MEMORANDUM

TO: Sal Misiti, Director
Town of North Castle Water & Sewer Department

FROM: Carolyn Lowe, P.E.
Michael Savarese, P.E.
Stephen Laun, P.E.
D&B Engineers and Architects, P.C.

DATE: February 12, 2021

RE: Town of North Castle Water District No. 4
Memorandum - WJWW Interconnection Hydraulic Modeling and Preliminary Evaluation
D&B No. 5493

Background

Water District No. 4 (WD4) serves approximately 458 residential and commercial connections, located predominantly in downtown Armonk, together with Business Park and IBM. WD4 also supplies water to Water District No. 5 (118 service connections). Water is currently supplied from two operating wellfields and storage is provided by a 1 million gallon (MG) ground storage tank located at Miller Circle.

In November of 2016, GHD Consulting Services Inc. (GHD) prepared an evaluation report for WD4, entitled Water System Capacity Study for Water District No. 4, Town of North Castle, NY (found on the TONC website). The report determined that WD4 has an existing production capacity deficit and concluded that WD 4 should seek additional supply capacity to meet demands associated with population growth, future development, or changes in use of properties that may increase water demand. The Town of North Castle (Town) has reviewed options for developing new water sources for WD4. From as early as 2010 to the present, the Town has conducted several evaluations consisting of both review of existing wells for the opportunity for greater yield and the review of potential properties to develop new wells. Since the inception of this evaluation, the Town has been successful in developing a new water supply well and is working towards incorporating it into the system.

This evaluation was initiated based upon the fact that Westchester County is extending the water main on the airport property to New King Street to serve the commercial properties affected by the PFAS contamination. Attachment 1 includes a figure that shows the proposed water line extension to New King Street. D&B was contracted by the Town Water & Sewer Department to evaluate the feasibility of an interconnection between the Town and the Westchester Joint Water Works (WJWW) supply at New King Street which can provide additional supply capacity for WD4. The amount of supplemental flow needed was identified by GHD in their report to be 0.96 million gallons per day (MGD). The intent of the interconnection is for the supplemental water from WJWW to reach the Town's Miller Circle storage tank.

Methodology and Assumptions

This study was conducted by using the GIS based hydraulic modeling software InfoWater by Innovyze, Inc., together with a hydraulic model of the WJWW distribution system that had been previously developed and calibrated utilizing Bentley WaterCAD software. As no full hydraulic model of the Town distribution system was available, the proposed water main interconnection was added to the existing WJWW hydraulic model for the purposes of the evaluation.

The following parameters were utilized in the hydraulic model to conduct the evaluation:

- Historical maximum day (22.23 MGD) and peak hourly (48.97 MGD) flow conditions of the full WJWW service area from the last ten years during the irrigation season.

- The Town's estimated maximum day demand flow rate as determined by dividing the maximum flow of 0.96 MGD evenly across 24 hours (667 gpm).

Interconnection Evaluation Scenarios

The following scenarios were evaluated for their ability to provide supplemental water to the Town's WD4 and the impact to WJWW supply capacity and system pressures:

a) Scenario A – This scenario investigated the inclusion of a new water main being installed from the future New King Street extension to the proposed point of interconnection with WD4 at the southwest end of Old Post Road. The intent is to determine if the pressure in this new water main is sufficient to meet the hydraulic grade of WD4's existing 1 MG Miller Circle ground storage tank without making any changes to WJWW's existing facilities.

b) Scenario B - In addition to the new water main indicated in Scenario A, this scenario investigated the inclusion of a ground storage tank and booster pumping station constructed either along the route of the new interconnecting water main or at the proposed point of connection to WD4 at the southwest end of Old Post Road. This would be needed if the pressure in the new water main alone is insufficient to meet the hydraulic grade of WD4's existing 1 MG Miller Circle ground storage tank.

c) Scenario C - In addition to the new water main indicated in Scenario A, this scenario investigates an increase in the total dynamic head, flow, and/or number of WJWW's Purchase Street pumps. This was evaluated as an alternative to Scenario B if the pressure in the new water main alone is insufficient to meet the hydraulic grade of WD4's existing 1 MG Miller Circle ground storage tank.

Interconnection Evaluation Results

D&B conducted hydraulic model runs in accordance with the stated assumptions for the maximum day and peak hourly flow conditions to evaluate interconnection Scenarios A through C and the effects, if any, on the WJWW distribution system. The following summarizes the results of each model run:

a) The evaluation of Scenario A determined that a 12" diameter interconnecting water main routed along King Street (Route 120), from the intersection of New King Street to the Town's water main located at the intersection of Old Post Road, would be the shortest path using existing roadway right-of-ways. For a map of the proposed route, see Attachment No. 2: Proposed Water Main Route for North Castle Interconnection to WJWW Supply. Following this route, however, has one main disadvantage in that it results in the water main having to climb over a fairly significant ridge. The pipe would rise from its starting elevation of 395 feet at New King Street to a maximum elevation of 515 feet between Cooney Hill Road and New Orchard Road, before returning to an elevation of 360 feet at the intersection of Old Post Road and Route 120. When this pipe route was added to the hydraulic model, it showed that the water was unable to travel over the ridge, let alone fill the Miller Circle storage tank, making this alternative not technically feasible. The furthest that the water could travel was about halfway between the south end of American Lane and Cooney Hill Road and a maximum elevation of approximately 420 feet. It had been anticipated that some form of pressure boosting would be necessary, given the historical pressures within the WJWW service area and the elevation of the Town's existing 1 MG Miller Circle ground storage tank (El. 565 feet, Overflow El. 590.5 feet).

b) The evaluation of Scenario A determined that additional pumping would be necessary to not only push water over the ridge bisecting King Street (Route 120) but also to reach the top of the Town's existing Miller Circle tank. This would avoid any need to pump the water twice. Hence, Scenario B involved inserting a ground storage tank and pump station within the model. This evaluation showed that, with a tank and booster pump station in place, the WJWW system was able to provide a maximum flow of 0.96 MGD divided evenly across 24 hours to the new ground storage tank, which the Town would be able to draw from as needed using the new booster pumps. This constant flow to the new ground storage tank did not put any additional strain on the WJWW supply and distribution system, nor did it result in any pressures below 35 psi under maximum day and peak hour conditions.

