2,500.00	$5,000
Pavment Replacement	LS	1	$3,000.00	$3,000
Hydrant	EA	1	$5,000.00	$5,000
Surface Restoration	LS	1	$2,500.00	$2,500
Erosion Control	LS	1	$1,000.00	$1,000
			Subtotal	$64,250
Pressure Reducing Valves and Vaults (Rosebrook Lane, Mt. Adams Lane)				
Pressure Reducing Valve Vaults	EA	2	$10,000.00	$20,000
Pressure Reducing Valves	EA	2	$7,500.00	$15,000
Gate Valves/Bypass Piping	EA	2	$15,000.00	$30,000
Connection to Existing	EA	2	$2,500.00	$5,000
Pavment Replacement	LS	1	$5,000.00	$5,000
Traffic Control	LS	1	$1,500.00	$1,500
Surface Restoration	LS	1	$1,500.00	$1,500
Erosion Control	LS	1	$500.00	$500
			Subtotal	$78,500
			Subtotal Construction Cost	$995,450
			15% Contingency	$149,000
			Total Construction Cost	$1,144,450
			Land/Easements	$30,000
			Legal	$10,000
			20% Engineering	$229,000
			Total Project Cost	$1,413,450
			ROUNDED PROJECT COST	**$1,410,000**

horizons Engineering Inc.

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March 20, 2017

Mr. Don Vaughan
President
New England Service Company
37 Northwest Drive
Plainville, CT 06062

Subject: Rosebrook Water Company Bretton Woods NH Hydraulic Modeling

Dear Mr. Vaughan,

At the request of New England Service Company, Horizons Engineering Inc. has collected data on the Bretton Woods water distribution infrastructure, performed a field visit, and completed hydraulic modeling of existing and proposed future conditions. The overall goal of these efforts was to finalize the proposed approach for implementing a system-wide reduction in operating pressures. This letter report summarizes the project's background, field visit findings, hydraulic modeling results, proposed modifications, anticipated easements, and next steps for implementing the project.

Background and Existing Conditions

The Bretton Woods water distribution infrastructure is managed by the Rosebrook Water Company under PWSIDs 0382010, 0388010, and 0388020. This project expanded on a hydraulic model prepared by Horizons in 2009 as well as a preliminary report by Horizons in 2016 for the System Evaluation for Pressure Reduction. Following completion of this study New England Service Company indicated that the preferred approach was to move forward with a project that allows reduction of operating pressures to less than 120 psi at the main system pump station. Additional pump stations are proposed to serve higher areas of the system that cannot be adequately served once pressures are reduced.

A map of the existing distribution system is provided in **Attachment 1.** System data for 2015 through 2016 indicate average system demand of 111,668 gallons per day (average flow of 77.6 gallons per minute). The existing system has a single pressure zone with a gravity water storage tank at elevation 2010. The current system configuration results in system pressures exceeding 180 psi in the lowest elevations the system. These high pressures are exacerbated by intermittent water-hammer events that occasionally cause instantaneous pressure surges in excess of 200 psi.

Rosebrook Water Company staff provided extensive information on the infrastructure and operation of the existing system that substantially improved the accuracy of the effort, for which we are extremely grateful.

Field Visit

On Wednesday, February 15, 2017, Mark Nance of Horizons Engineering met with Ms. Nancy Oleson of Rosebrook Water Company to discuss the water system and to inspect the water pump station. The water system information provided critical operating information for the hydraulic modeling. The water pump station visit provided instantaneous operating data in addition to further detail on the system configuration.

Horizons also met with Omni Resorts Mount Washington staff Mr. John Santaniello, Mr. Kolin Bailey, Mr. Jason Doyle, and a staff plumber to attempt to determine the fire flow design requirements for various large facilities, including the Mount Washington Hotel and Spa/Conference Center. We inspected the Administration Building, Bretton Arms Inn, Bretton Woods Nordic Center, Mount Washington Hotel, and the Spa/Conference Center. We also visited the drawing archives room in the Mount Washington Hotel basement to search for fire flow design requirements on various construction projects' contract drawings. Fire flow requirements were located for the Spa/Conference Center, however none were identified for the hotel or other structures.

Horizons performed preliminary inspections of each potential booster station site to assess technical and aesthetic siting concerns. As a result of the inspections, each booster station location was adjusted from that generally shown in the 2016 report.

Hydraulic Modeling

The modeling effort updated an existing, eight-year-old Water Cad hydraulic model of the distribution system, which was then examined in the context of the 2016 evaluation recommendations for alternative options to reduce operating pressures. After reviewing the existing conditions model, Horizons completed modeling to assess two scenarios that reduce distribution system pressures to below approximately 130 psi. Based on some preliminary calculations and testing, two alternatives were modeled to assess their viability.

ALTERNATIVE 1 – EXISTING TANK, BOOSTER PUMP STATIONS/PRVS: Modify the existing well pumps to serve the lowest pressure zone (Zone 1) and install three booster stations to serve higher elevations (Zones 2CR, 2MWP, and 2RT). The well pump modifications would include a minimum of adding a variable frequency drive (VFD) to Pump 2 and replacing the Pump 2 motor with an inverter-duty motor to be compatible with a VFD. The wells would pump into Zone 1 based on storage tank elevation setpoints, and the water storage tank would be filled by the Rosebrook Townhomes booster station. Based on the modeling results, it might be possible to continue to use the two existing well pumps, however complete replacement might be necessary to adequately reduce their flow and pressure capacity.

ALTERNATIVE 2 – EXISTING TANK, NEW SUPPLY PIPELINE/PRVS: Use the existing well pumps to pump directly to the existing water storage tank via a new dedicated pipeline. The distribution system would then be fed by gravity off the existing storage tank and would require two booster stations to serve higher elevations. The distribution system would have four separate pressure zones: Zone 1 (lowest elevation), Zone 2CR (fed by a new booster station), Zone 2MWP (fed by a new booster station), and Zone 2RT (fed by gravity from the existing storage tank). The dedicated pipeline between the wells and the storage tank would have no supply taps, would generally follow existing water pipeline alignments, and would require high pressure (~190 psi) at the existing well pump house.

The hydraulic modeling was based on the available information. A detailed discussion of the modeling assumptions and results is provided in **Attachment 2**.

Proposed Modifications

After discussion of Horizons' initial findings, New England Service Company selected Alternative 1 as the preferred modification set to reduce operating pressures throughout the system. Alternative 1 consists of the following major improvements, which are shown on **Attachment 1**:

1. Install a variable frequency drive and inverter duty motor on existing well pump 2 as well as control communications with the new Rosebrook Townhomes booster station.
2. Install ~350 feet of 8-inch pipeline from the west end of Dartmouth Road to the north end of Mount Adams Lane.
3. Install ~40 feet of 16-inch pipeline from the 16-inch main in Base Station Road to the 8-inch hotel supply pipeline at a location north of the Stables.
    a. Based on the model results, an additional ~2,620 feet of 16-inch pipeline is recommended to loop together several buildings near the Mount Washington Hotel as well as to replace the existing 8-inch hotel supply pipeline which will be undersized for future demands.
4. Install one pressure reducing valve in the Rosebrook Townhomes development west of townhome 10.
5. Install one pressure reducing valve at the north corner of the intersection of Mount Adams Lane and Hartford Lane.
6. Install one booster pumping station in the Crawford Ridge development northwest of unit 22.
7. Install one booster pumping station in the Mount Washington Place development on the west side of Hannah Loop east of unit 100.
8. Install one booster pumping station in the Rosebrook Townhomes development on the south side of Rosebrook Lane south of unit 50.

