Weston & Sampson

5 Centennial Drive, Peabody, MA 01960 (HQ)
Tel: 978.532.1900

August 3, 2018

Mr. Jason L. Mammone, PE
Director of Engineering
55 River Street
Dedham, MA 02026

Re: 2018 Rustcraft Road Pump Station Evaluation

Dear Mr. Mammone:

On Thursday, May 3, 2018, Weston & Sampson personnel conducted a site visit and evaluation of the Rustcraft Road Pump Station. This report updates the 2013 Pump Station Evaluation report and describes our current evaluation of the pump station, including the condition of the building structure, generator, wet well, and site; the inspection of electrical control panels and breakers; and the condition and operation of existing pumps, motors, check valves, gate valves, and existing mechanical piping.

This report also includes an update to the pump station capacity analysis and evaluation of existing flows that were part of the 2013 evaluation. This report provides specific recommendations and estimated costs for short-term capital improvements and planning level costs for long-term facility improvement objectives toward additional capacity within the municipal sewer system.

Description

Installed in 2008, this station is a duplex submersible type system that draws wastewater from an adjacent concrete wet well. The station conveys flows approximately 3,100 linear feet via a 6-inch ductile iron (DI) force main to a 12-inch gravity sewer on Rustcraft Road. The 12-inch gravity sewer extends for approximately 2,000 linear feet along Rustcraft Road, Central Avenue, and McKinley Avenue before discharging to a 21-inch sewer in Fairbanks Road (see Figure 1).

As part of the evaluation, the following activities were performed at the station:

1. Exterior Inspection

2. Inspection of Electrical Panels, Breakers, and Control Panels

3. Miscellaneous Inspection and Operation:

    - Pumps and Motors
    - Check and Gate Valves
    - Mechanical Piping
    - Standby Generator
    - Wet well walls and Interior

Photographs from the site visit are included in Appendix A and referenced herein. The pump station evaluation log is included in Appendix B.

Observations/Recommendations

The station is approximately 10 years old and most components are in good condition and not yet in need of replacement and/or repair. The following is a list of observations and recommended improvements:

- The building structure, grounds, fencing, and concrete wet well are all in good condition.

- Several modifications have been made to the station since the 2013 Pump Station Evaluation, based on recommendations at that time:

- Due to the amount of grease present in the system, a Protein Matrix grease control drip system was installed in 2017 at the station. The chemical tank along with the chemical feed pump are both housed within the pump station, and the chemical is fed through a tube directly into the wet well above the influent pipe for optimum mixing.

- The 2013 pump station evaluation concluded that both pumps showed excessive starts during normal flow conditions, which only increased during peak flow conditions. In order to improve the operational efficiency of the pumps, Variable Frequency Drives (VFD's) were installed on both pumps.

- The Muffin Monster sewage grinder unit continues to be utilized at the station and was upgraded in 2016 to a larger size.

- A Mission Control Telemetry system was installed to replace the previous MultiSmart control system.

- The station is still equipped with a digital back-up level control system, separate from the Mission control system, with its own submersible transducer that bypasses the Mission system in the event of failure of this primary system. It was noted in the 2013 report that the back-up level control system had failed and was no longer working at the time. The back-up level control system was repaired and is currently operating normally.

- A third pump was purchased in 2014 and is currently stored at the pump station as a spare unit in case of emergency.

- The slide rail systems in the wet well were observed to be in poor condition and it is therefore recommended that they be replaced.

- Based on available records and testing performed (see sub-bullets below), it was determined that the current discharge rate of the existing pumps is approximately 500 gallons per minute (gpm) and the current average daily flow to the station is approximately 210 gpm.

    - Wet well draw-down testing performed in conjunction with the evaluation revealed current pump discharge rates of 527 gpm for Pump No. 1 and 477 gpm for Pump No. 2. These pump discharge rates are consistent with the discharge rates observed in the 2013 Pump Station Evaluation.

    - During the wet well draw down testing, the average pump discharge rate recorded from the control panel digital display was 506 gpm for Pump No. 1 and 475 for Pump No. 2. The average discharge rate recorded from the flow meter digital display was 477 for Pump No. 1 and 448 for Pump No. 2.

    - During the evaluation, influent data was also recorded for two full cycles per pump. During these cycles, the average inflow to the wet well was approximately 206 gpm.

    - The Mission Control system records pump discharge rate data for each of the pumps at the station. Although the data shows somewhat erratic levels due to the ramping up and down of the pumps for each cycle, the rates appear to be consistent with the discharge rates observed during the draw-down testing.

    - The Mission Control system website records run time data for each of the pumps at the station. Pump station data for the most recent year (May 3, 2017 through May 3, 2018) showed an average combined run time of 613 minutes per day. The pumps appear to run fairly evenly on a daily basis, resulting in an average pump discharge rate of 502 gpm (based on the discharge rates for each pump taken during draw-down testing). Utilizing the average discharge rate of 502 gpm for the station and the run time data from this past year, it is estimated that the average daily flow (ADF)

currently handled by the station is approximately 214 gpm. This estimate is consistent with the average influent flow of 206 gpm estimated during the draw down testing. The pump run time data is presented in Appendix C.

- The Mission Control system website also records the number of pump starts at the station. Utilizing the same time period as above, the pumps show an average of 31 starts per day. The 2013 pump station evaluation showed an average of 50 starts per day, or approximately twice per hour. The decrease in starts indicates that the suggested improvements that were implemented have improved the efficiency at the station.

- Based on the above data, Pump No. 2 appears to be discharging at a lower rate than Pump No. 1 (477 gpm for Pump No. 2 versus 527 gpm for Pump No. 1). The difference in pump discharge rate is likely due to wear on the pump impellers as a result of grit and excessive run times. We recommend that if the current pumps are to remain in service, new impellers once again be installed on both pumps.

- During the station inspection, the mechanical seals on the pumps were noted to be showing signs of wear. It is recommended that the mechanical seals be replaced in conjunction with the replacement of the pump impellers.

- The velocity in the 6-inch force main with one pump running at the current pumping rate of approximately 500 gpm is approximately 5 feet per second (fps), which is at the upper limit of the recommended velocity range of 3 to 5 fps for sewer pump station force mains. Therefore, any proposed increase in pump discharge rate through the existing force main would create velocities greater than 5 fps and would result in greater head loss and pressure in the system and increased concerns of scour and wear within the existing 6-inch force main.

- With an approximate pump discharge rate of 500 gpm and an ADF of approximately 210 gpm, the pumps are currently only capable of keeping up with a peak flow of approximately 2.4 times the ADF. Using the industry standard "Ratio of Extreme Flow to Average Daily Flow" figure from TR-16, a peaking factor of approximately 4.6 is recommended for the current ADF, which indicates that the current pump rate is insufficient to accommodate reasonably expected peak flows.

    - Based on this information, if we were designing this pump station today for the current ADF, we would recommend 1) a minimum pumping rate of 950 gpm (approx. 1.3 MGD) to accommodate peak flows and 2) a 10-inch DI force main to maintain velocities between 3 and 5 feet per second (fps).

        - The pump station as it currently operates is more suited for an ADF of approximately 100 gpm, less than half of the actual ADF, in order to accommodate anticipated peak flows. In theory, these pumps run about twice as often as they should, which has a significant impact on their life expectancy.

    - To account for additional future flows, this larger force main size could accommodate a pump discharge rate of up to 1,300 gpm without exceeding the recommended velocity range. It is recommended that the any new pumps include VFDs and a maximum pumping rate of 1,300 gpm.

        - Based on the "Ratio of Extreme Flow to Average Daily Flow" figure from TR-16 this increased pumping rate would accommodate an ADF of approximately 310 gpm, which reflects an increase of 100 gpm (144,000 gpd) from the current ADF.

        - Due to the comparable head conditions under the proposed increased pumping rates with the larger force main, an increase in pump motor horsepower is not anticipated. As

a result, the existing pump station components (control panel, generator, etc.) would most likely be able to handle the higher capacity pumps.