   The new ground storage tank would be sized to accommodate 1 MG to provide operational flexibility to the Town, despite WJWW filling it at a constant rate. The booster pumps would be sized to provide sufficient total dynamic head to supply water from the new ground storage tank to the elevation of the existing Miller Circle tank. The facilities can be placed together at any location between New King Street and the point about halfway between the south end of American Lane and Cooney Hill Road, where the elevation reaches a maximum of 420 feet. The proposed ground storage tank and booster pump station would allow the Town to respond dynamically

to diurnal variations in demand, peak hour demands and fire demands occurring within their distribution system, while remaining hydraulically independent of the WJWW and protecting the WJWW from pressure drops associated with supplying the Town. There is also the possibility that new users/properties could be accommodated along the route downstream of the new storage and pumping facilities.

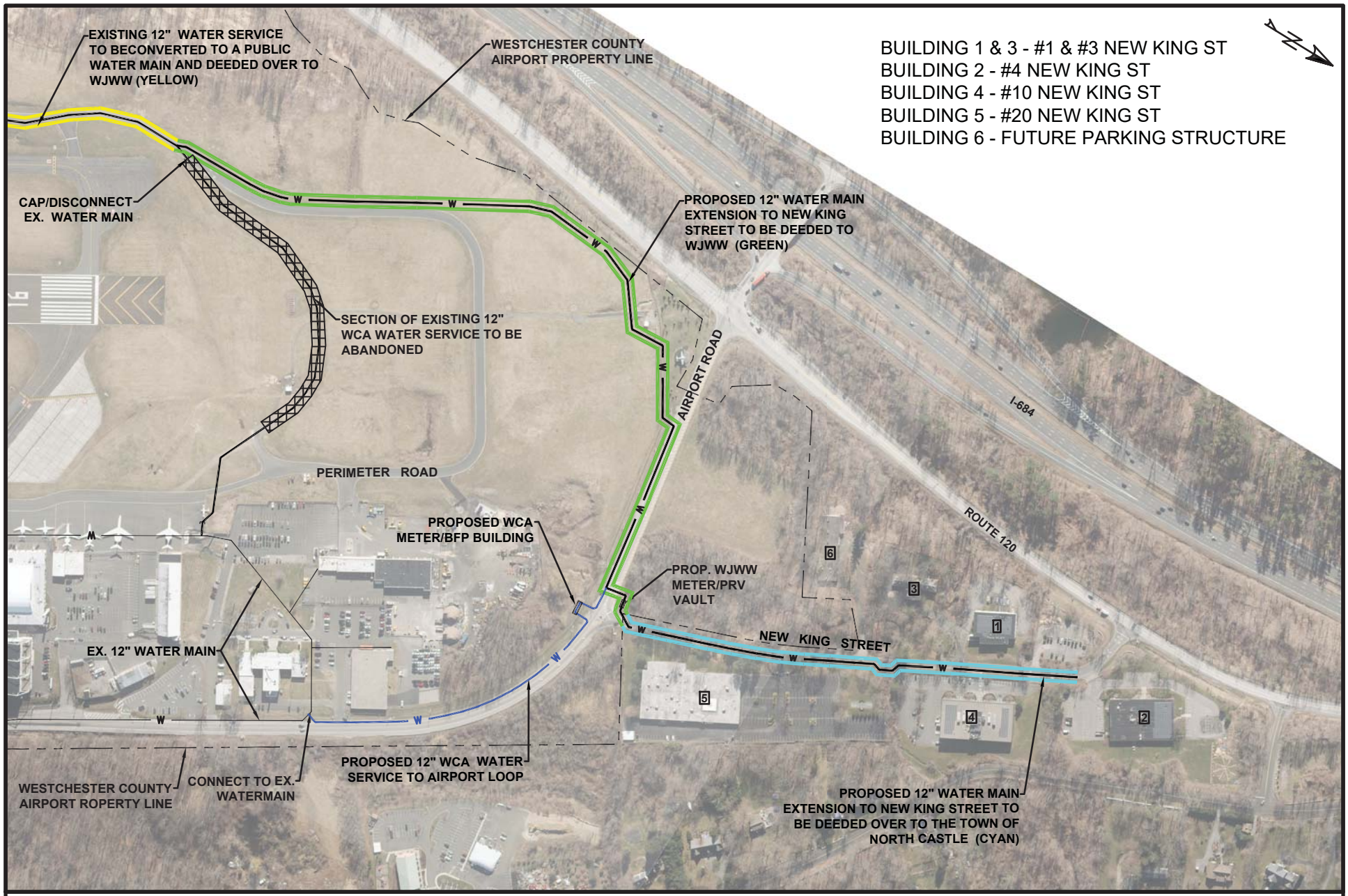
c) The evaluation of Scenario A determined that additional pumping would be necessary to not only push water over the ridge bisecting King Street (Route 120) but also to reach the top of the Town's existing Miller Circle tank. Hence, Scenario C involved increasing the total dynamic head and flow of the WJWW's Purchase Street Pump Station pumps to a point where the flow at New King Street was capable of both traveling over the ridge on King Street (Route 120) and reaching the overflow elevation of the existing Miller Circle ground storage tank. While satisfying the demands of the Town, this scenario resulted in overpressures at locations within the WJWW's distribution system in their "High Service Zone" served by these pumps. The overpressures occurred at locations of low elevation within the service zone, which already experience higher than normal pressures with the existing pumps. These overpressures would have the potential to cause water main breaks and potentially cause damage to private or public property and would be an unacceptable result for the WJWW. The WJWW has received design recommendations from Woodard and Curran to increase the flow of their Purchase Street Booster Pumps without increasing their total dynamic head. The increased design flow of these pumps takes into account the proposed 0.96 MG requested by the Town. For this design memo, please see Attachment 3: WJWW Purchase Booster Station Pump Modeling and Recommendations prepared by Woodard & Curran.

Interconnection Conclusions and Recommendations

Based on the results of the evaluations of the three scenarios, it was determined that Scenario B both satisfied the supplemental flow demands of the Town and also did not result in any deleterious effects on the WJWW system. The implementation of this recommendation would provide 0.96 MGD of water to the Town's WD4 with the ability to respond to fluctuations in demands (diurnal variations, fire demands, etc.) while maintaining pressures within the WJWW's distribution system under historical maximum day demand and peak hourly flow. The specific location of the required water storage tank and pump station will need to be determined within a follow-up study and or design. However, it is preferrable to site these facilities as close to the interconnection as possible to allow for as many new users as can be accommodated along the route.