Easements

The following summarize the locations of anticipated easements for each modification component and contact information.

1. ~350 feet of 8-inch pipeline. This pipeline would route along property lines between four parcels at the north end of Mount Adams Lane: 210-016, 210-017, 211-048, and 211-049.
    a. 210-016: Manning Realty Trust II, 13 Rockyledge Road, Swampscott, MA 01907
    b. 210-017: Robert and Donna Manning, Trustee Manning Realty Trust III, 15 Rockyledge Road, Swampscott, MA 01907
    c. 210-048: Robert Manning, Trustee Manning Realty Trust III, 13 Rockyledge Road, Swampscott, MA 01907
    d. 210-049: Robert and Donna Manning, Trustee Manning Realty Trust III, 13 Rockyledge Road, Swampscott, MA 01907
2. ~50 feet of 16-inch pipeline. This short interconnection would occur mostly in the right of way of Base Station Road with some possibility of incursion into parcel 210-008.
    a. 210-008: Omni Mount Washington, LLC, 4001 Maple Avenue, Suite 600, Dallas, TX 75219
3. PRV in Rosebrook Townhomes. This valve would be located in a new manhole in the ski area west of the Learning Center Quad unloading zone.
    a. 211-014: Omni Mount Washington, LLC, 4001 Maple Avenue, Suite 600, Dallas, TX 75219
4. PRV in Mount Adams Lane. This valve would be located in a new manhole in the Mount Adams Lane right of way.
5. Booster station in Crawford Ridge. This booster station would be located west of Crawford Ridge Road in parcel 211-015.
    a. 211-015: Crawford Ridge Homeowners Association, Route 302, Bretton Woods, NH 03575
6. Booster station in Mount Washington Place. This booster station would be located west of Hannah Loop in parcel 211-025.
    a. 211-025: Mount Washington Place Condo Association, Route 302, Bretton Woods, NH 03575
7. Booster station in Rosebrook Townhomes. This booster station would be located south of Rosebrook Lane either in the Rosebrook Lane right of way or in parcel 211-004.
    a. 211-004: Jack Sylvester 2012 Family Trust, P.O. Box 48, Orrs Island, ME 04066

Next Steps

Following are the next major steps to the pressure reduction project:

- Rosebrook Water Company to confirm the proposed Alternative 1 approach is acceptable.
- Confirm easements are available from the property owners.
- Perform a topographic and utility survey of each proposed improvement location.
- Perform final design and prepare construction documents, including determining final selection of booster station and pressure reducing valve criteria.

Thank you for the opportunity to be of service. We look forward to continuing to work with you toward the implementation of the desired improvements. If you have any questions, please contact me at my office phone number of 603-444-4111 extension 18.

Very truly yours,
Horizons Engineering, Inc.

Jon L. Warzocha, P.G.
CEO

Mark J. Nance, P.E.
Senior Project Manager

Attachments: Attachment 1 Overall Plan
Attachment 2 Hydraulic Model Evaluation

HEI Project 17002

There were two primary purposes for the modeling. The first was to determine the water supply capacity of the existing system to establish the baseline performance, including identifying its high pressure areas and any hydraulic restrictions. The second was to evaluate the optimal configuration and settings for planned system modifications that would reduce pressure in the lowest system areas.

Water distribution system modeling uses a computer program to simulate the flow of water through the distribution network under various conditions. The modeling was performed using the Bentley stand-alone WaterCAD version V8i computer program for both steady-state and extended period simulations.

EXISTING SYSTEM

The existing system has a single pressure zone with service connections at elevations from approximately 1560 to 1845 feet. Pump performance curves for the two supply wells were input into the model using curves provided by the Rosebrook Water Company (RWC) as summarized in the following table.

Table 1 Existing Well Pump Performance Characteristics at Full Speed

Pump	Shutoff Head, ft	Design Flow, gpm	Head, ft	Max Flow, gpm	Head, ft
Well Pump 1 (50 hp)	550	300	475	475	335
Well Pump 2 (60 hp)	693	350	495	500	290

Notes: 1. Well Pump 1 = Sulzer JTS-10AC, 10-stage, 1780 rpm, 7.36-inch impellers
2. Well Pump 2 = Xylem 7CLC, 6-stage, 3450 rpm, 5-inch impellers

Pump controls were based on water storage tank elevations reported by operations staff as follows. While the tank diameter was measured as part of a recent project, the tank depth and invert elevation are not available. The tank volume is reported by different documentation as 600,000 and 650,000 gallons. Operations staff reports the two well pumps are programmed with the same controls and an automatic alternator switches the active pump. Since Pump 1 has a lower pumping capability than Pump 2, Pump 2 was turned off in the model for a conservative assessment of pump supply.

Existing water storage tank: Base elevation = 1991 feet ASSUMED
Diameter = 90 feet → 47,586 gallons stored per foot of depth
Maximum water surface elevation = 2004.66 feet ASSUMED

Pump 1 controls: Turns on if tank water depth is less than 8.9 feet = elevation 1999.9
Turns off if tank water depth is equal to 9.3 feet = elevation 2000.3

Pump 2 controls: Turns on if tank water depth is less than 8.9 feet = elevation 1999.9
Turns off if tank water depth is equal to 9.3 feet = elevation 2000.3

Water production data from 2015 and 2016 is shown in the following figure.