- Considering the proposed increased pumping rates and force main diameter, we were also asked to review impacts to existing downstream gravity sewers in the system. As detailed above, the existing force main discharges to a 12-inch gravity sewer in Rustcraft Road which extends for approximately 2,000 linear feet along Rustcraft Road, Central Avenue, and McKinley Avenue before discharging to a 21-inch gravity sewer in Fairbanks Road. Utilizing the existing Dedham Sewer System Model (XPSWMM) developed by Weston & Sampson in 2016, we analyzed the impact that modifications to the pumping rates at the Rustcraft Road Pump Station would have on the downstream gravity sewers.

    - The analysis consisted of introducing pumping rates of 500, 950, and 1,300 gpm into Scenario 4 and Scenario 1 from the 2016 model.

        - Scenario 4 represents average daily dry weather flow plus projected 5 Year – 24-hour inflow and was used to check for system capacity under the various pumping scenarios.

        - Scenario 1 represents average daily dry weather flow and was used to check for adequate velocities under low flow conditions.

    - The results revealed that under Scenario 4 of the 2016 model, the existing 12-inch gravity sewer downstream of the Rustcraft Road force main is close to capacity with the current pump discharge rate of 500 gpm and will surcharge under either of the proposed increased pumping rates of 950 or 1,300 gpm.

    - Replacing the existing 12-inch gravity sewer with a 15-inch PVC line will eliminate the surcharge condition, but under Scenario 4 segments of the system would be flowing above the 80% design flow for the potential future 1,300 gpm pumping rate.

    - Replacing the existing 12-inch gravity sewer with an 18-inch PVC line will obviously also eliminate the surcharge condition, but the system will not exceed 50% flow capacity along its entire length for the 1,300 gpm pumping rate under Scenario 4.

    - Under Scenario 1 of the 2016 model, the flow velocities in the proposed 18-inch gravity sewer on Rustcraft Road are above 2.0 FPS for all the pumping rates analyzed.

    - The 21 to 36-inch gravity interceptor sewers downstream of Rustcraft Road to the MWRA tie-in at Maverick Street do not show any surcharged conditions under any of the pumping rates or flow scenarios analyzed, therefore we do not recommend upgrades to any of these lines

    - Based on this analysis, we recommend that in conjunction with any increase in pumping capacity and force main diameter, the approximate 2,000 feet of 12-inch downstream gravity sewer be replaced with 18-inch PVC sewer. See Appendix D for profiles and analysis results generated using the 2016 Sewer System Model.

        - If the town were to move forward with the alternative to upgrade the pumps, force main, and downstream gravity sewers, it is recommended that the new 10-inch force main be installed adjacent to the existing 6-inch force main, in order to allow for flexibility of the pump station to operate on either force main and provide a bypass/backup option in an emergency event, or during service to either force main.

Estimated Costs

The following table displays the recommended short-term improvements and their estimated costs, including labor and materials. These improvements would simply bring the station back to its design capacity and help to better accommodate current flows to the station.

Short-Term Recommendations	Estimated Cost
Replace the current slide rail system	$4,000
Replace the impellers and mechanical seals on both pumps	$8,000
Subtotal	$12,000
15% Contingencies	$1,800
Total	$13,800

Consideration to bring any additional flow to the station would require significant upgrades as discussed herein. **A planning level estimated cost for upgrading the existing pumps, installing 3,100 linear feet of new 10-inch DI force main, and replacing 2,000 linear feet of 12-inch PVC gravity sewer with 18-inch PVC gravity sewer, including engineering services during design and construction, is approximately $3.2M.**

Summary/Conclusions

Based on the analysis performed and as discussed herein, the Rustrcraft Road Pump Station is currently undersized to properly and efficiently handle existing flow to the station. The current pump rate in connection with the current average daily flows leads to excessive pump run times, thereby shortening the life of the pumps and other appurtenances. Additionally, the pump station can't currently handle peak flows for any period of time. The Town is fortunate that no recorded sanitary sewer overflow has occurred to date in this area.

Any addition of flow to this station would further reduce the life expectancy of the station and would further compromise the ability of the pumps to accommodate average and peak flows, thereby creating the potential for surcharge conditions and possible overflows in the tributary sewers. Before any additional flow to this station is approved, higher capacity pumps are required as discussed herein. Also as discussed herein, with the existing force main at the maximum recommended velocity and the downstream gravity sewers at or near capacity, installation of larger diameter force main and gravity sewer is required in conjunction with the installation of the higher capacity pumps.

Please feel free to contact me if you would like to discuss the observations and recommendations in this report. I may be reached at 978.532.1900 extension 2409.

Very truly yours,
WESTON & SAMPSON ENGINEERS, INC.

Steven K. Pedersen, P.E.
Senior Associate

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Legend

- Sewer Manholes
- Pump Station
- Force Main
- Sewer Pipe

FIGURE 1

TOWN OF DEDHAM, MASSACHUSETTS
RUST CRAFT ROAD PUMP STATION EVALUATION

RUST CRAFT ROAD PUMP STATION
FORCE MAIN AND DOWNSTREAM SEWER

JULY 2018 | SCALE: NOTED

Weston & Sampson

APPENDIX A

Pump Station Evaluation Site Photographs

Rustcraft Road Pump Station Exterior (Front)

Rustcraft Road Pump Station Exterior (Side) and Wet Well/Valve Vault

Bypass Connection

Wet Well (Inside)

Control Panel

Control Panel Interior

Variable Frequency Drives (VFD's)

Mission Control Panel

Automatic Transfer Switch

Panel Board

Muffin Monster Control Panel

Protein Matrix Grease Control

Standby Generator

Discharge Piping

Discharge Piping

Backflow Preventer

Sump Pump

APPENDIX B

Pump Station Evaluation Report Log

5 Centennial Drive, Peabody, MA 01960 (HQ)
Tel: 978.532.1900

PUMP STATION EVALUATION REPORT

DATE/TIME: *Thursday May 3rd, 2018 – 7:00 a.m.*

INSPECTOR(S): *Sal Ferrera, Michael Paulin, Ryan Henley*

JOB NAME: *Rustcraft Road Pump Station Evaluation - 2018*

STATION NAME: *Rustcraft Road Pump Station*

LOCATION: *Rustcraft Road, Dedham, MA*

ENGINEER: *Weston & Sampson*

PEOPLE PRESENT AT EVALUATION:

Sal Ferrera

Michael Paulin

Ryan Henley

STATION LAYOUT: *Duplex submersible pump station, controls, concrete building/generator structure, station is approximately ten (10) years old*

LIQUID BEING PUMPED: *Sanitary sewage*

COMMENTS: *Station building and exterior are still in good condition, interior components also were observed to be in good condition*

MOTOR # 1

MANUFACTURER: *Myers*

MODEL NUMBER: *4RC 400 M2-43*

SERIAL NUMBER: *N/A*

VOLTAGE: *480* PHASE: *3* AMPS: *56*

HORSEPOWER: *40* HERTZ: *60*

CONDITION OF CABLE JACKET: GOOD *X* FAIR _____ POOR _____

GROUND RESISTANCE? *Good*

SUPPLY VOLTAGE: L1:L2 *485* L2:L3 *48* L3:L1 *485*

AMPERAGE PUMP MOTOR: (BLACK)L1: *40* (RED)L2: *40* (WHITE)L3: *40*

RPM: *N/A* TYPE: _____ SERVICE FACTOR: *1:2*

PUMP # 1

MANUFACTURER: *Myers*

MODEL NUMBER: *4RC 400 M2-43*

SERIAL NUMBER: *N/A*

GPM: *500* TDH: *120* SIZE: *4"*

GAUGE READINGS: SUCTION PRESSURE (ft/psi): *N/A*

DISCHARGE PRESSURE (ft/psi) *N/A*

RUNNING TIME METER (hours): *N/A*

CONDITION OF EQUIPMENT: GOOD: *X* FAIR: _____ POOR: _____

FLOW TEST: START LEVEL: *6.7* FINISH LEVEL: *5.0*

TIME SPAN: *7:40* GALLONS/INCH: _____

GALLONS/MIN: *265* PRESSURE: _____

SHUT-OFF PSI: _____ DISCHARGE LINE FULL? _____

VIBRATION

MOTOR: UPPER BEARING: _____ (inches/sec)