Enclosures:
Attachment No. 1: Proposed New King Street Water Main Extension
Attachment No. 2: Proposed Water Main Route for North Castle Interconnection to WJWW Supply
Attachment No. 3: WJWW Purchase Booster Station Pump Modeling and Recommendations prepared by Woodard & Curran

Attachment No. 1
Proposed New King Street Water Main Extension



D&B ENGINEERS AND ARCHITECTS

DOMESTIC WATER LINE IMPROVEMENTS
WESTCHESTER COUNTY AIRPORT
TOWN OF HARRISON AND NORTH CASTLE AND VILLAGE OF RYE BROOKE, NEW YORK

PROPOSED NEW KING STREET WATER MAIN EXTENSION

SCALE: 1" = 400'

Attachment No. 2
Proposed Water Main Route for North Castle Interconnection to WJWW Supply

L:\5493_NorthCastle_WJWW_Interconnection\ContourMap.mxd (10/28/2020)

D&B Engineers and Architects, P.C.

PROPOSED WATER MAIN ROUTE FOR NORTH CASTLE INTERCONNECTION TO WJWW SUPPLY

Attachment No. 3
WJWW Purchase Booster Station Pump Modeling and Recommendations prepared by Woodard & Curran

COMMITMENT & INTEGRITY
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MEMORANDUM

TO: Paul Kutzy, Manager
Westchester Joint Water Works

FROM: Steve Robbins, P.E., LEED AP

DATE: October 7, 2020

RE: Purchase Booster Station Pump Modeling and Recommendations

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Background

Westchester Joint Water Works' (WJWW) Purchase Booster Pump Station (hereafter "the station") is located at 4195 Purchase Street, in Purchase NY. It draws water from the Purchase Storage Tanks and provides head to transport water to the Park Lane tanks in WJWW's Upper High Service (UHS) pressure zone.

Prior to recent emergency renovations to provide additional capacity, the station had six pumps, with design flows, design heads, and control schemes as shown in the table below.

Table 1 – Purchase Booster Station Existing Pump Parameters

Pump Station and Pumps		Design Flow	Design Head	Activation Conditions
Purchase Booster Station Source: Purchase Tanks	Pump 1	450 gpm 0.65 MGD	192 ft	Stage 3 On: Park Lane Tank Level < 45 ft Off: Park Lane Tank Level > 65 ft
	Pump 2	450 gpm 0.65 MGD	192 ft	Stage 4 On: Park Lane Tank Level < 45 ft Off: Park Lane Tank Level > 55 ft
	Pump 3	350 gpm 0.50 MGD	215 ft	Stage 5 On: Park Lane Tank Level < 32 ft Off: Park Lane Tank Level > 50 ft
	Pump 4	350 gpm 0.50 MGD	215 ft	Stage 6 On: Park Lane Tank Level < 30 ft Off: Park Lane Tank Level > 45 ft
	Pump 5	1,400 gpm 2 MGD	194 ft	Stage 2 On: Park Lane Tank Level < 55 ft Off: Park Lane Tank Level > 72 ft
	Pump 6	1,400 gpm 2 MGD	194 ft	Stage 1 On: Park Lane Tank Level < 60 ft Off: Park Lane Tank Level > 74 ft

The UHS zone has a maximum hydraulic grade of 593 ft. Under current non-emergency July average demand and maximum demand conditions with the existing pump station, pressures in the UHS zone at various locations vary as shown in the table below.

Table 2 – Existing Non-Emergency Pressures in the UHS Zone

Location	Pressure Range During July 2019 Average Demand	Pressure Range During July 2020 Maximum Day Demand
Quaker Lane (Middle of UHS Zone)	90 – 105 psi	55 – 65 psi
Purchase Street at Tower Road	60 – 85 psi	50 – 110 psi
Woodside Zone Boundary on Old Lake Street	105 – 120 psi	95 – 110 psi
Orchard Street (Far Northwest of UHS Zone)	48 – 50 psi	48 – 50 psi
Park Lane Tanks Inlet (Highest Elevation in UHS Zone)	33 – 38 psi	20 – 40 psi

Due to recent issues with the station's supply capacity and the hydraulics of the UHS zone, which limits the effectiveness of the Park Lane tanks to quickly compensate for a dramatic pressure loss in the UHS zone east of I-684 from Rye Lake to Country Club Drive which includes Westchester County Airport, WJWW retained Woodard & Curran to develop recommendations for new pumps at the station to increase pumping capacity.

Pump Selection Performance Requirements

The modified station will be required meet the following five performance criteria:

1. The station must output 3,500 gpm (5 MGD) of flow from a single pump under normal, non-fire-flow operating conditions to fill the Park Lane Tanks during peak hour, maximum day demand conditions. There must be a lead duty and a backup duty pump to ensure continuity of pump station performance.

2. The station must be able to provide 3,500 gpm (5 MGD) fire flow to the UHS zone east of I-684 from Rye Lake to Country Clube Drive, which includes Westchester County Airport, during peak hour, maximum day demand conditions. When providing both domestic and fire flow during peak hour, maximum day demand conditions, the total station output must be at least 7,000 gpm (10 MGD) when using two pumps.

3. The station must be able to provide a maximum of 770 gpm of flow at the proposed New King Street interconnection to North Castle on the northeast end of the UHS zone, at peak-hour operating pressure for that area of the system.

4. The station must be able to maintain pressures consistent with existing conditions, as indicated in Table 4.

5. American Water Works Association (AWWA) design guidelines around minimum distribution system pressure must be met and damaging pressure conditions must be avoided.

Pump Selection Modeling

Woodard & Curran updated our existing WaterGEMS model of WJWW's system to include the new PRV in the former West Harrison meter vault. The model was then used to predict hydraulic conditions in the UHS zone with the updated system demands and pump performance requirements. After testing various pump design points, 3,500 gpm (5 MGD) at 195 ft TDH was identified as the optimal design point for the new pumps to achieve the five performance requirements laid out in the previous section. To provide lead/lag configuration with redundancy, three such pumps will be provided, with one operating as lead, one as lag, and one as backup.