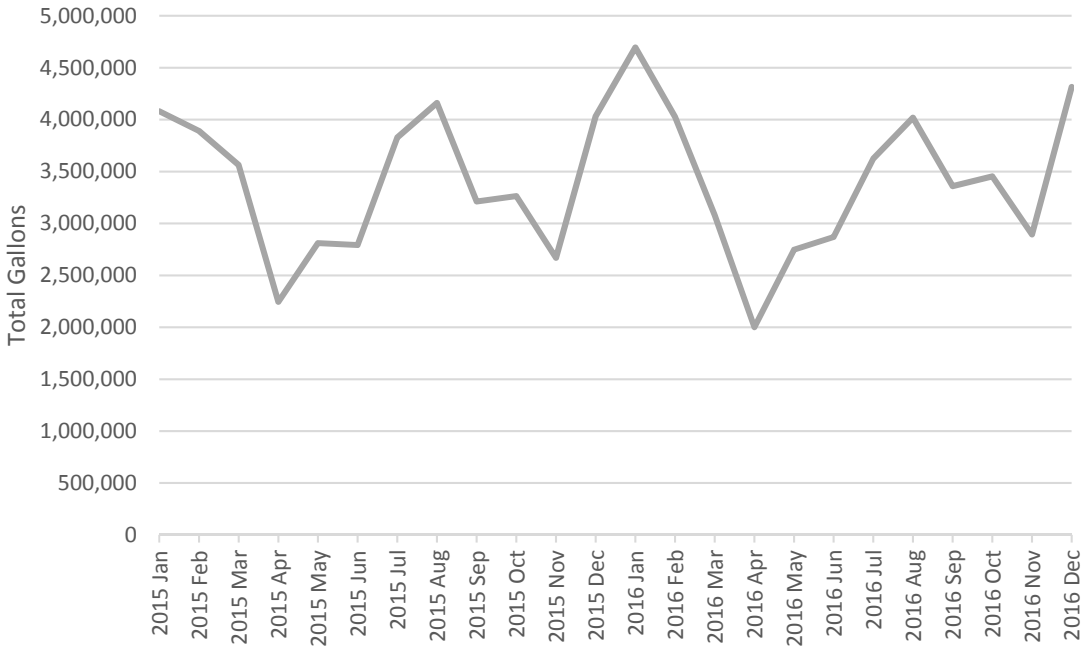


Figure 1 Rosebrook Water System Monthly Water Production

The average total gallons per day (gpd) were 111,086 in 2015 and 112,248 in 2016, which shows consistent water demands between the years. **Figure 1** shows peak demands occur in the winter and the late summer, which reflects the seasonal nature of the community. The peak months were December through March and July through October. During the peak months, the average total gallons per day were 123,070 in 2015 and 124,779 in 2016.

Based on this data, the following water demands were used for modeling the existing system:

- Average daily demand (ADD) (from 2016) = 112,248 gpd = 77.9 gpm
- Maximum day demand (MDD) (from June 26, 2015) = 414,000 gpd = 287.5 gpm = 3.69 x ADD
  - Used 4.0 x Average daily demand = 311.6 gpm
- Peak hour demand (PHD): no data, used 8.0 x Average daily demand = 623.2 gpm

Although the ratios used for MDD and PHD are higher than typical industry values and the New Hampshire Department of Environmental Services (NHDES) value in Eng-Wq 405.19, this seasonal community's peaking characteristics are expected to be higher due to vacation users compared to a full-time resident community. Due to the seasonal water demands, actual water distribution is expected to vary throughout the year as well as day to day. This is due to varying occupancy: some homes might have large taps but be unoccupied most of the year.

The distribution system has 393 residential taps and 19 commercial taps for a total of 412 service connections. The demands were distributed through the system by calculating the percentage of

flow for each tap or residential area based on the 2016 total meter readings as summarized in the following table.

Table 2 Existing Taps and Water Distribution

Area	Taps					Demand Distribution
	5/8"	1"	2"	3"	6"	
Residential						
Crawford Ridge	22					1.05%
Dartmouth Ridge	13	2				1.13%
Fairway Village	50					2.25%
Forest Cottages	54					2.30%
Mount Madison		10				0.45%
Mount Washington Homes	5	4				0.74%
Mount Washington Place	105					5.96%
Mountain View	15					0.81%
Presidential View		15				0.63%
River Front	9					0.50%
Rosebrook Townhomes	28					1.67%
Stickney Circle	51					2.13%
Stone Hill		10				0.48%
Commercial						
Administration Building		1				0.29%
Alpine Club Bathroom Trailer and Kitchen	1	1				0.22%
Arms Inn		1				2.93%
Caretakers Home	1					0.03%
Drummonds Ski Shop	1					0.08%
Fabyans	1					1.07%
First Aid Building	1					0.04%
Golf/Nordic Building		1				1.00%
Irving Store	1					0.27%
Mount Washington Hotel					1	67.23%
Outdoor Pool & Cabana			1			1.54%
Real Estate Office/Peabody & Smith	1					0.02%
Ski Area and Maintenance Building	1		1			3.58%
Spa Building				1		1.34%
Sports Club/Rosebrook Recreation Center						0.00%
Stables	1					0.28%

Notes: 1. The Sports Club/Rosebrook Recreation Center is currently not in use. Its meter was removed in February 2016.
2. Two portable meters are used for filling the ice rink, snowmaking for the tubing hill only, and testing the ski run snowmaking equipment.

The water pumped from the two well pumps is greater than the sum of all the taps' meter readings; this difference is categorized as unaccounted-for water. The distribution demands were

based on the well pump gallons per minute to include the unaccounted-for water. The water was distributed through the system using the taps' meter readings for percentages. This method distributes the unaccounted-for water evenly through the system.

In December 2016, Pump 2 averaged approximately 444 gallons per minute when it was running against a discharge head of approximately 195 psi. That performance exceeds the pump curve provided by RWC staff by approximately 54 gpm, which suggests one or more of the following issues: the pump curve is incorrect, the flow meter is incorrect, or the pressure gauge is incorrect. The model used the Pump 2 curve provided as it was the best available information.

Elevation information is critical in water modeling. Junction elevation information was taken from the previous model developed in 2009.

Despite the extensive data evaluation efforts and determining the most representative demand distribution, the information above does not provide adequate information to fully calibrate the model. Conventional model calibration involves measuring pressures and flows in the field and adjusting the model accordingly. Many issues can influence model performance, including:

- Groundwater table elevation
- Partially closed valves
    - RWC reports the main valves haven't been exercised in several years, possibly since 1999.
    - RWC reports the curb stops are exercised each year. Given the infrequency of main valve testing, this is a critical last-ditch program to minimize home flooding and should be continued.
- Air in pipelines
- Sediment in pipelines

The system has experienced occasional issues with water hammer, the last occurring for approximately one month during the summer of 2016. The water hammer events spike the pressure in various locations, however no specific cause has yet been identified. These events can cause pressure gauges to lose their calibration, so readings from existing pressure gauges installed before water hammer events may be suspect.

The NHDES adopted the 10 States Standards in Env-Dw 404.01(a), which requires the following pressures per section 8.2.1:

- Maintain a minimum pressure of 20 psi (140 kPa) at ground level at all points in the distribution system under all conditions of flow.
- The normal working pressure in the distribution system shall be at least 35 psi (240 kPa) and should be approximately 60 to 80 psi (410 - 550 kPa).

A reduction of operating system pressure will reduce the maximum available flow. A water demand during a fire is typically the highest instantaneous flow required from a distribution system. Horizons Engineering staff met with Omni Resorts Mount Washington staff to attempt to determine the design fire flow rates required for its structures, which are the largest in the

distribution system. After hours of searching through record documents and examining fire service entrances, only one complex' fire flow design criteria was found, which was for the Mount Washington Hotel's Spa/Conference center and had a maximum requirement of 880 gpm at 124 psi.

Fire flow rates vary depending on the local fire department. The Insurance Services Office (ISO) issues a Fire Suppression Rating Schedule that recommends fire flows for residential and commercial construction. The ISO fire flow range for residential buildings is typically from 500 to 1,500 gallons per minute (gpm). The Uniform Fire Code (UFC) requires a minimum of 1,000 gpm for residential buildings with areas up to 3,600 square feet. The National Fire Protection Association requires up to 8,000 gpm for up to 4 hours depending on the building fire flow area and construction type.

The modeling evaluated the system to supply a minimum of 1,000 gpm at the Mount Washington Hotel (MWH) at a minimum pressure of 20 psi because the MWH has a single, long, relatively small service pipeline that should represent the most difficult fire demand on the system.