LOWER BEARING: _____ (inches/sec)

PUMP: UPPER BEARING: _____ (inches/sec)

LOWER BEARING: _____(inches/sec)

MOTOR # 2

MANUFACTURER: *Myers*

MODEL NUMBER: *4RC 400 M2-43*

SERIAL NUMBER: *N/A*

VOLTAGE: *480* PHASE: *3* AMPS: *56*

HORSEPOWER: *40* HERTZ: *60*

CONDITION OF CABLE JACKET: GOOD*X* FAIR _____ POOR_____

GROUND RESISTANCE? *Good*

SUPPLY VOLTAGE: L1:L2 *485* L2:L3 *48* L3:L1 *485*

AMPERAGE PUMP MOTOR: (BLACK)L1: *40* (RED)L2: *40* (WHITE)L3: *40*

RPM: *N/A* TYPE: _____ SERVICE FACTOR: *1:2*

PUMP # 2

MANUFACTURER: *Myers*

MODEL NUMBER: *4RC 400 M2-43*

SERIAL NUMBER: *N/A*

GPM: *500* TDH: *120* SIZE: *4"*

GAUGE READINGS: SUCTION PRESSURE (ft/psi): *N/A*

DISCHARGE PRESSURE (ft/psi) *N/A*

RUNNING TIME METER (hours): *N/A*

CONDITION OF EQUIPMENT: GOOD: *X* FAIR: _____ POOR:_____

FLOW TEST: START LEVEL: *6.7* FINISH LEVEL: *5.0*

TIME SPAN (MIN): *8:20* GALLONS/FOOT: _____

GALLONS/MIN: *259* PRESSURE: _____

SHUT-OFF PSI: _____ DISCHARGE LINE FULL? _____

PUMP/LEVEL CONTROL PANEL

MANUFACTURER: _____

_____

MODEL NUMBER: _____

SERIAL NUMBER: _____

TYPE: _____ AMP RATING: _____

COMMENTS: _____

_____

ALARMS:

HIGH WATER: _____ PUMP FAIL: _____

LOW WATER: _____ MOISTURE: _____

TEMPERATURE: _____ OTHER: _____

TYPE: _____

_____

MOTOR CONTROL CENTER (MCC)

MANUFACTURER: _____

SERIAL NUMBER: _____

MAIN: _____

LAYOUT DESCRIPTION: _____

_____

MOTOR STARTERS/VFD (S): *SMVector Lenze AC Tech*

ALL WIRES LABELED (TAGGED)?: *Color braided*

LAYOUT SKETCH:

STAND-BY GENERATOR (IF APPLICABLE)

ENGINE

MANUFACTURER: *Cummins*

MODEL NUMBER: *GGLA*

SERIAL NUMBER: *A080150652*

GENERATOR

MANUFACTURER: *Cummins*

MODEL NUMBER: *GGLA-6382433*

SERIAL NUMBER: *A080150652*

RATING: *125 kW*

AUTOMATIC TRANSFER SWITCH

MANUFACTURER: *Cummins*

MODEL NUMBER: *OTB CB-6382434*

SERIAL NUMBER: *A080150652*

DATA WITH GENERATOR RUNNING (Did not perform Generator Test)

RPM: VOLTS AMPS

FREQUENCY (HERTZ) OIL TEMP (DEGREES)

OIL PRESSURE ( ) WATER TEMP (DEGREES)

RUN TIME (HOURS)

LEAKS OR UNUSUAL ACTIVITY, DESCRIBE:

MISCELLANEOUS EQUIPMENT

FLOW METER

MANUFACTURER: *Siemens*

MODEL NUMBER: *7ME6910-1AA10-1AA0*

SERIAL NUMBER: *7ME652 894002N487*

RATING AMP: _____ VOLT: *115/230*

UNIT HEATER

MANUFACTURER: *Marley*

MODEL NUMBER: *UH 1548*

SERIAL NUMBER: _____

RATING AMP: _____ VOLT: _____

VENTILATION SYSTEM

MANUFACTURER: *Fasco*

MODEL NUMBER: _____

SERIAL NUMBER: _____

RATING AMP: _____ VOLT: _____

DEHUMIDIFIER

MANUFACTURER: _____

MODEL NUMBER: _____

SERIAL NUMBER: _____

RATING AMP: _____ VOLT: _____

SUMP PUMP

MANUFACTURER: *Everbilt*

MODEL NUMBER: *UT03301*

SERIAL NUMBER: *092140*

RATING AMP: *3.0* VOLT: *115*

TELEMETRY

DESCRIBE SYSTEM: *Mission Control Telemetry System*

MANUFACTURER: *Mission Communications*

MODEL NUMBER: _____

SERIAL NUMBER: _____

BACKFLOW PREVENTER

MANUFACTURER: _____

MODEL NUMBER: _____

SERIAL NUMBER: _____

DATE OF LAST INSPECTION: _____

COMMENTS: _____

_____

OTHER (GREASE CONTROL CHEMICAL PUMP)

MANUFACTURER: *Chem-Tech (XP Series)*

MODEL NUMBER: *N/A*

SERIAL NUMBER: *N/A*

RATING AMP: *N/A* VOLT: *N/A*

FINAL CHECK

ARE PUMPS INSTALLED PROPERLY? *YES*

DO CHECK VALVES OPERATE CORRECTLY? *YES*

NOISE LEVEL: HIGH _____ MEDIUM _____ LOW *X*

LEAKS? *None noted*

_____

WETWELL

CONDITION OF WALLS, ETC. *Good, some debris noted on walls*

ADDITONAL COMMENTS: *-Slide rail system for pumps needs replacement*

-Recommend redirecting Protein Matrix drip to manhole upstream of wet well

-Recommend force main upgrade to larger diameter pipe

APPENDIX C

Pump Station Run Time Data

Dedham, Massachusetts
Rustcraft Road Pump Station
Pump Run Time Data (Summary)

Month	Total Daily Runtime (Minutes)	Ave. Daily Flow * (Gal./Min.)	Max. Daily Flow * (Gal./Min.)
May 2017	19,265	232	301
June 2017	20,371	237	325
July 2017	21,889	246	342
August 2017	21,042	237	312
September 2017	16,225	189	215
October 2017	15,813	178	265
November 2017	15,695	182	267
December 2017	18,976	213	264
January 2018	19,029	214	314
February 2018	17,844	222	274
March 2018	19,430	219	456
April 2018	17,369	202	399
May 2018	1,537	179	183
Total	224,483	212	456