The proposed pumps were modeled to be controlled first by the level of the Park Lane tanks. The pumps were also modeled with a control based on downstream pressure, such that the lead and lag pumps activate when a substantial drop in pressure occurs during a fire flow condition in the UHS zone. The modeled control parameters for the new pumps are shown in Table 2. In reality, the three new pumps would be powered with variable frequency drives and would be able to modulate across the full range of anticipated system flows. Winter and non-irrigation low-flow conditions were not modeled, but could be handled by retaining the existing pumps 5 and 6.

Table 3 – Purchase Booster Station Proposed Pump Modeled Parameters

Pump Station and Pumps		Design Flow	Design Head	Park Lane Tank Level Activation Conditions	Fire Flow Activation Conditions
Purchase Booster Station New Pumps Source: Purchase Tanks	Pump A	3,500 gpm 5 MGD	195 ft	Lead On: Park Lane Tank Level < 65 ft Off: Park Lane Tank Level > 74 ft	(Single Stage, No Lead or Backup) On: Downstream Pressure < 50 psi Off: Downstream Pressure > 95 psi
	Pump B	3,500 gpm 5 MGD	195 ft	Lag On: Park Lane Tank Level < 55 ft Off: Park Lane Tank Level > 74 ft	(Single Stage, No Lead or Backup) On: Downstream Pressure < 50 psi Off: Downstream Pressure > 95 psi
	Pump C	3,500 gpm 5 MGD	195 ft	None Takes over lead or lag duty if other pumps fail	None Takes over lead or lag duty if other pumps fail

No changes were modeled to any other pump stations or pressure zones. Modeling parameters for other pump stations and other hydraulic fittings remain the same as in Woodard & Curran's July 2020 Delaware Aqueduct Shutdown Hydraulic Modeling Report.

Recent 2020 maximum day and peak demand conditions in the UHS and Woodside zone were modeled. In 2020, the maximum recorded daily demand in the UHS and Woodside zones was 2,790 gpm, on July 29th, 2020. The peak hour demand during that day was 4,280 gpm. The diurnal curve for the UHS and Woodside zones was updated to match the diurnal pattern of July 29th, 2020. Since the hydraulic model covers all pressure zones, July 2019 average demand conditions, as described in Woodard & Curran's July 2020 Delaware Aqueduct Shutdown Hydraulic Modeling Report, were applied to all other pressure zones during modeling, as those demands do not impact the modeled supply conditions in the Woodside and UHS zones for these analyses.

Modeling results showing minimum pressures throughout WJWW's system over a 48-hour modeling period are shown in the figures included with this report. Figure 1 shows the minimum pressure during July 29th, 2020 maximum day demand with the existing pump station. Figure 2 shows the minimum pressure during the July 29th, 2020 maximum day demand with the modified pump station. Figure 3 shows the minimum pressure with the same demands and pump station as Figure 2, plus a 2-hour, 3,500 gpm fire flow at Tower Road.

Figures 2 and 3 show satisfactory hydraulic conditions and the modeling demonstrates that the new 3,500 gpm (5 MGD), 195 ft TDH pumps at the station can meet the five performance requirements laid out in this report, while maintaining or improving existing pressures throughout the UHS and Woodside zones. During fire flow conditions in the UHS zone east of I-684 from Rye Lake to Country Club Drive, which includes Westchester County Airport, the model predicts a minimum pressure of 55 psi at the Tower Road supply connection, which is higher than the 50 psi that the model estimates during maximum day demand conditions with the existing pump station.

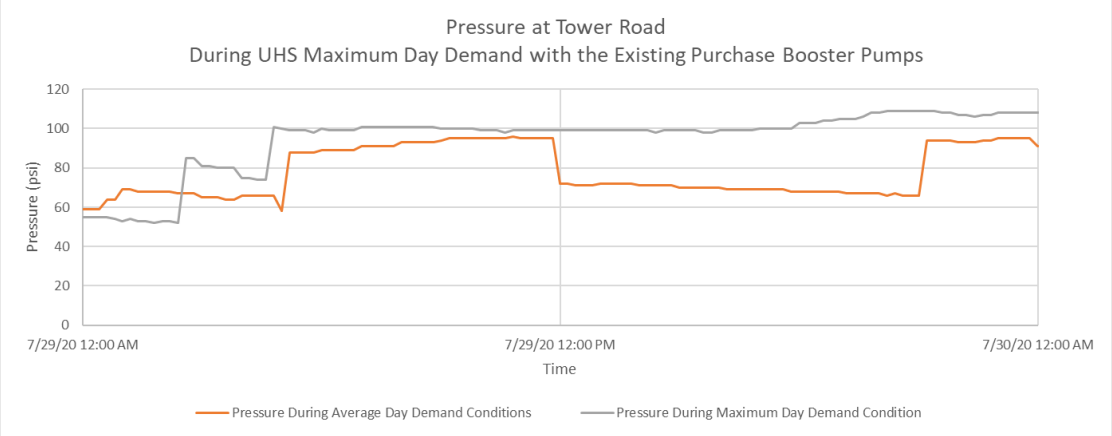
A comparison of system pressures in the UHS zone between the existing pump station, proposed pump station maximum day demand conditions, and proposed maximum day fire flow demand conditions is shown in the table on the following page.

Table 4 – Comparison of UHS Zone Pressures During Maximum Day Demand

Location	Existing Pump Station Maximum Day Demand Pressure Range	Proposed Pump Station Maximum Day Demand Pressure Range	Proposed Pump Station Maximum Day Demand with Fire Flow Pressure Range
Quaker Lane (Middle of UHS Zone)	55 – 65 psi	55 – 75 psi	60 – 70 psi
Purchase Street at Tower Road	50 – 110 psi	55 – 110 psi	55 – 115 psi
Woodside Zone Boundary on Old Lake Street	95 – 110 psi	105 – 125 psi	100 – 115 psi
Orchard Street (Far Northwest of UHS Zone)	48 – 50 psi	48 – 50 psi	48 – 50 psi
Park Lane Tanks Inlet (Highest Elevation in UHS Zone)	20 – 40 psi	33 – 36 psi	26 – 36 psi

For further comparison to existing conditions, the modeled pressures at Tower Road during average day and maximum day demand conditions, with the existing station's pumps, is shown in the graph below. During maximum day demand conditions, the pressure starts low when no pumps are active, then plateaus around 100 – 110 psi as the tank drains and the two active pumps turn on. The pressure remains high, as the demand is too high to allow the Park Lane tanks to fill, so the station's pumps remain on for most of the day. During average day demand conditions, pressures associated with a more typical tank filling and draining cycle can be seen. This graph further demonstrates that the proposed pumps at the station maintain similar pressures as the existing pumps during maximum day demand conditions.