EXISTING SYSTEM WATER MODELING RESULTS. The hydraulic modeling is based only on the system information entered into the system, which, while detailed, is not an exhaustive representation of system characteristics. It calculates a theoretical moment in time based on the stated assumptions and relatively evenly distributes the demands. Inaccuracies in the assumptions have varying degrees of impact on the system performance. Based on the information provided, the modeling results appear to be reasonable.

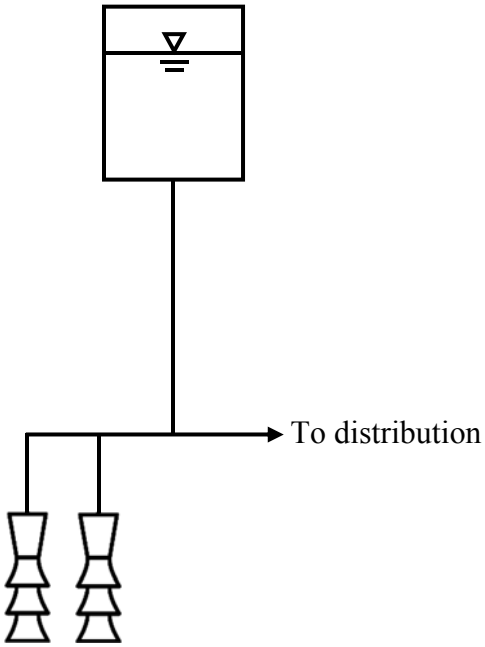
The following table lists average annual demand (AAD) and peak hour demand (PHD) results from the model. The modeling applied the fire flows to the peak hour demand.

Table 3 Existing System Hydraulic Modeling Results

Condition	Flow, gpm	Notes
AAD, NO fire flow	78	Low pressure at Dartmouth Ridge (node J-79) was 100 psi. Pressure at Crawford Ridge (node J-15) was 113 psi. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 151 psi. High pressure 200' south of the water pump station (node J-3) was 190 psi.
PHD, NO fire flow	624	Low pressure at Dartmouth Ridge (node J-79) was 99 psi. Pressure at Crawford Ridge (node J-15) was 112 psi. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 144 psi. High pressure 200' south of the water pump station (node J-3) was 190 psi.
PHD, 1,000 gpm fire flow at MWH	1,622	Low pressure at Dartmouth Ridge (node J-79) was 96 psi. Pressure at Crawford Ridge (node J-15) was 111 psi. Pressure at Rosebrook Townhomes (node J-22) was 120 psi. Pressure at the Mount Washington Hotel (node J-74) was 83 psi. High pressure 200' south of the water pump station (node J-3) was 189 psi.
PHD, 1,000 gpm fire flow at high point	1,622	Low pressure at Dartmouth Ridge (node J-79) was 81 psi. Pressure at Crawford Ridge (node J-15) was 111 psi. Pressure at Rosebrook Townhomes (node J-22) was 120 psi. Pressure at the Mount Washington Hotel (node J-74) was 141 psi. High pressure 200' south of the water pump station (node J-3) was 189 psi.

The hydraulic modeling of the existing system generally corroborated operations staff reports of system function. The goal of this project is to reduce the high pressures to no more than 120 psi if possible.

A schematic representation of the existing distribution system is provided in the following figure.



SYSTEM MODIFICATIONS

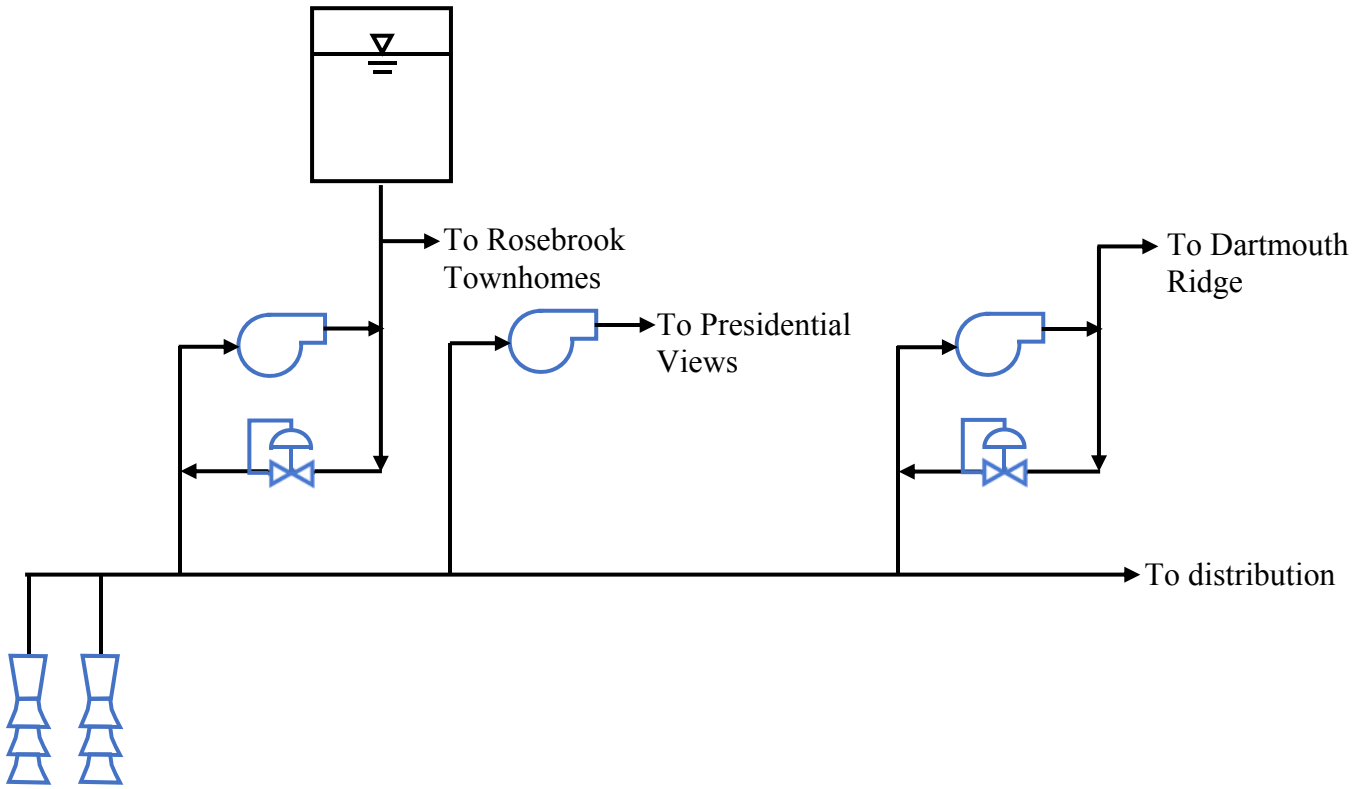
To reduce the maximum pressure in the lowest zone, multiple zones with booster stations are needed to supply water to the highest service areas. A 2016 preliminary report titled System Evaluation for Pressure Reduction by Horizons Engineering proposed a new storage tank at a lower elevation than the existing water storage tank as part of the distribution modifications. However, at the request of Rosebrook Water Company, the hydraulic model evaluation described herein relied on the existing storage tank and did not assume a new tank would be installed.