*Based on pump rate of 502 gallons/minute calculated during draw down testing

Dedham, Massachusetts

Rustcraft Road Pump Station

Pump Run Time Data

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
5/3/2017	310	30	309	30	618	310,572	216
5/4/2017	312	29	310	30	622	312,229	217
5/5/2017	374	29	365	30	757	380,330	264
5/6/2017	370	29	367	29	738	370,436	257
5/7/2017	335	30	341	30	676	339,399	236
5/8/2017	303	31	303	30	607	304,696	212
5/9/2017	308	31	294	31	609	305,650	212
5/10/2017	308	31	294	30	602	302,335	210
5/11/2017	315	30	306	31	621	311,777	217
5/12/2017	324	31	339	30	663	332,719	231
5/13/2017	369	29	360	29	729	365,966	254
5/14/2017	441	29	421	30	862	433,012	301
5/15/2017	352	31	368	31	720	361,497	251
5/16/2017	315	29	321	29	636	319,260	222
5/17/2017	315	30	323	30	638	320,264	222
5/18/2017	327	30	322	30	649	325,789	226
5/19/2017	344	31	362	29	723	363,305	252
5/20/2017	339	29	331	30	670	336,235	233
5/21/2017	349	30	323	30	672	337,390	234
5/22/2017	310	30	304	31	614	308,312	214
5/23/2017	335	31	308	30	642	322,524	224
5/24/2017	309	30	318	31	626	314,589	218
5/25/2017	321	30	312	30	633	317,854	221
5/26/2017	340	31	340	31	680	341,558	237
5/27/2017	332	29	330	29	662	332,368	231
5/28/2017	353	29	312	28	665	334,075	232
5/29/2017	333	28	331	29	664	333,473	232
5/30/2017	324	31	296	30	620	311,526	216
5/31/2017	338	31	311	31	649	325,839	226
6/1/2017	332	29	304	30	636	319,210	222
6/2/2017	350	30	305	30	656	329,304	229
6/3/2017	359	30	316	29	676	339,349	236
6/4/2017	384	30	329	31	714	358,383	249
6/5/2017	359	30	316	30	675	338,997	235
6/6/2017	447	32	352	31	799	401,071	279
6/7/2017	386	31	299	31	685	343,869	239
6/8/2017	350	30	288	30	638	320,214	222
6/9/2017	352	30	308	31	660	331,564	230
6/10/2017	380	31	317	31	697	349,795	243
6/11/2017	371	31	289	30	660	331,263	230
6/12/2017	327	30	273	31	601	301,582	209

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
6/13/2017	365	31	296	31	660	331,615	230
6/14/2017	373	31	277	30	649	325,990	226
6/15/2017	354	30	260	31	613	307,910	214
6/16/2017	477	28	353	28	931	467,615	325
6/17/2017	373	31	287	31	660	331,213	230
6/18/2017	373	29	273	30	646	324,182	225
6/19/2017	392	31	305	30	697	350,247	243
6/20/2017	366	28	285	29	651	326,894	227
6/21/2017	366	30	280	29	646	324,433	225
6/22/2017	355	30	278	30	633	317,703	221
6/23/2017	375	30	273	30	648	325,538	226
6/24/2017	403	29	299	29	701	352,205	245
6/25/2017	411	27	295	28	706	354,365	246
6/26/2017	385	30	273	30	658	330,560	230
6/27/2017	388	29	282	29	670	336,687	234
6/28/2017	403	29	286	29	688	345,727	240
6/29/2017	399	29	297	29	696	349,745	243
6/30/2017	416	31	300	32	724	363,556	252
7/1/2017	397	30	292	29	688	345,727	240
7/2/2017	381	28	283	28	664	333,523	232
7/3/2017	342	29	256	30	598	300,075	208
7/4/2017	318	29	241	29	559	280,690	195
7/5/2017	368	30	254	29	622	312,128	217
7/6/2017	369	30	245	30	613	308,010	214
7/7/2017	426	29	270	29	696	349,343	243
7/8/2017	439	29	309	32	776	389,872	271
7/9/2017	411	31	270	31	681	341,960	237
7/10/2017	382	30	250	30	631	316,950	220
7/11/2017	398	31	272	30	671	336,737	234
7/12/2017	414	30	260	30	675	338,796	235
7/13/2017	397	30	276	31	673	338,194	235
7/14/2017	416	31	256	30	672	337,490	234
7/15/2017	451	29	265	29	716	359,488	250
7/16/2017	419	30	264	30	682	342,613	238
7/17/2017	399	30	250	30	649	326,090	226
7/18/2017	438	22	361	22	982	493,329	343
7/19/2017	455	31	290	31	745	373,901	260
7/20/2017	438	31	293	31	731	367,121	255
7/21/2017	437	29	270	29	707	355,118	247
7/22/2017	425	28	274	29	699	351,251	244
7/23/2017	441	28	280	28	720	361,748	251
7/24/2017	497	26	336	27	881	442,605	307
7/25/2017	418	31	270	30	688	345,325	240
7/26/2017	423	29	279	30	702	352,657	245
7/27/2017	460	28	271	28	730	366,770	255

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
7/28/2017	453	29	331	31	784	393,890	274
7/29/2017	498	27	291	27	788	395,949	275
7/30/2017	458	28	301	29	770	386,909	269
7/31/2017	431	28	263	28	694	348,740	242
8/1/2017	463	29	269	28	739	371,240	258
8/2/2017	544	27	297	27	895	449,334	312
8/3/2017	478	29	282	29	760	381,786	265
8/4/2017	443	28	317	27	760	381,535	265
8/5/2017	521	26	282	27	803	403,130	280
8/6/2017	467	29	269	28	736	369,733	257
8/7/2017	411	29	249	29	660	331,363	230
8/8/2017	411	31	262	32	681	342,111	238
8/9/2017	416	29	257	29	673	337,892	235
8/10/2017	413	29	239	29	652	327,446	227
8/11/2017	424	29	228	28	652	327,446	227
8/12/2017	458	28	257	28	716	359,337	250
8/13/2017	438	28	253	29	691	346,782	241
8/14/2017	402	30	246	29	647	325,035	226
8/15/2017	405	29	252	29	657	329,807	229
8/16/2017	414	29	252	29	666	334,477	232
8/17/2017	425	28	246	29	672	337,239	234
8/18/2017	439	30	236	29	675	339,047	235
8/19/2017	421	29	268	32	705	353,913	246
8/20/2017	431	29	241	29	672	337,290	234
8/21/2017	400	30	235	29	634	318,607	221
8/22/2017	429	29	251	29	680	341,709	237
8/23/2017	442	28	241	29	683	343,216	238
8/24/2017	410	30	235	29	645	323,981	225
8/25/2017	426	29	243	29	670	336,235	233
8/26/2017	417	29	246	30	664	333,372	232
8/27/2017	396	30	223	29	619	310,823	216
8/28/2017	390	30	224	30	614	308,563	214
8/29/2017	128	12	471	56	639	320,767	223
8/30/2017	0	0	535	66	535	268,888	187
8/31/2017	8	9	540	77	549	275,567	191
9/1/2017	171	27	369	96	548	275,366	191
9/2/2017	238	34	318	34	556	279,032	194
9/3/2017	255	35	331	35	586	294,450	204
9/4/2017	235	35	289	34	523	262,710	182
9/5/2017	221	34	282	34	503	252,766	176
9/6/2017	232	34	294	34	525	263,865	183
9/7/2017	252	35	335	36	615	308,613	214
9/8/2017	241	36	326	36	567	284,858	198
9/9/2017	228	35	319	35	547	274,713	191
9/10/2017	229	33	294	33	523	262,760	182

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
9/11/2017	219	33	292	33	511	256,734	178
9/12/2017	240	33	300	33	540	271,248	188
9/13/2017	236	35	319	35	555	278,530	193
9/14/2017	242	35	297	35	539	270,645	188
9/15/2017	247	34	305	35	552	277,124	192
9/16/2017	229	35	327	34	556	279,032	194
9/17/2017	221	35	294	36	515	258,843	180
9/18/2017	218	34	291	33	508	255,328	177
9/19/2017	220	34	289	35	509	255,529	177
9/20/2017	244	35	318	35	570	286,314	199
9/21/2017	247	35	299	34	545	273,910	190
9/22/2017	240	34	316	36	556	279,083	194
9/23/2017	253	35	288	34	541	271,599	189
9/24/2017	236	34	295	35	531	266,879	185
9/25/2017	226	35	262	34	487	244,731	170
9/26/2017	234	33	266	35	505	253,469	176
9/27/2017	248	37	316	37	564	283,201	197
9/28/2017	231	34	282	34	512	257,286	179
9/29/2017	231	35	284	36	519	260,551	181
9/30/2017	268	33	340	32	615	309,065	215
10/1/2017	230	33	274	33	504	253,017	176
10/2/2017	220	34	253	34	473	237,348	165
10/3/2017	227	33	267	33	494	248,196	172
10/4/2017	204	34	251	35	455	228,710	159
10/5/2017	204	35	245	35	449	225,546	157
10/6/2017	217	37	274	36	505	253,369	176
10/7/2017	223	36	277	35	500	250,908	174
10/8/2017	239	36	292	36	531	266,828	185
10/9/2017	255	35	290	36	556	279,384	194
10/10/2017	207	35	257	35	463	232,728	162
10/11/2017	223	36	267	34	508	254,976	177
10/12/2017	204	34	256	34	460	231,071	160
10/13/2017	196	32	290	33	486	243,877	169
10/14/2017	217	35	285	34	502	252,164	175
10/15/2017	210	33	322	34	533	267,431	186
10/16/2017	197	33	262	32	459	230,468	160
10/17/2017	217	33	294	33	511	256,784	178
10/18/2017	228	32	271	33	499	250,757	174
10/19/2017	226	33	255	33	481	241,416	168
10/20/2017	242	33	282	33	523	262,811	183
10/21/2017	251	34	283	34	534	268,134	186
10/22/2017	243	34	285	34	528	265,322	184
10/23/2017	232	34	254	33	486	244,078	169
10/24/2017	235	33	260	33	495	248,548	173
10/25/2017	254	34	297	34	551	276,521	192

