**BOARD OF TRUSTEES**
**Regular Meeting**
**October 10, 2018**
**7:00 p.m.**

1. CALL MEETING TO ORDER

2. PLEDGE OF ALLEGIANCE

3. ROLL CALL

4. APPROVAL OF AGENDA

5. PRESENTATIONS
   A. Pump Station #7 Service Area Study Report by Gourdie Fraser

6. PUBLIC HEARINGS

7. PUBLIC COMMENT: Restricted to three minutes regarding items on this agenda

8. REPORTS/BOARD COMMENTS
   A. Current List of Boards and Commissions – Appointments as needed

9. CONSENT AGENDA
   A. Communications
   B. Minutes – September 26, 2018- regular meeting
   C. Accounts Payable
   D. Payroll
   E. Meeting Pay
   F. Fire Reports

10. NEW BUSINESS
    A. Discussion/Action: (Gallinat) Sidewalk Committee Recommendation on calling in existing waivers
    B. Discussion/Action: (Smith) Award Bid for Construction Services for Office Remodel at the Isabella Treatment Facility to JBS Contracting
    C. Discussion/Action: (Smith) Deny request to waive quarterly water and sewer penalties for The Crossings on Broadway
    D. Discussion: (Stuhldreher) 2019 Budget Recommendation Discussion

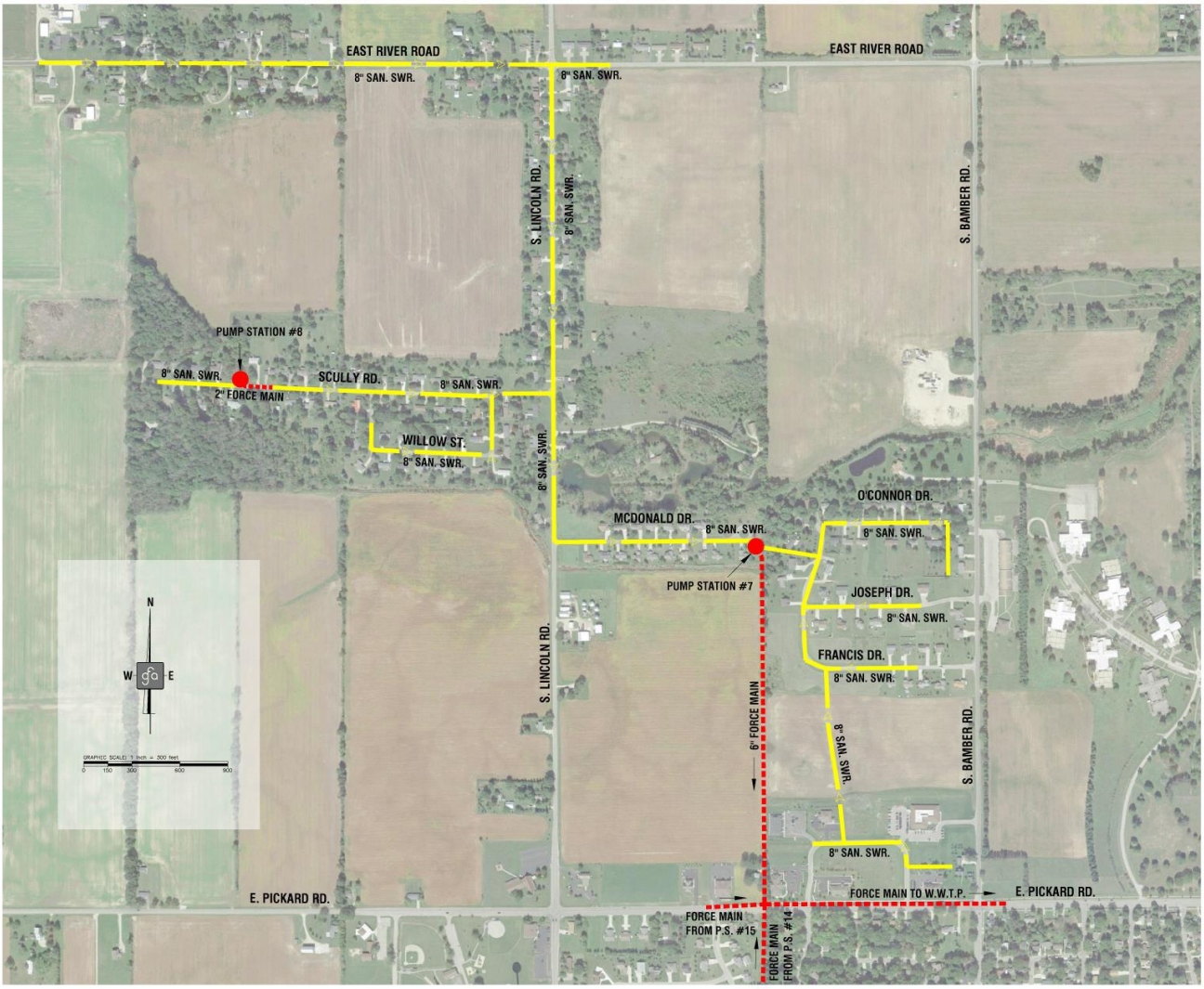
11. EXTENDED PUBLIC COMMENT: Restricted to 5 minutes regarding any issue