The basic operating criteria of the modified system are listed as follows:

- Zone 1 (lowest elevations) would serve elevations from approximately 1575 to 1700.
- Zone 2 (highest elevations) would serve elevations from approximately 1700 to 1845. Preliminary designation assumptions were as follows to match the booster station locations:
    - Zone 2CR for Crawford Ridge
    - Zone 2MWP for Mount Washington Place
    - Zone 2RT for Rosebrook Townhomes
- Minimum pressure during fire flow = 20 psi
- Minimum pressure during normal operation = 35 psi, try to maintain 45 psi = 104 feet
    - Zone 1: maintain a minimum hydraulic grade line of 1804 feet at the highest elevations
    - Zone 2: maintain a minimum hydraulic grade line of 1949 feet at the highest elevations

Two primary alternative configurations were considered to reduce the service pressures, which are summarized as follows and discussed further in the table below. Alternative 1 was the concept discussed in the 2016 System Evaluation for Pressure Reduction report. Both alternatives use the existing ~650,000-gallon water storage tank.

ALTERNATIVE 1 – EXISTING TANK, BOOSTER PUMP STATIONS/PRVS: Modify the existing well pumps to serve the lowest pressure zone (Zone 1) and install three booster stations to serve higher elevations (Zones 2CR, 2MWP, and 2RT). The well pump modifications would include a minimum of adding a variable frequency drive (VFD) to Pump 2 and replacing the Pump 2 motor with an inverter-duty motor to be compatible with a VFD. The wells would pump into Zone 1 based on storage tank elevation setpoints, and the water storage tank would be filled by the Rosebrook Townhomes booster station. Based on the modeling results, it might be possible to continue to use the two existing well pumps, however complete replacement might be necessary to adequately reduce their flow and pressure capacity. A schematic representation of this configuration is provided in the following figure.



Applying pump affinity laws to well pumps 1 and 2 and assuming the maximum turndown using a variable frequency drive would be 60 percent suggests the pumps' minimum performance would be approximately as listed in the following table.

Table 4 Existing Well Pump Performance Characteristics at 60 Percent Speed

Pump	Shutoff Head, ft	Design Flow, gpm	Head, ft	Max Flow, gpm	Head, ft
Well Pump 1 (50 hp)	330	180	285	285	201
Well Pump 2 (60 hp)	416	210	297	300	174

The performance listed above is theoretical and, if Alternative 1 will be pursued further, we recommend testing the existing Pump 1 by running its VFD at its minimum speed to confirm the limits of its capabilities if possible. Well pump 2 would require a variable speed drive and might require replacement of its pump with an inverter duty motor.

ALTERNATIVE 2 – EXISTING TANK, NEW SUPPLY PIPELINE/PRVS: Use the existing well pumps to pump directly to the existing water storage tank via a new dedicated pipeline. The distribution system would then be fed by gravity off the existing storage tank and would require two booster stations to serve higher elevations. The distribution system would have four separate pressure zones: Zone 1 (lowest elevation), Zone 2CR (fed by a new booster station), Zone 2MWP (fed by a new booster station), and Zone 2RT (fed by gravity from the existing storage tank). The dedicated pipeline between the wells and the storage tank would have no supply taps, would generally follow existing water pipeline alignments, and would require high pressure (~190 psi) at the existing well pump house. A schematic representation of this configuration is provided in the following figure.