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
10/26/2017	249	34	291	34	541	271,449	189
10/27/2017	218	33	271	33	489	245,785	171
10/28/2017	227	33	277	33	504	253,017	176
10/29/2017	266	33	322	34	588	295,254	205
10/30/2017	285	35	431	33	759	381,284	265
10/31/2017	202	32	246	32	447	224,592	156
11/1/2017	186	31	247	32	433	217,310	151
11/2/2017	208	34	255	32	476	239,257	166
11/3/2017	201	33	263	34	465	233,280	162
11/4/2017	221	35	295	35	517	259,496	180
11/5/2017	221	34	281	34	503	252,515	175
11/6/2017	202	33	257	33	459	230,669	160
11/7/2017	297	48	280	34	669	335,733	233
11/8/2017	193	34	310	35	502	252,314	175
11/9/2017	194	34	319	33	513	257,588	179
11/10/2017	211	33	335	34	546	274,412	191
11/11/2017	204	33	353	33	557	279,735	194
11/12/2017	205	33	348	32	554	277,978	193
11/13/2017	190	33	288	33	478	240,110	167
11/14/2017	196	33	303	33	499	250,356	174
11/15/2017	199	33	299	33	497	249,803	173
11/16/2017	196	33	322	34	518	260,149	181
11/17/2017	199	33	293	33	492	246,991	172
11/18/2017	208	34	338	33	546	274,161	190
11/19/2017	219	33	352	34	571	286,666	199
11/20/2017	199	33	296	33	495	248,347	172
11/21/2017	212	34	304	33	516	259,245	180
11/22/2017	222	33	369	33	591	296,761	206
11/23/2017	164	29	238	29	402	201,691	140
11/24/2017	213	32	330	32	543	272,654	189
11/25/2017	220	34	355	34	574	288,474	200
11/26/2017	197	31	316	31	513	257,437	179
11/27/2017	186	31	302	32	487	244,681	170
11/28/2017	198	33	306	32	504	253,017	176
11/29/2017	198	33	313	33	512	257,035	178
11/30/2017	274	21	329	25	765	384,347	267
12/1/2017	183	31	331	31	514	257,889	179
12/2/2017	195	30	367	30	561	281,945	196
12/3/2017	197	31	368	30	565	283,703	197
12/4/2017	191	29	365	29	556	279,032	194
12/5/2017	198	29	379	30	577	289,679	201
12/6/2017	220	31	404	31	625	313,685	218
12/7/2017	197	29	389	29	586	294,400	204
12/8/2017	202	30	413	30	615	308,764	214
12/9/2017	212	30	414	30	626	314,388	218

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
12/10/2017	195	29	407	29	602	302,084	210
12/11/2017	195	30	362	29	557	279,484	194
12/12/2017	205	30	417	30	622	312,580	217
12/13/2017	204	30	429	31	633	317,653	221
12/14/2017	202	29	443	29	645	323,981	225
12/15/2017	215	29	477	29	692	347,434	241
12/16/2017	194	26	538	26	732	367,774	255
12/17/2017	222	30	428	29	650	326,643	227
12/18/2017	209	30	346	30	555	278,631	193
12/19/2017	201	24	495	40	759	380,932	265
12/20/2017	155	23	457	41	620	311,275	216
12/21/2017	220	31	375	31	594	298,518	207
12/22/2017	213	30	370	31	583	292,793	203
12/23/2017	223	29	459	29	682	342,262	238
12/24/2017	199	29	356	29	555	278,480	193
12/25/2017	180	29	285	29	465	233,632	162
12/26/2017	217	29	398	29	615	308,613	214
12/27/2017	230	30	437	30	668	335,281	233
12/28/2017	211	29	396	29	607	304,796	212
12/29/2017	221	29	413	29	634	318,256	221
12/30/2017	224	29	423	28	647	324,935	226
12/31/2017	226	30	413	30	639	320,716	223
1/1/2018	210	30	384	31	594	298,267	207
1/2/2018	212	31	350	30	562	282,447	196
1/3/2018	221	31	359	32	580	291,086	202
1/4/2018	185	30	297	30	482	242,119	168
1/5/2018	215	31	364	31	579	290,734	202
1/6/2018	225	31	405	30	630	316,397	220
1/7/2018	224	31	367	31	591	297,012	206
1/8/2018	204	30	317	31	521	261,856	182
1/9/2018	218	32	333	31	551	276,722	192
1/10/2018	210	30	348	31	558	280,238	195
1/11/2018	238	31	377	32	615	308,613	214
1/12/2018	246	29	485	29	731	367,021	255
1/13/2018	309	32	569	30	901	452,398	314
1/14/2018	240	30	451	31	690	346,731	241
1/15/2018	230	31	416	30	646	324,634	225
1/16/2018	226	30	376	30	602	302,486	210
1/17/2018	209	30	366	30	575	288,876	201
1/18/2018	213	29	364	29	577	289,579	201
1/19/2018	224	30	380	31	605	303,591	211
1/20/2018	225	29	406	29	631	316,900	220
1/21/2018	219	30	365	29	584	293,195	204
1/22/2018	279	23	360	23	780	391,529	272
1/23/2018	211	28	475	29	686	344,572	239

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
1/24/2018	222	33	365	32	586	294,450	204
1/25/2018	211	31	362	32	573	287,670	200
1/26/2018	224	31	352	31	575	288,976	201
1/27/2018	238	30	431	29	668	335,683	233
1/28/2018	225	29	464	30	688	345,626	240
1/29/2018	205	29	372	29	577	289,780	201
1/30/2018	201	30	327	29	528	265,071	184
1/31/2018	203	29	359	30	562	282,297	196
2/1/2018	222	31	369	30	592	297,162	206
2/2/2018	235	32	434	35	671	336,888	234
2/3/2018	222	29	458	29	680	341,659	237
2/4/2018	209	30	409	29	618	310,421	216
2/5/2018	205	30	410	31	616	309,266	215
2/6/2018	207	30	381	30	588	295,505	205
2/7/2018	203	29	437	28	641	321,721	223
2/8/2018	208	30	409	30	617	309,718	215
2/9/2018	209	30	382	30	591	296,811	206
2/10/2018	200	28	466	29	666	334,226	232
2/11/2018	229	29	556	28	785	394,342	274
2/12/2018	190	29	389	29	579	290,533	202
2/13/2018	199	30	386	29	585	293,597	204
2/14/2018	196	28	423	29	619	310,823	216
2/15/2018	198	29	406	29	604	303,289	211
2/16/2018	201	31	401	30	602	302,436	210
2/17/2018	217	29	429	28	645	324,081	225
2/18/2018	200	27	470	28	670	336,386	234
2/19/2018	208	28	467	27	674	338,696	235
2/20/2018	204	33	408	29	612	307,357	213
2/21/2018	191	37	427	29	618	310,421	216
2/22/2018	206	30	440	29	646	324,433	225
2/23/2018	203	28	458	28	661	332,067	231
2/24/2018	211	33	496	28	707	355,219	247
2/25/2018	209	27	525	26	734	368,377	256
2/26/2018	204	29	396	30	600	301,230	209
2/27/2018	206	31	417	29	623	312,631	217
2/28/2018	204	29	397	29	601	302,034	210
3/1/2018	211	30	387	29	598	300,125	208
3/2/2018	393	29	746	24	1308	656,901	456
3/3/2018	230	26	637	27	867	435,323	302
3/4/2018	229	27	584	27	813	408,353	284
3/5/2018	235	31	491	32	726	364,811	253
3/6/2018	288	43	369	33	668	335,532	233
3/7/2018	224	29	478	28	702	352,356	245
3/8/2018	252	32	459	33	734	368,829	256
3/9/2018	239	31	432	31	672	337,340	234