12. MANAGER COMMENTS

13. FINAL BOARD MEMBER COMMENT

14. CLOSED SESSION

15. ADJOURNMENT




# Charter Township of Union Pump Station #7 Sanitary Sewer Service Area Study

September 2018


Engineering
Surveying
Testing &
Operations

123 West Front Street
Traverse City, Michigan 49684
231.946.5874 (p)
231.946.3703 (f)

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# EXECUTIVE SUMMARY

As part of the township's dedication to system maintenance and auditing, this report is a close look at the Pump Station 7 & 8 service areas. This system has been in operation for almost 40 years and still operates within the original design parameters. Overall, it is in very good condition and appears to have been well maintained.

Many areas of the storm and sanitary sewer systems within the township were overwhelmed with high flows as a result of the significant rain event that occurred in June 2017. The township is responsible only for the sanitary sewer system and although they are intended to be separate systems, they can be connected via unknown connections above and below the surface. These connections can include:

- Surface flooding entering sanitary sewer manholes.
- Floodplain waters entering sanitary pump stations and sewer manholes
- Groundwater infiltration through breached sanitary sewer pipes and manholes
- Individual private storm leads including footing / roof drains and/or sump pumps

The goal of this study is to examine factors influencing system performance, including:

- System Condition
- System Operations
- External Factors – Impact of Significant Rainfall Events

In conjunction with a thorough system inventory and analysis, we used a range of investigative techniques over the course of this study (including flow monitoring and hydraulic modeling/capacity analysis), to round out this evaluation. The flow monitoring data allowed the team to update and calibrate the township's hydraulic model, which in turn, allowed us to simulate the system's response to differing levels of dry and wet weather (storm) events.

**Flow Monitoring Results**

The open-channel flowmeters performed well during the monitoring periods. All monitoring periods provided solid dry and wet weather flow information generally consistent with data available from corresponding pump stations.

Flow & Capacity

- The existing sanitary sewer main appears to demonstrate more than adequate capacity to meet peak hour flow values during both wet and dry weather conditions during the monitoring

period. No adverse impacts, backups, surcharging was reported or identified by the DPW or residents.

- Pump station #7 and #8 appear to demonstrate more than adequate capacity to meet peak hour flows at firm capacity (largest pump offline) during wet and dry weather conditions during the monitoring period. No adverse impacts, backups, surcharging was reported by the DPW or residents

Sewer Use

- Both service areas exhibit average peaking factors, and should be able to withstand high wet weather inflow.
- Both service areas experienced lower than typical average day flow per their user values during the flow monitoring period that was conducted.

**Inflow & Infiltration (I&I) Study**

As a means of comparison and determine the extent of I/I that was occurring in the system, review of the flow monitoring data was completed to compare the peak hour flow that was recorded during a dry weather condition versus a wet weather (rain event) condition and determined there was some impact (30% increase) in flow monitored in the system during a rain event.