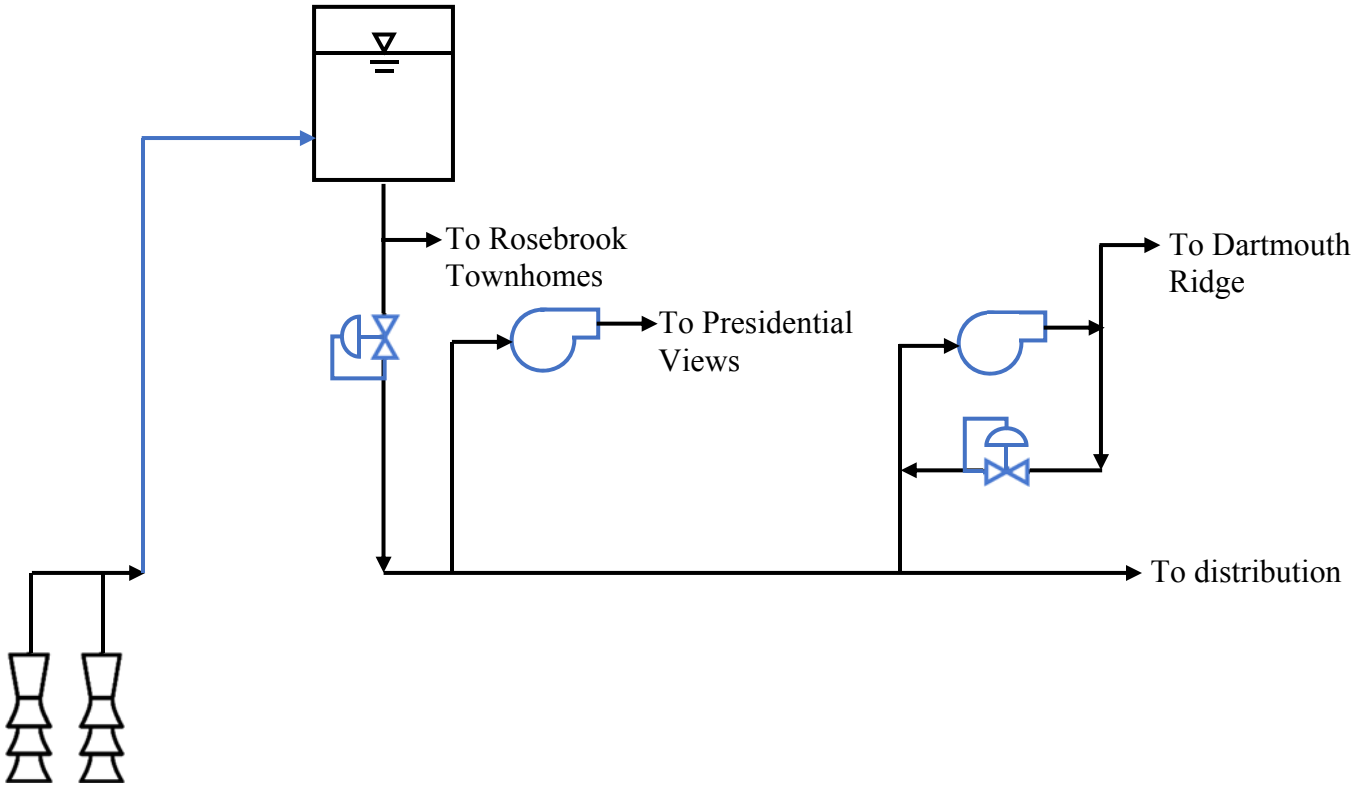


Table 5 System Modifications Alternatives Comparison

Description	Pros	Cons
ALTERNATIVE 1 – EXISTING TANK, BOOSTER PUMP STATIONS/PRVS		
Modify well Pump 2 and install 3 booster stations	• No major pipelines needed	• Pump 2 VFD required; replacement of both pumps may be required depending on actual maximum turndown • Higher operation and maintenance costs due to one additional booster pump station compared to Alternative 2 • The Rosebrook Townhomes booster station siting is expected to be particularly exposed to view and potential vehicle damage.
ALTERNATIVE 2 – EXISTING TANK, NEW SUPPLY PIPELINE/PRVS		
Install ~4,300 feet of 8" or 6" pipeline from wells to the existing storage tank and install 2 booster stations	• Only 2 booster pump stations needed (for Presidential Views and Mt. Wash. Pl.); Rosebrook Townhomes can be fed by gravity • Existing 2 well pumps can be used • Pipeline can be smaller than the current 16" tank connection • New pipeline connection opposite the existing connection would turn over water in the existing storage tank more often, which would improve tank water quality • Lower operation and maintenance costs due to one less booster pump station compared to Alternative 1	• Pipeline would need to cross the Ammonoosuc River • **High pressure (~190 psi) would be required in the existing pump house**

Regarding the booster stations and pressure reducing valves, the following criteria were assumed for each location:

Crawford Ridge Booster Station

- Floor elevation = 1710
- Serves buildings up to elevation = 1845
- Normal duty pump capacity = 0 to 40 gpm
- Features:
  - Variable frequency drive for each pump
  - Emergency power generator

Mount Washington Place Booster Station

- Floor elevation = 1680
- Serves buildings up to elevation = 1825
- Normal duty pump capacity = 0 to 80 gpm
- Features:
  - Variable frequency drive for each pump
  - Emergency power generator

Mount Adams Lane Pressure Reducing Valve

- Valve elevation = 1700
- Valve size = 6 inch
- Valve downstream setpoint = approximately 30 psi (1804 - 1700 = 104 feet = 45 psi is too high in the model as the Zone 2MWP booster station pumps in a loop during high flow rates)

Rosebrook Townhomes Booster Station

- Floor elevation = 1680
- Serves buildings up to elevation = 1810
- Normal duty pump capacity = 0 to 80 gpm
- Features:
  - Variable frequency drive for each pump
  - Emergency power generator

Rosebrook Townhomes Pressure Reducing Valve

- Valve elevation = 1725
- Valve size = 8 inch
- Valve downstream setpoint = approximately 86 psi (1804 - 1725 = 79 feet = 34 psi)

SYSTEM MODIFICATIONS WATER MODELING RESULTS. The hydraulic modeling revealed a critical problem with the system during fire flow conditions. The end of the Mount Washington Hotel water supply connection consists of approximately 4,300 feet of 8-inch piping, which connects to the main distribution system's 16-inch trunk pipeline. When a 1,000 gpm fire flow is supplied to the hotel during peak hour conditions, the total flow is over 1,600 gallons per minute, which has a velocity of over 9 feet per second in an 8-inch pipeline. This high velocity yields significant pressure loss – so much that the initial runs for both alternatives resulted in negative pressures at the hotel.

After considering several options, the most efficient solution would be to install a short interconnection between the 16-inch main pipeline in Base Station Road with the 8-inch hotel supply pipeline. This interconnection allows the water to flow through both the 8-inch and 16-inch pipelines to reach the hotel. The interconnection would likely be located just north of the Stables building. If additional flow or pressure becomes necessary at the hotel or other nearby buildings, the 8-inch supply pipeline could be upsized from this interconnection point towards the hotel. The short interconnection was necessary to make either alternative viable.

Modeling Alternatives 1 and 2 worked as a steady state analysis, however due to the complicated controls required by the pump systems operating in series up to the storage tank, it was necessary to model Alternative 1 as an extended period simulation to identify feedback problems with pump and pressure reducing valve setpoints. After many iterations using different infrastructure locations and control scenarios, a suitable and relatively simple configuration was identified.

Based on the evaluation findings, the following tables list the modeling results for both alternatives including the 16-inch pipeline interconnection. The modeling applied the fire flows to the peak hour demand. An example graphic output from the software is shown below.

Table 6 Alternative 1 Modified Well Pumps Hydraulic Modeling Results

Condition	Flow, gpm	Notes
AAD, NO fire flow	78	Low pressure at Dartmouth Ridge (node J-79) was 45 psi*. Pressure at Crawford Ridge (node J-15) was 56 psi*. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 66 psi. High pressure 200' south of the water pump station (node J-3) was 105 psi.
PHD, NO fire flow	624	Low pressure at Dartmouth Ridge (node J-79) was 45 psi*. Pressure at Crawford Ridge (node J-15) was 56 psi*. Pressure at Rosebrook Townhomes (node J-22) was 121 psi. Pressure at the Mount Washington Hotel (node J-74) was 63 psi. High pressure 200' south of the water pump station (node J-3) was 105 psi.
PHD, 1,000 gpm fire flow at MWH	1,622	Low pressure at Dartmouth Ridge (node J-79) was 45 psi*. Pressure at Crawford Ridge (node J-15) was 56 psi*. Pressure at Rosebrook Townhomes (node J-22) was 120 psi. Pressure at the Mount Washington Hotel (node J-74) was 34 psi. High pressure 200' south of the water pump station (node J-3) was 104 psi.

Note: 1. Model run as an extended period simulation.
2. The system pressures in Dartmouth Ridge and Crawford Ridge would be controlled by the selected setpoints for their respective new booster stations. The exact setpoints would be determined during final design.

Both alternatives are viable. Alternative 1 appears to provide slightly higher pressure to the hotel during a fire flow and it keeps operating pressure at the well pump house relatively low (refer to results for node J-3). As expected, the pump controls were critical to the system's operation. The VFDs for the Crawford Ridge and Mount Washington Place booster stations were set to maintain a target discharge pressure, which would be operator-adjustable. The Rosebrook Townhomes booster station would serve to fill the storage tank, which would maintain the distribution pressure for the upper Rosebrook Townhomes and for the Mountain View homes. The well pumps would operate based on the storage tank level, as they do now. The Rosebrook booster station pumps would turn on and off in conjunction with the well pumps.

The upper Rosebrook zone (Zone 2RT) will still have pressures approaching 130 psi, which is unavoidable without an additional PRV close to the tank or a new lower water storage tank (which was the intent of the 2016 preliminary report) due to the ~310-foot maximum elevation difference between the storage tank and the homes (= 2010 – 1700).

Structures in Zones 2CR and 2MWP will have a maximum available flow based on their respective booster stations. Each booster station can provide a range of flows, and a higher maximum flow will increase the minimum flow capacity. At low flows such as in the middle of the night, the booster pumps are expected to cycle on and off frequently depending on the minimum flow capacity of the system. The maximum flow is currently expected to be approximately 300 gallons per minute.

Several of the modeling assumptions were conservative, including assuming peak hour demand rather than maximum day demand for the fire flow condition and assuming a peaking factor of eight rather than six. However, there are also unresolved factors that carry some risk and could be studied further, including the assumed water storage tank elevations, the identification of required fire flow rates for each sprinkled structure, and some operational discrepancies such as differences between pump performance curves and reported pumped water quantities.

horizons Engineering Inc.