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
3/10/2018	150	20	281	21	431	216,356	150
3/11/2018	247	30	398	30	645	323,680	225
3/12/2018	229	30	323	30	552	277,224	193
3/13/2018	220	32	276	31	496	248,849	173
3/14/2018	276	32	382	31	667	335,180	233
3/15/2018	262	33	341	34	603	302,837	210
3/16/2018	260	33	331	32	591	296,811	206
3/17/2018	252	31	357	32	609	305,801	212
3/18/2018	268	33	345	32	613	307,759	214
3/19/2018	228	32	303	33	531	266,577	185
3/20/2018	233	32	308	32	541	271,449	189
3/21/2018	235	33	290	32	525	263,564	183
3/22/2018	247	33	323	33	570	286,214	199
3/23/2018	240	33	320	33	559	280,891	195
3/24/2018	253	33	331	33	584	293,044	204
3/25/2018	259	33	326	33	586	294,049	204
3/26/2018	227	32	286	33	514	258,040	179
3/27/2018	232	34	281	34	513	257,537	179
3/28/2018	227	32	296	32	523	262,409	182
3/29/2018	241	33	292	33	533	267,532	186
3/30/2018	248	32	327	32	575	288,675	200
3/31/2018	248	32	337	32	585	293,848	204
4/1/2018	232	33	283	32	515	258,692	180
4/2/2018	211	31	274	32	485	243,676	169
4/3/2018	244	32	315	32	558	280,439	195
4/4/2018	237	32	317	32	554	277,978	193
4/5/2018	240	33	299	34	539	270,595	188
4/6/2018	249	34	324	33	572	287,419	200
4/7/2018	271	33	339	33	610	306,554	213
4/8/2018	247	33	335	33	582	292,090	203
4/9/2018	234	33	292	33	525	263,865	183
4/10/2018	220	32	283	33	503	252,515	175
4/11/2018	232	33	292	32	525	263,413	183
4/12/2018	238	33	287	33	524	263,313	183
4/13/2018	243	33	301	33	543	272,905	190
4/14/2018	247	33	320	34	567	284,908	198
4/15/2018	280	34	319	33	599	300,728	209
4/16/2018	433	28	546	30	1145	575,240	399
4/17/2018	254	36	317	36	572	287,168	199
4/18/2018	249	35	317	35	565	283,954	197
4/19/2018	264	34	308	33	571	286,967	199
4/20/2018	264	35	315	34	579	290,583	202
4/21/2018	267	33	324	34	590	296,359	206
4/22/2018	266	33	323	33	589	295,857	205
4/23/2018	249	33	282	32	531	266,427	185

Date	Pump 1		Pump 2		Total Daily Runtime (Minutes)	Ave. Daily (gpd)*	Ave. Daily Flow (gpm)
	Minutes	Starts	Minutes	Starts			
4/24/2018	250	34	306	35	557	279,585	194
4/25/2018	278	33	358	32	636	319,260	222
4/26/2018	270	33	308	34	578	290,182	202
4/27/2018	259	33	316	33	575	288,625	200
4/28/2018	278	34	322	34	600	301,130	209
4/29/2018	259	32	311	32	570	286,063	199
4/30/2018	239	33	272	33	511	256,382	178
5/1/2018	244	33	275	33	519	260,400	181
5/2/2018	237	34	258	34	495	248,548	173
5/3/2018	231	34	279	36	524	263,012	183
Totals	101,715	11,305	121,180	11,553	613	308,031	214

*Based on pump rate of 502 gallons/minute calculated during draw down testing

APPENDIX D

2016 Sewer Model Profiles and Analysis

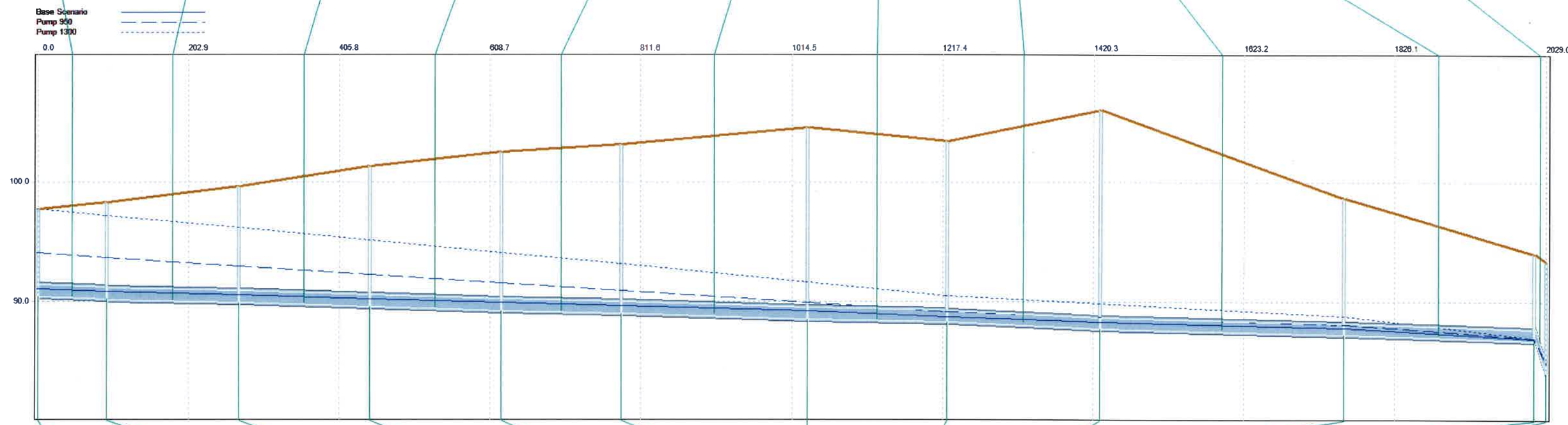
EXISTING 12 INCH GRAVITY SEWER RUSTCRAFT ROAD- System Surcharging Observed For the 950 GPM & 1,300 GPM Pumping Rates

Scenario 4 Model Flows – ADWF + 5 Year 24 Hour Inflow

link Results Velocity Results Flow Ratio

	Link434	Link434	Link434	Link435	Link435	Link435	Link436	Link436	Link436	Link437	Link437	Link437	Link438	Link438	Link438	Link439	Link439	Link439	Link440	Link440	Link440	C-OO1	C-OO1	C-OO1	C-OO1	C-OO1	C-OO1	C-OO1	C-OO1	C-OO1	C-OO9	C-OO9	C-OO9
Scenario	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1
Link Name	Link434			Link435			Link436			Link437			Link438			Link439			Link440			C-OO1			C-OO1			C-OO1			C-OO9		
Design Full	1.530	1.530	1.530	1.220	1.220	1.220	1.490	1.490	1.490	1.390	1.390	1.390	1.350	1.350	1.350	1.400	1.400	1.400	1.200	1.200	1.200	2.400	2.400	2.400	1.740	1.740	1.740	2.080	2.080	2.080	17.900	17.900	17.900
Max Flow	1.119	2.119	2.847	1.119	2.119	2.803	1.119	2.119	2.756	1.119	2.119	2.709	1.119	2.119	2.667	1.119	2.119	2.638	1.119	2.119	2.615	1.119	2.119	2.615	1.129	2.129	2.625	1.265	2.265	2.761	1.275	2.275	2.771
Max Flow/	0.729	1.381	1.860	0.919	1.739	2.302	0.750	1.420	1.848	0.806	1.526	1.952	0.829	1.569	1.977	0.797	1.510	1.880	0.930	1.761	2.173	0.466	0.883	1.090	0.650	1.225	1.511	0.607	1.087	1.325	0.071	0.127	0.155