- Inflow: Data did indicate the presence of some wet weather inflow, although the peaking factor does not reflect it to be overly excessive and within acceptable range of regulatory guidelines. Inflow, or peaking sources of clear water (storm drain cross-connection, flooding manhole, etc.), does not appear to be significant based on the rainfall/metered flow data during the monitoring period, pump station data, and calculated peaking factors. However as infrastructure ages, it could become more problematic and further investigation is warranted to assess cost effectiveness of further action.
- Infiltration: High groundwater has been reported (observed) at locations within the existing collection system. Infiltration of some of this groundwater may be reflected in the metered data collected during the monitoring period. Based on the flows per benefit experienced, infiltration is not excessive and within acceptable range of the regulatory guidelines

**Hydraulic Modeling**

Hydraulic modelling and capacity assessment was performed with flow data for both dry and wet weather events. Analysis of the data reflected that both the sanitary sewer main and pump stations have more than adequate capacity and reserve to handle the existing flows including influence of stormwater within the regulatory guidelines. The model included the influence of Pump Station #14 to verify that the operation of the station in conjunction with Station #7 did not cause interference as well. No adverse impacts and / or deficiencies were noted.

**Infrastructure Condition Evaluation**

- Review of the televising and inspection reports for the collection system indicated minimal deformities and/or breaks in pipe with 90% of the system in excellent condition.
- The pump stations have been well maintained as indicated by the records. Critical components are routinely inspected and replaced and/or repaired when warranted.

**Infrastructure Operations Evaluation**

- Both pump stations during the June 2017 experienced higher than typical run times per both DEQ guidelines, industry standard and historical data, indicative of the presence of groundwater infiltration and/inflow.
- Although Pump Station #8 experienced alarms during the June 2017, Pump Station #7 did not. Accounting for the pump run times, it is evident both pumps in this station were running the majority of the time during the event, however, no operational issues were found to occur (as evidenced by the lack of alarms). Based upon the available information, the station was able to maintain operations and sustain the amount of both sewage and intrusion of stormwater without backup. A high water alarm would have activated, had a backup in Pump Station #7 occurred.

**Summary**

The condition, operations and capacity of the sanitary sewer system is in healthy conditions with the ability to handle dry weather and moderate wet weather (25-year stormwater event) with no deficiencies noted or excessive ongoing inflow/infiltration problems. There a few corrective measures that the township can implement to protect the system from stormwater and mitigate system backups when it does occur, but overall the system is functioning as design and within typical industry/regulatory guidelines.

Union Township has a substantial amount of gravity sewer, pump stations and manholes located within 100’ of the 100-year floodplain and other open-channel water features (drains, streams, rivers, etc). During any significant rainfall and flooding event, these sewers, manholes, and stations can be a significant source of excess flows – creating conditions that can overwhelm the sewer and hydraulically stress the wastewater treatment plant. As evident from the wastewater treatment plant incoming flows experienced during the June 2017 (100-year rain) event, all infrastructure in the system was susceptible to stormwater intrusion during major rain events. New and/or existing sanitary sewer infrastructure is not sized to accommodate that volume of water and inflow/infiltration can compound the problem. The township is only responsible for the sewer system, however, unknown and/or undiscovered stormwater connections (such as footing drains) can impact system performance.

**Conclusions & Recommendations**

There were no system deficiencies noted. However, this report does present some suggestions to help minimize the impact of future significant storm events. These suggestions include:

1. Continue the township's ongoing inspection and maintenance program. This is an important effort and helps to prevent issues that would otherwise occur by blockages that build up over time.
2. A mainstream program to waterproof the collection system
3. Continue to implement the asset management and capital improvement program the Township has in place to budget for aging pump station components and monitoring pump station operations
4. Investigate the possibility of footing drain connections with dye testing

# 1 INTRODUCTION

On June 22nd and 23rd, 2017, the mid-Michigan area received an unprecedented amount of rain in a very short timeframe. This event caused significant observed flooding in both the stormwater and wastewater collection systems as well as high river levels along the Chippewa River. In addition the township, City of Mt. Pleasant, and county staff and regulatory agencies fielded numerous reports of basements, street/yard flooding, and caused significant property damage. See Figure 1 on page 1-2 for a comparison of historical storm data.