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September 5, 2018

Mr. Tom Hansen
Abenaki Water Company
32 Artisan Court #2
Gilford, NH 03249

Subject: Analysis and Recommendations Summary - Abenaki Water Company Rosebrook Water System

Introduction

Abenaki Water Company ("AWC") has filed a petition with the New Hampshire Public Utilities Commission to support comprehensive water system improvement projects which, among other things will reduce extreme pressures in portions of the Rosebrook Water System ("System"). The Rosebrook system is part of the Abenaki Water Company, a subsidiary of New England Service Company ("NESC"). Horizons Engineering, Inc. ("Horizons") staff is familiar with the System since its initial work on the System in 1987. AWC has requested that Horizons analyze the System and provide recommendations on future capital improvements.

Background

The System dates back to the early 1970s and it is Horizon's understanding that it was initially constructed to serve the Bretton Woods Ski Area and appurtenant commercial and residential developments. The System relies on two overburden wells in the valley adjacent to the Ammonoosuc River, a 650,000 gallon concrete atmospheric storage tank on the ski slope to provide storage and maintain system pressure, and a network of distribution piping, mostly ductile iron ranging in size from 8 to 16 inches in diameter. The system serves 407 customers including the Mount Washington Hotel, several other commercial properties and a community of second homes and condominiums. The estimated serviced population is in excess of 1,100 people. The system has 63 fire hydrants and provides water for internal sprinkler systems. The System is routinely assessed by the New Hampshire Department of Environmental Services ("NHDES"). The NHDES has raised concerns that AWC address the System's high pressure.

Owing to significant topography within the service area, static pressures in the system vary from 35 pounds per square inch (psi) at the higher elevations to approximately 190 psi in the valley along the Ammonoosuc River. Intermittent pressure surges (water hammer) have reportedly increased this pressure significantly higher. The higher pressures in the system have reportedly caused problems with

leakage and premature failure of valves, fittings, pumps and other appurtenances and pose operational and safety challenges in the day to day operation and maintenance of the system. These higher pressures exceed typical design operational ranges. Per the "Recommended Standards for Water Works" (aka Ten State Standards), PART 8 Distribution System Piping and Appurtenances, 8.2.1 Pressure, recommended system pressures"…should be approximately 60 to 80 psi…" These design standards have been adopted by the NHDES for large drinking water systems under Part Env Dw-404.

Since acquiring the System in September 2016, AWC has recognized the hazards associated with operating the water system at high pressures. Past incidents of pressure related issues have reportedly disrupted service. The following are examples of the difficulties of system operation reported by Abenaki:

- Rosebrook Water Company was informed that their commercial package and property policy, running from 6/23/15 through 6/23/16 could not be renewed. This event was triggered by an extensive damage claim by Rosebrook following a water hammer incident which flooded several townhouses during a hydrant flushing operation.
- In 2010, a high pressure event during a repair at the System's well house caused major damage to that facility and forced the Mt. Washington Hotel to close for three days.
- Recently, Abenaki has been unable to effect timely repair of two fire hydrants because the excessively high pressures posed a serious safety and construction concern for the contractor. (See Attached e-mail from of F.X. Lyons dated August 22, 2018).

NHDES has reportedly been aware of the high pressure situation for some time. In its Sanitary Survey report dated August 4, 2014 (attached) NHDES concluded "...pressure in the distribution system, as a result of storage tank elevation, is much higher than necessary for adequate water service and fire flow. This pressure presents serious questions about power consumption and about safety of the operation when making pipe repairs. We urge the system owner to consider alternate ways of using the existing tank and adopting a lower pressure gradient".

In January 2017, NHDES stated in a letter to AWC (attached), "We are in support of and recommend system modifications which will reduce the public health risk and will maintain pressures within the recommended range. Not only will this provide for a safer and less costly system to operate, it also creates the ability for the company to take back ownership of system maintenance from home and commercial owners who are currently maintaining their own PRVs."

The Town of Twin Mountain Fire Department is also concerned about the high pressures. In February, 2017 the department sent a letter to AWC (attached) in support of the project to reduce system pressure to a maximum of 100 psi. The department stated that they believe such a project will "...improve safety and reliability of the system."

Recommendations

The primary concern is that the System is presently operated at one pressure gradient despite the topography varying widely across the service area. Typically, a water service area with such varying terrain would be designed with multiple pressure zones served by booster pump stations as needed.

At the request of the AWC, Horizons evaluated the System in July 2016 and recommended alternative methods to lower the maximum system pressure to 100 psi maximum. The recommendations include installing pressure reducing valves and constructing three new pump stations while maintaining the temporary use of the existing tank.

To mitigate rate shock to customers, AWC recommends the plan be conducted over the following phases:

Phase 1. Design the System improvements, including the tank and pump stations. The plan would include constructing a new water storage tank at a lower elevation. This would preclude the need for pressure reducing valves. The new tank will enable Rosebrook to lower the maximum system pressure to a more reasonable 100 psi.

Phase II. Construct a new water transmission main and one booster pump station. The pressure at the well will be reduced to 100 psi. The overall system pressure will remain at 200 psi max. The Phase II improvements will become part of the overall pressure reduction project when it is completed. The phased construction approach will also reduce a safety concern associated with operating the wells at 200 psi.

Phase III. Construct two additional pump stations and install pressure reducing valves to lower the maximum service area pressure to 100 psi. The high elevations will be serviced by the pump stations which will have adequate fire flow capabilities and standby power.

Phase IV. Construct the new storage tank. The tank will replace the existing partially buried storage tank that is now on one of the resort ski slopes. Upon completion of Phase IV, the System will meet AWCs design and safety standards. The mitigation of unsafe pressure will allow for better maintenance, scalability, and less concern for damage and disruptions over the next 40 years.

In conclusion, Horizons recommends adoption of this multi-phased project. In addition to mitigating rate shock, Horizons believes the phased project components will ensure operational reliability and control, reduce the potential for increased water losses, and optimize scalability of the water system.

Please feel free to contact me if you have any questions or if you need any additional information.

Sincerely,

Stephen LaFrance, P.E.
Principal Engineer
Horizons Engineering, Inc.

Enclosures

C:\Users\SysAdmin\Desktop\New England Water - Rosebrook Letter 2018-09-04.docx

Don Vaughan

From: F. X. LYONS <fxlyons@hotmail.com>
Sent: Wednesday, August 22, 2018 3:05 PM
To: Don Vaughan
Subject: Re: Rosebrook Hydrants

Difficult undertaking with a high risk. In reviewing the P&L system prints page 3 shows a 16" valve adjacent to the broken hydrant. Their survey dated 11/3/99 labeled it as 3A, they apparently operated the valve, documented the turns and added a comment 'Seems OK'. This valve must still be in place. If a metal detector can not pick up the gate box that would lead me to believe that the gate box top section was removed following some event. That area can be excavated, 'carefully' , a new gate box installed and the valve tested. Without this valve being operational there is 4500+/- feet of 16" pipe between the tank and the north side of Rt 302 with out an operational valve. That is not a risk I am willing to take. Would you want us to attempt to locate that valve. We could schedule that next week. Thanks FX

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Thomas S. Burack, Commissioner

August 4, 2014

Charles Adams
Rosebrook Water Co
123 E Main St 2nd Floor
Charlottesville VA 22902

Subject: Rosebrook Water; PWS ID 0382010; Carroll
Sanitary Survey

Dear Mr. Adams:

On 10/23/2013 I met with Nancy Oleson and Brian Sullivan to review facilities and management of the Rosebrook Water Company. The purpose of this survey is to review the capacity of the system's source, treatment, distribution and management to continuously produce safe drinking water. I thank Ms. Oleson and Mr. Sullivan for their assistance.