Conduit Link435 from PP60 to PP50 Conduit Link436 from PP50 to PP40 Conduit Link437 from PP40 to PP30 Conduit Link439 from PP20 to PP10 Conduit C-OO1050 from OO1050 to OO1040 Conduit C-OO1040 from OO1040 to OO930



	PP70	PP70	PP70	PP60	PP60	PP60	PP50	PP50	PP50	PP40	PP40	PP40	PP30	PP30	PP30	PP20	PP20	PP20	PP10	PP10	PP10	OO109	OO109	OO109	OO105	OO105	OO105	OO104	OO104	OO104	OO930	OO930	OO930	OO220	OO220	OO220
Scenario	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump	Base S	Pump	Pump
Node Nam	PP70			PP60			PP50			PP40			PP30			PP20			PP10			OO109			OO105			OO104			OO930			OO220		
Ground Ele	97.750			98.300			99.640			101.35			102.56			103.17			104.60			103.47			106.10			98.685			93.982			93.376		
Maximum	91.390	91.390	91.390	91.190	91.190	91.190	90.910	90.910	90.910	90.550	90.550	90.550	90.240	90.240	90.240	89.970	89.970	89.970	89.520	89.520	89.520	89.270	89.270	89.270	88.668	88.668	88.668	88.198	88.198	88.198	87.710	87.710	87.710	85.750	85.750	85.750
Surcharge	0.000	2.660	6.360	0.000	2.490	6.022	0.000	2.065	5.273	0.000	1.716	4.594	0.000	1.318	3.862	0.000	0.933	3.164	0.000	0.367	2.105	0.000	0.000	1.200	0.000	0.081	1.147	0.000	0.000	0.557	0.000	0.000	0.000	0.000	0.000	0.000

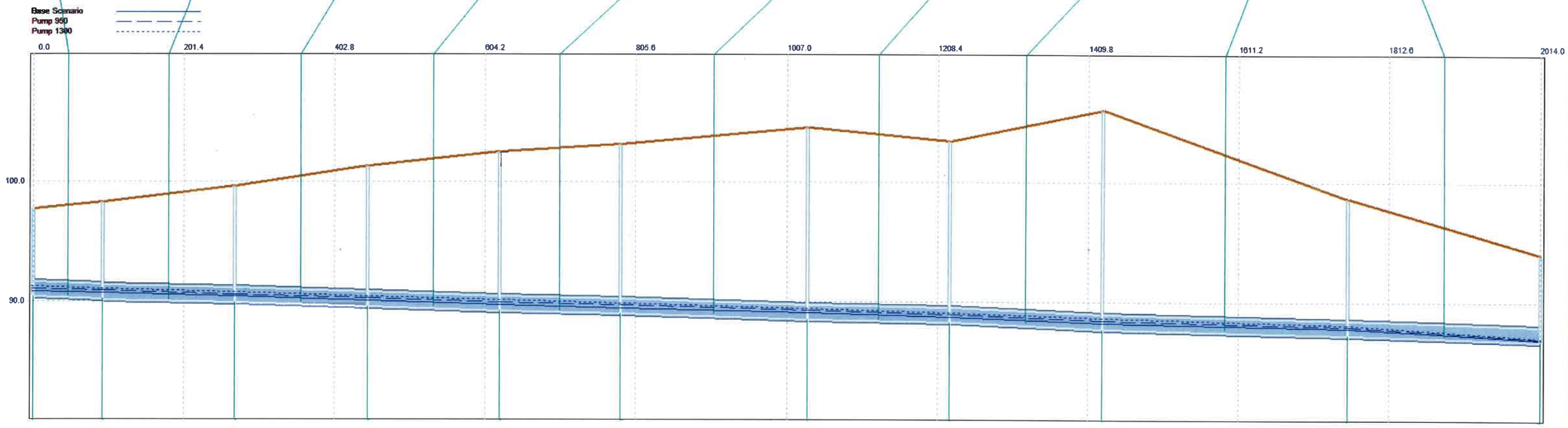
PROPOSED 15 INCH GRAVITY SEWER UPGRADE RUSTCRAFT ROAD - System Flowing Above 80% Design Flow For 1,300 GPM Pumping Rates

Scenario 4 Model Flows – ADWF + 5 Year 24 Hour Inflow

link Results Velocity Results Flow Ratio

	Link434	Link434	Link434	Link435	Link435	Link435	Link436	Link436	Link436	Link437	Link437	Link437	Link438	Link438	Link438	Link439	Link439	Link439	Link440	Link440	Link440	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10
Scenario	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1
Link Name	Link434			Link435			Link436			Link437			Link438			Link439			Link440			C-OO10			C-OO10			C-OO10		
Design Full	3.890	3.890	3.890	3.090	3.090	3.090	3.790	3.790	3.790	3.520	3.520	3.520	3.430	3.430	3.430	3.560	3.560	3.560	3.050	3.050	3.050	4.390	4.390	4.390	3.180	3.180	3.180	3.810	3.810	3.810
Max Flow	1.124	2.147	2.900	1.119	2.119	2.900	1.131	2.119	2.900	1.129	2.119	2.900	1.126	2.119	2.900	1.130	2.119	2.900	1.119	2.119	2.900	1.119	2.119	2.900	1.129	2.129	2.910	1.265	2.265	3.046
Max Flow/	0.292	0.553	0.754	0.362	0.685	0.938	0.300	0.560	0.766	0.321	0.601	0.823	0.329	0.618	0.846	0.318	0.595	0.814	0.366	0.694	0.950	0.255	0.483	0.661	0.355	0.670	0.915	0.332	0.594	0.799

Conduit Link435 from PP60 to PP50 Conduit Link436 from PP50 to PP40 Conduit Link437 from PP40 to PP30 Conduit Link439 from PP20 to PP10 Conduit Link440 from PP10 to OO1090 Conduit C-OO1050 from OO1050 to OO1040 Conduit C-OO1040 from OO1040 to OO930



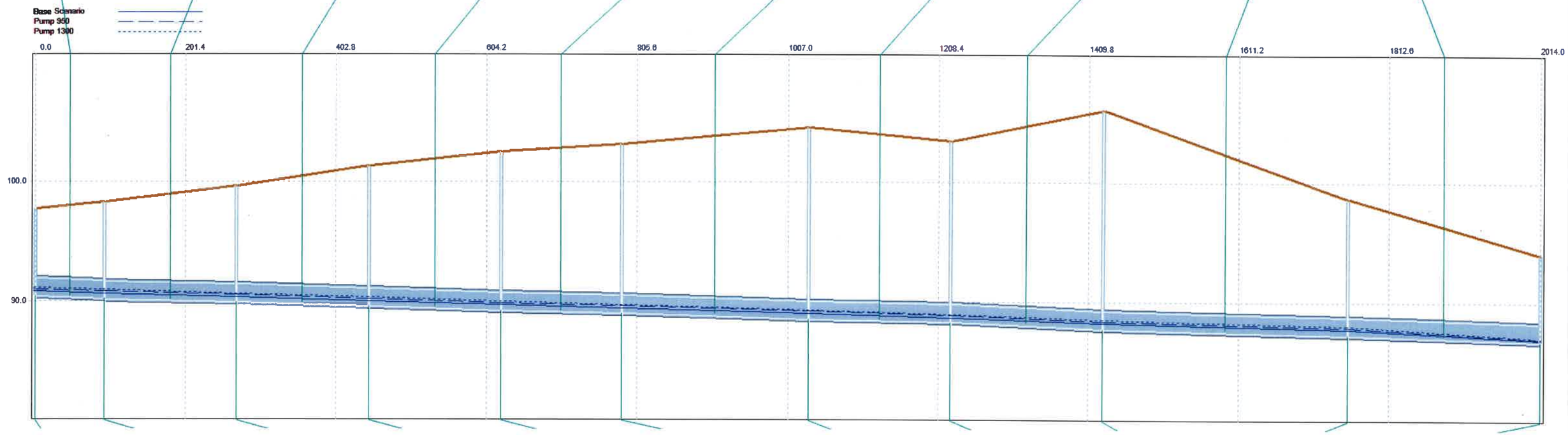
PROPOSED 18 INCH GRAVITY SEWER UPGRADE RUSTCRAFT ROAD - System Flowing At Approximately 50% Design Flow For 1,300 GPM Pumping Rates