THE JUNE 22/23, 2017 STORM EXCEEDED 25, 50 & 100 YEAR STORM EVENTS – SOMETHING THAT HAS NOT OCCURRED SINCE 1986.

The township commits to maintaining an extensive asset and operational management plan to provide a reasonable level of service (LOS) to its residents. However, as a result of the late June 2017 flooding the township elected to conduct a more intensive study of the existing infrastructure and determine what, if any impact and/or damage the storm may have caused. Although the stormwater and wastewater collection systems are separate by design, they can potentially be connected via unanticipated and/or illegal connections above and below the surface.

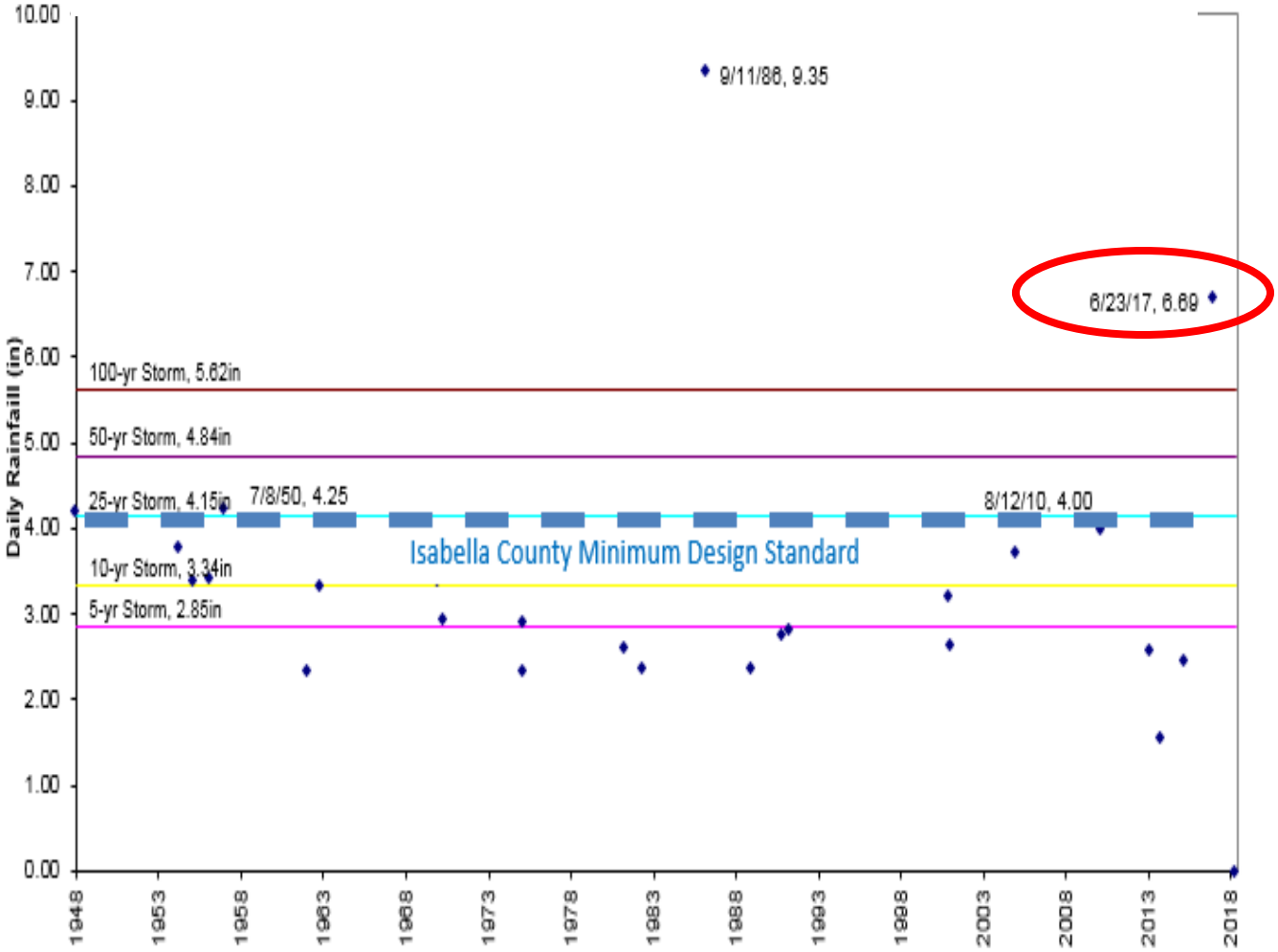
GFA was retained by Union Township to conduct a sanitary sewer system study focusing on the hardest hit area - the Pump Station #7 service area (including McDonald and O'Connor Drive in the Mission Creek area). This study is intended to provide a comprehensive evaluation of the existing collection and distribution system infrastructure for:

- Pump Station #7 (McDonald Drive),
- Pump Station #8 (Scully Drive), and
- The corresponding service area.

*Pump Station #7 (McDonald Drive)*

*Pump Station #8 (Scully Drive)*

## Figure 1 – NOAA Storm Data 1949-2017, Top 25 Storms




The focus of this investigation was to evaluate the existing infrastructure (condition and operations) and determine what, if any impact Pump Station #7, Pump Station #8, and/or associated equipment may have caused or contributed to the flooding of residents' basements in the service area. The evaluation will review current and during the flooding event with the overall scope of services to include:

1. Public Engagement
2. Data Collection
3. Asset Condition Assessment
4. Flow Monitoring
5. Hydraulic Modelling
6. Findings and Recommendations

# 2 PROJECT BACKGROUND

## 2.1 EXISTING FACILITIES

Construction on the Union Township sewer system began in 1979 and has expanded through the years to keep pace with the growth in population. The system today consists of gravity sewers, lift stations and force main for collection and distribution and a surface water discharge treatment facility providing service to approximately 5,500 customers within the limits of the Township. A map illustrating the existing sanitary sewer system is included in the Appendix as Figure A.

Treatment Facility

*The wastewater treatment plant under construction (2015), a planned upgrade to increase the capacity from 1.2 to 2.4 MDG.*

Wastewater treatment for Union Township takes place at the wastewater treatment plant (WWTP). This facility consists of a 2.4 million gallon per day (MGD) oxidation ditch treatment system with additional phosphorous removal, filtering and disinfection which discharges treated effluent to the Chippewa River. Secondary treatment includes aerobic digestion, thickening and onsite storage of solids.

Sanitary Collection and Distribution System

The sanitary collection system includes approximately 148,000 linear feet (52 miles) of pipe within the township, ranging in size from 6" to 18". Most of the piping is polyvinyl chloride (PVC) pipe. The sanitary distribution system includes nineteen (19) pumping stations and force main, approximately 79,000 linear feet (12.5 miles) of pipe within the township, most 4" in size. This study is limited to the

Pump Station #7 service area, as defined and illustrated on Appendix Figure A. A more detailed review of the existing infrastructure within this service area is provided in Section 3.

## 2.2 June 2017 Rainfall Event

As noted in the introduction, a severe rain event occurred in late June 2017, with 7.29" of rain recorded over 24 hours between June 22nd and June 23rd (as per the National Oceanic and Atmospheric Administration). This severe rainfall was widespread through mid-Michigan with similar rainfall volumes being reported that week in neighboring communities, including: Mount Pleasant - 7.2"; Midland - 7.49"; and Saginaw - 5.95".

This rainfall found its way to tributaries to the Tittabawassee, Chippewa and Pine Rivers, resulting in a significant flooding of rivers, creeks and drains throughout the area. In some spots the flood stage rose to levels that allowed rain water to enter manholes and the sanitary sewer system. This included the Pump Station #7 service area. During this rainfall DPW staff observed sanitary flooding at manholes and the stations themselves. In addition, township residents reported claims of six (6) basement flooding, sewage backup, and surface flooding to township staff. In response township staff recorded as much information as possible and additional information was reported to FEMA through the claims process.