FACILITIES SUMMARY

The Rosebrook water system consists of two gravel packed wells, a single 650,000-gallon storage tank and a network of distribution piping, mostly ductile iron from 8 to 16 inches in diameter. The system serves 407 service connections, among which are the Mount Washington Hotel, several other commercial properties, and a community of second homes and condominiums. Estimated peak population served is in excess of 1,000 people. The system serves fire demand by way of some internal sprinkler systems and 63 exterior hydrants. There is also some limited outdoor water use, including minor snowmaking at the Nordic Center.

Water demand varies widely with the seasons and occupancy of the facilities served. Average year-round daily demand had been placed at about 154,000 gallons per day (gpd) historically. A 2007 report put estimated maximum daily demand as high as 500,000 gpd. Although construction is not moving forward at this time, residential and commercial construction is estimated to increase peak demand to about 740,000 gpd at full build-out.

The two gravel packed wells are summarized as follows:

Well	DES No.	Depth	Nominal well capacity (gpm)	Treatment
1	001	43'	350	Chlorine, soda ash
2	002	52'	450	Chlorine, soda ash

Well 1 is located within the pumping station, while well 2 is located 90 feet away. Well 1 is equipped with soft start to minimize hydraulic surges at startup. Injection of chlorine for disinfection and soda ash for corrosion control takes place within the pumphouse. Discharge pressure is normally about 185 psi, which is exceptionally high for residential water supplies.

A pipe break in the pump discharge main within the pumphouse in May 2010 did extensive damage to the pumphouse structure, electrical and instrumentation. The incident pointed out sub-standard piping and structural work at the facility. Repairs to the immediately affected infrastructure have since been completed. A generator has also been added to provide back-up power for the well pumps and pumphouse.

The 650,000-gallon tank is located adjacent to ski trails toward the south westerly side of the service area. Tank water level is now transmitted to the pumping station by way of line communication replacing the former battery-powered radio signal relay. Pump operating range is reportedly from 10 to 12 feet in tank depth, with a total tank depth of 13 feet.

The distribution system is primarily ductile iron. However maximum pressure is about 185 psi, significantly higher than the 100 psi allowed in state design standards. A backflow prevention program was adopted in 2013. There are a number of reduced-pressure zone devices and double-check valves in place, on high and low hazard classified service connections within the distribution system, which are tested routinely.

STAFFING AND CERTIFIED OPERATOR VERIFICATION

This water system is required to retain a primary certified operator certified at treatment grade 1 and distribution grade 2. The following certified operators are affiliated with Rosebrook Water and show adequate levels of certification:

Operator	Certificate No.	Treatment Level	Distribution Level
Nancy Oleson	2767	2	2
Brian Sullivan	3059	2	2

Significant Deficiencies

1. No significant deficiencies were noted during the site visit

Minor Deficiencies

Though less urgent than deficiencies noted above, the following deficiencies should be addressed in the course of system operation:

1. Pressure in the distribution system, as a result of storage tank elevation, is much higher than necessary for adequate water service and fire flow. This pressure presents serious questions about power consumption and about safety of the operator when making pipe repairs. We urge the system owner to consider alternate ways of using the existing tank and adopting a lower pressure gradient.

DES recommends developing an asset management plan to ensure that you get the most value from each of your assets and have the financial resources to rehabilitate and replace them when necessary. Asset management helps a system make critical decisions about how to achieve the desired level of service at the lowest appropriate cost to customers. For assistance contact Luis Adorno, by phone at (603) 271-2472, or email luis.adorno@des.nh.gov.

I can be reached at 271-2410 or wade.pelham@des.nh.gov if there are any questions regarding this letter.

Sincerely,

Wade Pelham
Drinking Water and Groundwater Bureau

cc. Nancy Oleson, Primary Operator
Michael Hahaj, Rosebrook Water Co

The State of New Hampshire
Department of Environmental Services

Clark B. Freise, Assistant Commissioner

January 26, 2017

Alex Cranshaw
Abenaki Water Co.
37 Northwest Drive
Plainville, CT 06062

Subject: Rosebrook Water (0382010)
Pressure Reduction Project

Dear Mr. Cranshaw:

We understand that you are in the process of presenting drinking water system upgrades to the community. The biggest issue that you plan to address is the high pressure areas throughout the system and in some locations are high enough to pose safety concerns. A normal system pressure range recommended by this department is 60 to 80 psi, with a minimum and maximum of 35 psi and 100 psi, respectively. It is our understanding that the existing water system owned by Rosebrook Water can exceed 200 psi in some locations. This extremely high pressure creates a safety risk, increased water loss through water main breaks or leaks, increased operating costs, and the necessity of home pressure reducing valves (PRVs). You have also indicated that the system lost insurance coverage because of numerous claims caused by the excessive pressure.

We are in support of and recommend system modifications which will reduce the public health risk and will maintain pressures within the recommended range. Not only will this provide for a safer and less costly system to operate, it also creates the ability for the operating company to take back ownership of system maintenance from home and commercial owners who are currently maintaining their own PRVs.

If you have any questions, please do not hesitate to reach out to me at Randal.Suozzo@des.nh.gov or 271-1746.

Sincerely,

Randal A. Suozzo, P.E.
NHDES Drinking Water & Groundwater Bureau

ec: Don Vaughan, Abenaki Water Company

Twin Mountain Fire Department

Twin Mountain. Fire Department
PO Box 119
104 Route 3 North.
Twin Mountain, NH 03595

Phone: 603-846-5545
FAX: 603-278-7944
email: twinmountainfirerescue@townofcarroll.org

February 25, 2017

Mr. Donald J. T. Vaughan
Abenaki Water Company
37 Northwest Drive
Plainville, CT 06062

Re: Rosebrook Water System

Dear Mr. Vaughan:

The Twin Mountain Fire Department is a municipal department providing fire protection services for Bretton Woods, served by the Rosebrook water system. As presently configured, the Rosebrook system has pressures as high as 200 psi in some areas. This pressure is excessively high and potentially dangerous from the perspective of operating fire hydrants and other equipment. Typically, municipal systems operate between 50 and 75 psi which is generally adequate for fire fighting purposes.

As the current owner and operator of the Rosebrook system, Abenaki has presented a plan for improvements to the system that would lower the maximum pressure to 100 psi while still maintaining adequate fire flows. The Twin Mountain Fire Department supports this project and believes that it would improve safety and reliability of the system.

Respectfully,

Jeremy Oleson
Fire Chief

Cc: TMFD - File