Scenario 4 Model Flows – ADWF + 5 Year 24 Hour Inflow

link Results Velocity Results Flow Ratio

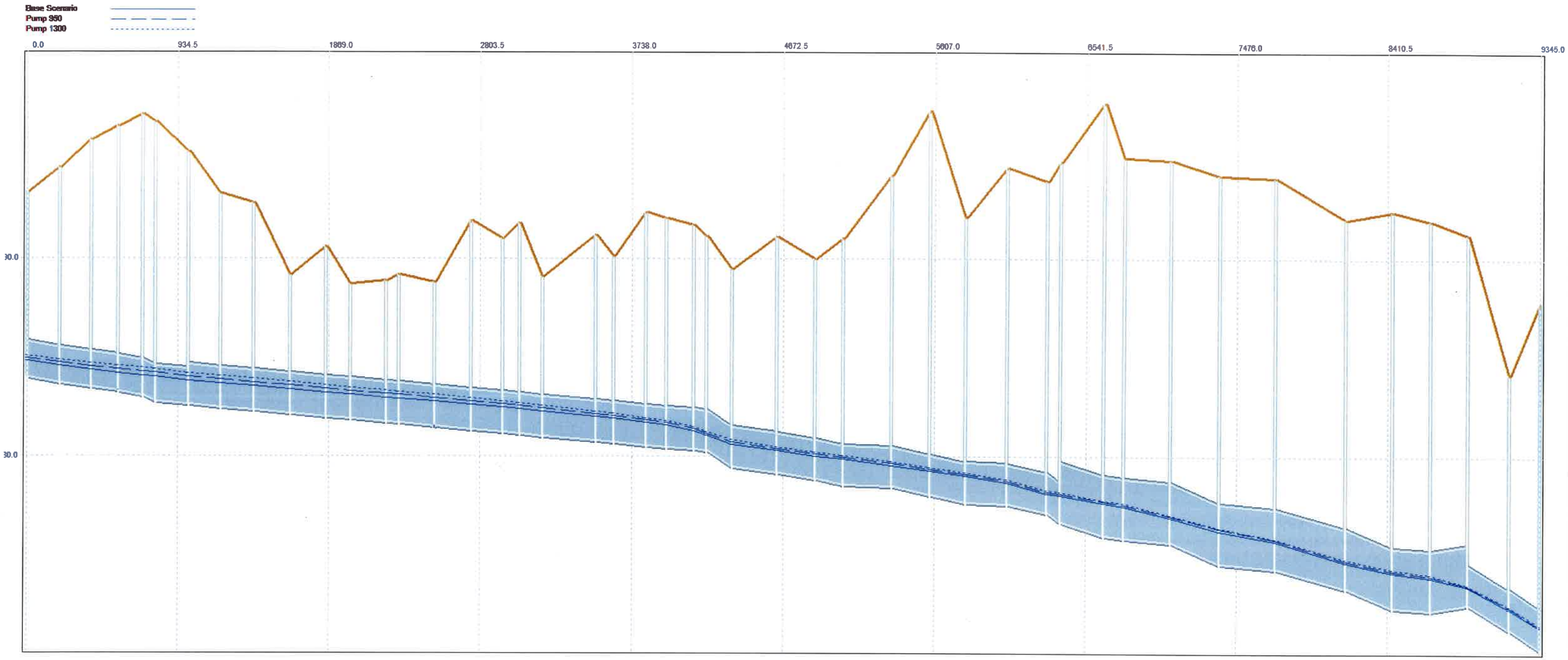
	Link434	Link434	Link434	Link435	Link435	Link435	Link436	Link436	Link436	Link437	Link437	Link437	Link438	Link438	Link438	Link439	Link439	Link439	Link440	Link440	Link440	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10
Scenario	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1	Base Sc	Pump 9	Pump 1
Link Name	Link434			Link435			Link436			Link437			Link438			Link439			Link440			C-OO10			C-OO10			C-OO10		
Design Full	6.330	6.330	6.330	5.030	5.030	5.030	6.160	6.160	6.160	5.730	5.730	5.730	5.570	5.570	5.570	5.790	5.790	5.790	4.970	4.970	4.970	7.140	7.140	7.140	5.170	5.170	5.170	6.200	6.200	6.200
Max Flow	1.120	2.165	2.928	1.126	2.120	2.900	1.142	2.121	2.900	1.139	2.123	2.900	1.141	2.119	2.900	1.148	2.140	2.900	1.122	2.119	2.900	1.128	2.119	2.900	1.141	2.129	2.910	1.265	2.265	3.046
Max Flow/	0.180	0.342	0.468	0.224	0.422	0.577	0.186	0.348	0.471	0.200	0.371	0.506	0.205	0.380	0.520	0.199	0.369	0.501	0.226	0.427	0.584	0.159	0.297	0.406	0.221	0.412	0.563	0.204	0.365	0.491

Conduit Link435 from PP60 to PP50 Conduit Link436 from PP50 to PP40 Conduit Link437 from PP40 to PP30 Conduit Link439 from PP20 to PP10 Conduit Link440 from PP10 to OO1090 Conduit C-OO1050 from OO1050 to OO1040 Conduit C-OO1040 from OO1040 to OO930



EXISTING 21 INCH TO 36 INCH GRAVITY INTERCEPTOR SEWER DOWNSTREAM OF RUSTCRAFT ROAD TO MWRA TIE IN ON MAVERICK STREET – NO SURCHARGING OBSERVED

Scenario 4 Model Flows – ADWF + 5 Year 24 Hour Inflow



PROPOSED 18 INCH GRAVITY SEWER UPGRADE RUSTCRAFT ROAD – ALL SYSTEM FLOW VELOCITIES ABOVE 2.0 FPS

Scenario 1 Model Flows – ADWF

link Pipe Results Velocity link.1 Results Velocity Results Flow Ratio

	Link434	Link434	Link434	Link435	Link435	Link435	Link436	Link436	Link436	Link437	Link437	Link437	Link438	Link438	Link438	Link439	Link439	Link439	Link440	Link440	Link440	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10	C-OO10
Scenario	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch	Base Sc	18 Inch	18 Inch
Diameter (	1.500			1.500			1.500			1.500			1.500			1.500			1.500			1.500			1.500			1.500		
Max Flow	1.120	2.159	2.926	1.125	2.120	2.900	1.140	2.123	2.900	1.139	2.124	2.900	1.140	2.119	2.900	1.146	2.137	2.900	1.122	2.119	2.900	1.120	2.119	2.900	1.134	2.120	2.900	1.129	2.123	2.904
Max Veloci	2.67	3.24	3.50	2.32	2.85	3.12	2.64	3.13	3.42	2.52	3.00	3.25	2.48	2.95	3.21	2.53	3.01	3.24	2.31	2.82	3.10	2.88	3.43	3.71	2.34	2.79	3.04	2.63	3.27	3.65