Graph 1 – Pressure at Tower Road with Existing Pump Station



Pump Product Selection

With the pump design point identified through modeling, Woodard & Curran researched and selected a suitable pump model. We recommend the Grundfos Model 8015-3/4 KPVS. It is a 250 HP pump with a design point of 3,500 gpm at 195 ft TDH. Product data and pump curves for this pump model are included at attachments to this memorandum.

Next Steps

With pump product selected and system hydraulics confirmed, the following next steps are required:

1. Electrical requirements must be confirmed, including internal electrical supply capacity and standby power capacity.

2. Physical space requirements must be confirmed. The size of the proposed pumps must be confirmed. An available space in the station must be identified for the pumps and variable-frequency drives. Any required modifications to the interior of the pump station to provide sufficient space must be identified.

3. The size of the suction and discharge header for the pumps must be reviewed to determine if modifications are necessary.

4. The size of the existing surge relief valve must be reviewed to determine if it is adequately sized for the increased flow.

In addition, Woodard & Curran will be performing a hydraulic transient analysis to review any additional operational or equipment requirements that will be needed as part of the station upgrades.

WATER

PURCHASE BOOSTER STATION MODIFIED
THREE PUMPS ADDED, 3,500 GPM @ 195 FT HEAD
ALL EXISTING PUMPS REMOVED

PUMP A (LEAD)
ON AT PARK LANE LEVEL < 65 FT
OFF AT PARK LANE LEVEL > 74 FT

PUMP B (LAG)
ON AT PARK LANE LEVEL < 55 FT
OFF AT PARK LANE LEVEL > 74 FT

PUMP C (BACKUP)
REPLACES ANY PUMPS THAT FAIL

ARMONK INTERCONNECTION
770 GPM CONSTANT DEMAND

PS

PS

PS

Legend

- Tanks
- PS Pump Stations
- Existing PRVs
- NYC Aqueduct
- WJWW Member Municipal Boundary

Water Pipe Diameter

- 4 Inches or Less
- 6 Inches
- 8 Inches
- 10 Inches
- 12 Inches
- 14 Inches
- 16 Inches
- 18 - 24 Inches
- Greater than 24 Inches

Pressure Zone

- High Pressure Zone
- Intermediate Pressure Zone
- Lower Pressure Zone
- Upper High Pressure Zone
- Woodside Pressure Zone

Minimum Pressure

- Less than 20 psi
- 21 - 35 psi
- 36 - 80 psi
- 81 - 150 psi
- Greater than 150 psi

0 2,000 4,000 8,000 12,000 16,000 Feet

Sources: Esri, HERE, Garmin, (Hong Kong), Esri Korea, Esri Community

WESTCHESTER JOINT WATER WORKS

FIGURE 1
MINIMUM PRESSURE
JULY 2019 AVERAGE DEMAND

WOODARD &CURRAN

SCALE: 1 " = 4,000 '

DATE: SEPTEMBER 2020

WATER

PURCHASE BOOSTER STATION MODIFIED
THREE PUMPS ADDED, 3,500 GPM @ 195 FT HEAD
ALL EXISTING PUMPS REMOVED

PUMP A (LEAD)
ON AT PARK LANE LEVEL < 65 FT
OFF AT PARK LANE LEVEL > 74 FT

PUMP B (LAG)
ON AT PARK LANE LEVEL < 55 FT
OFF AT PARK LANE LEVEL > 74 FT

PUMP C (BACKUP)
REPLACES ANY PUMPS THAT FAIL

ARMONK INTERCONNECTION
770 GPM CONSTANT DEMAND

PS

PS

PS

Legend

- Tanks
- Pump Stations
- Existing PRVs
- NYC Aqueduct
- WJWW Member Municipal Boundary

Water Pipe Diameter

- 4 Inches or Less
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0 2,000 4,000 8,000 12,000 16,000 Feet

Sources: Esri, HERE, Garmin, (Hong Kong), Esri Korea, Esri Community

WESTCHESTER JOINT WATER WORKS

FIGURE 2
MINIMUM PRESSURE
2020 UHS ZONE MDD
NO FIRE FLOW

WOODARD &CURRAN

SCALE: 1 " = 4,000 '

DATE: SEPTEMBER 2020

ARMONK INTERCONNECTION
770 GPM CONSTANT DEMAND

FIRE FLOW IN UPPER HIGH SERVICE ZONE
3,500 GPM FROM 6 AM TO 8 AM

PURCHASE BOOSTER STATION MODIFIED
THREE PUMPS ADDED, 3,500 GPM @ 195 FT HEAD
ALL EXISTING PUMPS REMOVED

PUMP A (LEAD)
NON-FIRE OPERATION)
ON AT PARK LANE LEVEL < 65 FT
OFF AT PARK LANE LEVEL > 74 FT
FIRE FLOW OPERATION
ON WHEN DOWNSTREAM PRESSURE < 60 PSI
OFF WHEN DOWNSTREAM PRESSURE > 95 PSI

PUMP B (LAG)
NON-FIRE OPERATION)
ON AT PARK LANE LEVEL < 55 FT
OFF AT PARK LANE LEVEL > 74 FT
FIRE FLOW OPERATION
ON WHEN DOWNSTREAM PRESSURE < 60 PSI
OFF WHEN DOWNSTREAM PRESSURE > 95 PSI

PUMP C (BACKUP)
REPLACES ANY PUMP THAT FAILS

PS

Legend

- Tanks
- Pump Stations
- Existing PRVs
- NYC Aqueduct
- WJWW Member Municipal Boundary

Water Pipe Diameter

- 4 Inches or Less
- 6 Inches
- 8 Inches
- 10 Inches
- 12 Inches
- 14 Inches
- 16 Inches
- 18 - 24 Inches
- Greater than 24 Inches

Pressure Zone

- High Pressure Zone
- Intermediate Pressure Zone
- Lower Pressure Zone
- Upper High Pressure Zone
- Woodside Pressure Zone

Minimum Pressure

- Less than 20 psi
- 21 - 35 psi
- 36 - 80 psi
- 81 - 150 psi
- Greater than 150 psi

0 2,000 4,000 8,000 12,000 16,000 Feet

Sources: Esri, HERE, Garmin, (Hong Kong), Esri Korea, Esri Community

WESTCHESTER JOINT WATER WORKS

FIGURE 3
MINIMUM PRESSURE
2020 UHS ZONE MDD
WITH AIRPORT FIRE FLOW

WOODARD &CURRAN

SCALE: 1 " = 4,000 '

DATE: SEPTEMBER 2020

Construction Datasheet

Project name	: WJWW Purchase St.	Tag Number	: P-3, 4, 5
Consulting engineer	:	Service	:
Customer	: DOLPHIN EQUIPMENT CORP	Model	: 8015-3/4 KPVS
Customer ref. / PO	:	Quantity	: 3
Quote Number / ID	: 1210314	Quoted By (Sales Office)	: DOLPHIN EQUIPMENT CORP
Date last saved	: August 24, 2020 12:05 PM	Quoted By (Sales Engineer)	: Gene Geyer

Construction

Nozzle	Size (in.)	Nozzle Configuration	Pos'n
Suction	10	125# ANSI	-
Discharge	8	125# ANSI	-

Orientation / Configuration	: Vertical
Rotation	: Clockwise
Wear Ring Configuration	: Single - Case
Discharge Elbow Size	: -
Subplate	: -
Sump Depth (feet)	: -
Bearing Frame	: -
Bearing Frame Foot	: -
Bearing Type (Radial/Thrust)	: Sleeve Bearing / Sleeve Bearing
Bearing Lubrication	: -
Thrust Bearing	: -
Intermediate Bearing	: -
Lower Bearing	: -
Bearing Housing Accessories	: -
PACO Construction code	: 31-80153-145061-1972P

Baseplate, Coupling and Guard

Baseplate	: -
Drip Pan	: -
Coupling	: Rigid, Axial Split Coupling (aluminum) KPVSC6
Guard	: OSHA Approved

Seal & Packing Construction

Sealing Method	: Single Seal, Type 21S
Seal Material	: Buna Carbon Ceramic SS-Spring and Hardware
Packing Gland	: -
Lantern Ring	: -
Recirculation Lines	: Nylon Tubing with Brass Fittings

Weights (Approx.)

Pump	: 1,250.0 lb
Baseplate	: -
Driver	: 2,084.0 lb
Estimated Shipping gross weight	: 3,334.0 lb

Motor Information

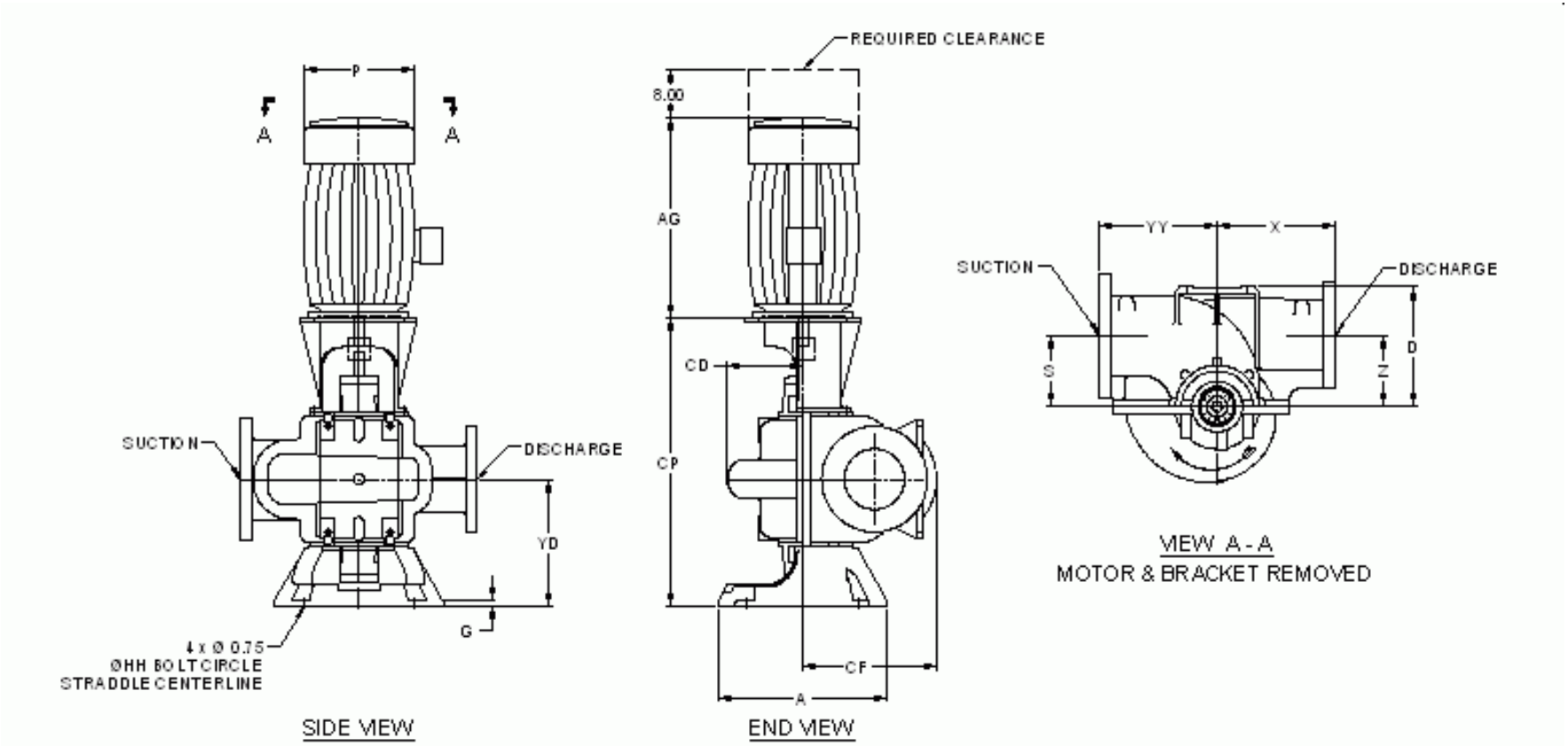
Manufacturer	: Baldor
Frame Size	: 447TC
Power	: 250 hp
RPM	: 1800 rpm
Enclosure	: ODP
Operating Power Supply	: 460/3/60
Efficiency	: Premium
Service factor	: 1.15
Motor Application	: General Purpose
Motor Options/Accessories	: -
Cord Length (feet)	: -

Materials

Case	: Cast Iron, ASTM A48 - Class 35
Motor Bracket	: Cast Iron, ASTM-A48, CL 30
Impeller	: Silicon Bronze, ASTM B584 C87600 (B21)
Impeller Cap Screw and Washer	: -
Impeller Key	: Steel, Cold Drawn C1018
Case wear ring	: Tin Bronze, ASTM B584-90500 (B18)
Impeller wear ring	: -
Pump Shaft	: Stainless Steel, AISI-416
Sleeve	: Sleeveless
Line Shaft	: -
Column	: -
Discharge Pipe	: -
Discharge Elbow	: -
Suction Elbow	: -
Subplate	: -
Hardware	: Steel, Grade 5
O Rings	: Buna N
Pump Coatings	: Standard Manufacturers Paint

General Arrangement

Project name	: WJWW Purchase St.	Tag Number	: P-3, 4, 5
Consulting engineer	:	Service	:
Customer	: DOLPHIN EQUIPMENT CORP	Model	: 8015-3/4 KPVS
Customer ref. / PO	:	Quantity of pumps	: 3
Quote Number / ID	: 1210314	Quoted By (Sales Office)	: DOLPHIN EQUIPMENT CORP
Date last saved	: August 24, 2020 12:05 PM	Quoted By (Sales Engineer)	: Gene Geyer



NOT FOR CONSTRUCTION, Unless certified and referenced on order

Units	Frame	Suct(in)	Disch(in)	A	AG	CD	CF	CP	D	G	HH	P	S	X	YD	YY	Z	Weight ea
inches	**447TC**	**10**	**8**	**28.00**	**53.25**	**12.75**	**20.75**	**50.38**	**19.00**	**0.88**	**26.00**	**29**	**12**	**19**	**20.63**	**19**	**12**	**3,334.0**

Conditions of Service		**Motor Data**			
Flow: 3,500.0 USgpm	Fluid: Cold Water	HP: 250	Encl: ODP	Phase: 3	Efficiency: Premium
TDH: 195.0 ft	Temp.: 68.00 deg F	RPM: 1780 rpm	Hz: 60	Voltage: 460	S.F.: 1.15

Pump Performance Datasheet

Customer	:	Quote Number / ID	: 1210314
Customer ref. / PO	:	Model	: 8015-3/4 KPVS
Tag Number	: P-3, 4, 5	Stages	: 1
Service	:	Based on curve number	: RC2322-4 Rev 1
Quantity	: 3	Date last saved	: August 24, 2020 12:05 PM

Operating Conditions

Flow, rated	: 3,500.0 USgpm
Differential head / pressure, rated (requested)	: 195.0 ft
Differential head / pressure, rated (actual)	: 195.0 ft
Suction pressure, rated / max	: 0.00 / 0.00 psi.g
NPSH available, rated	: Ample
Site Supply Frequency	: 60 Hz

Performance

Speed, rated	: 1780 rpm
Impeller diameter, rated	: 14.15 in
Impeller diameter, maximum	: 15.00 in
Impeller diameter, minimum	: 9.00 in
Efficiency	: 86.68 %
NPSH required / margin required	: 18.73 / 0.00 ft
nq (imp. eye flow) / S (imp. eye flow)	: 30 / 131 Metric units
MCSF	: 1,200.0 USgpm
Head, maximum, rated diameter	: 227.3 ft
Head rise to shutoff	: 16.20 %
Flow, best eff. point	: 4,050.5 USgpm
Flow ratio, rated / BEP	: 86.41 %
Diameter ratio (rated / max)	: 94.33 %
Head ratio (rated dia / max dia)	: 87.32 %
Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
Selection status	: Acceptable

Liquid

Liquid type	: Cold Water
Additional liquid description	:
Solids diameter, max	: 0.00 in
Solids concentration, by volume	: 0.00 %
Temperature, max	: 68.00 deg F
Fluid density, rated / max	: 1.000 / 1.000 SG
Viscosity, rated	: 1.00 cP
Vapor pressure, rated	: 0.34 psi.a

Material

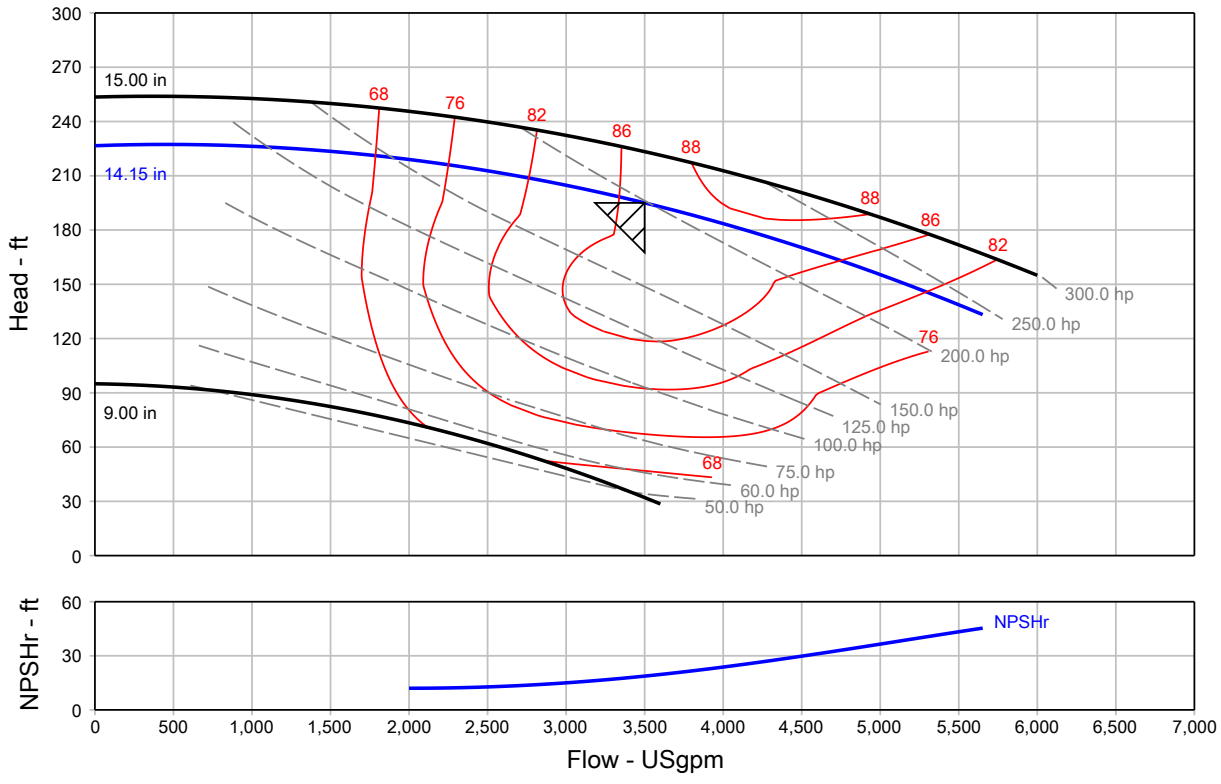
Material selected	: Cast iron

Pressure Data

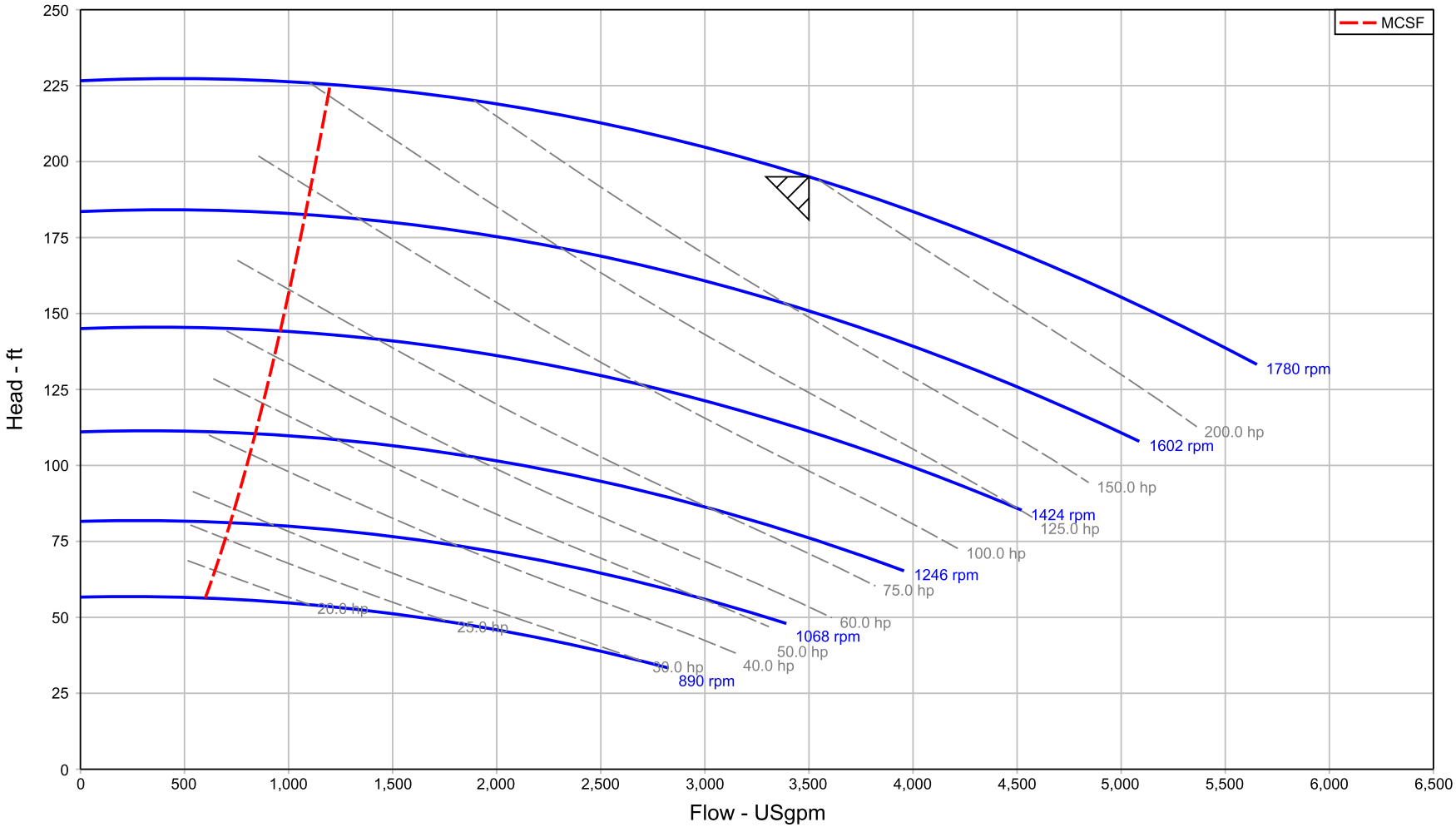
Maximum working pressure	: 98.38 psi.g
Maximum allowable working pressure	: 250.0 psi.g
Maximum allowable suction pressure	: 200.0 psi.g
Hydrostatic test pressure	: 375.0 psi.g

Driver & Power Data (@Max density)

Motor sizing specification	: Max power (non-overloading)
Margin over specification	: 0.00 %
Service factor	: 1.15
Power, hydraulic	: 172 hp
Rated power (based on duty point)	: 199 hp
Max power (non-overloading)	: 245 hp
Nameplate motor rating	: 250 hp / 186 kW



Multi-Speed Performance Curve



Project name	: WJWW Purchase St.	Tag Number	: P-3, 4, 5	Speed, rated	: 1780 rpm
Consulting engineer	:	Service	:	Flow, rated	: 3,500.0 USgpm
Customer	:	Model	: 8015-3/4 KPVS	Differential head / pressure, rated	: 195.0 ft
Customer ref. / PO	:	Quantity	: 3	Fluid density, rated / max	: 1.000 / 1.000 SG
Quote Number / ID	: 1210314	Quoted By (Sales Office)	: DOLPHIN EQUIPMENT CORP	Viscosity	: 1.00 cP
Date last saved	: September 10, 2020 1:47 PM	Quoted By (Sales Engineer)	: Gene Geyer	Cq/Ch/Ce/Cn [ANSI/HI 9.6.7-2010]	: 1.00 / 1.00 / 1.00 / 1.00
		Stages	: 1	Based on curve number	: RC2322-4 Rev 1