## 2.3 Previous Studies & History

**I/ I Study (2007 -2008)**

A inflow and infiltration (I&I) study was conducted in 2007 to evaluate select service areas suspected of having I&I issues, including the Pump Station #7 Service Area (McDonald). Flow monitoring was conducted for a 14 month period along with a creation of a hydraulic model to determine the extent of wet weather response and operating capacity in the system. For this specific area, flow monitoring demonstrated no response to wet weather conditions and the infrastructure was in good working condition with no recommendations for improvements needed.

It was determined that a few portions of the sewer in other parts of the system were most likely experiencing inflow and/or infiltration from an external source along with recommendations for further investigation procedures to locate respective sources was cited. These locations were identified and both improvements to the sewer system were implemented along with a program to eliminate illegal connections in targeted locations was implemented. Findings from the study indicated little to no response during wet weather conditions for this specific service area.

**AMP (2013 to Present)**

As a compliance measure, the Charter Township of Union was mandated to complete an Asset Management Plan (AMP) by the Michigan Department of Environmental of Quality (MDEQ) as part of their NDPDES Surface Water Discharge Permit. The objective of this AMP is to establish and ensure the

best management practices for the sanitary sewer system. The Township maintains and updates this document frequently. It includes such items as:

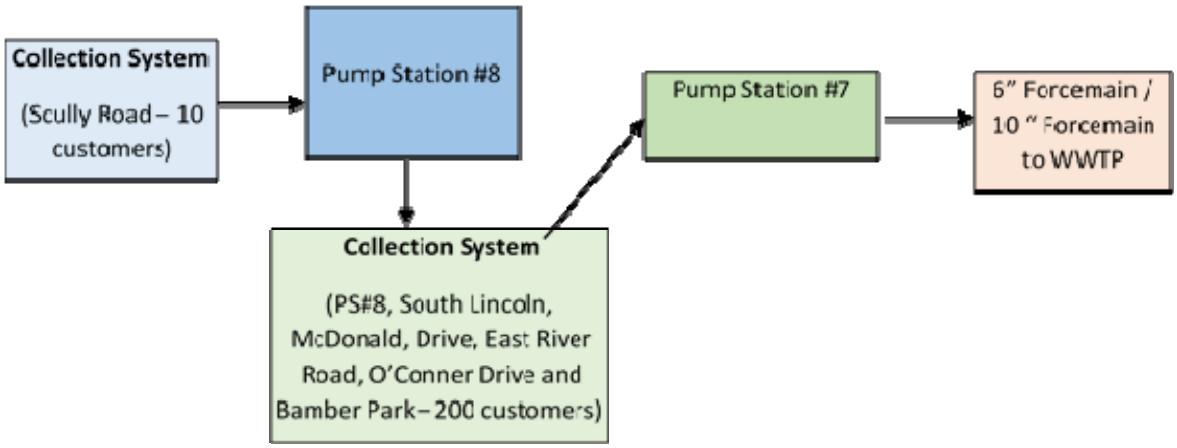
- Provide uninterrupted sewer service to meet customers' desired service levels.
- Ensure adequate sewer capacity and for the Township to address the Township's planned growth.
- Sustain sewer infrastructures by implementing good preventative maintenance management program to extend asset lifecycle.
- Identify and establish a Capital Improvement Plan
- Ensure adequate funding support and resources to sustain long-term asset management.

# 3 SYSTEM INVENTORY & ANALYSIS

An inventory and assessment of the infrastructure is necessary to establish an understanding of the typical historical operations and what occurred during the 2017 rain event. This information was also useful and applied to the flow monitoring and hydraulic modelling discussed in Sections 4 and 5. This section will provide an overview of available data for system components, including the collection system, the pump stations, and the wastewater treatment plant.

Union Township owns and operates approximately 29 miles of gravity sanitary sewer, much of it located within 100 feet of the 100-year floodplain and/or open-channel drains and water features. The sanitary sewer ranges in size from 6" to 18" is primarily constructed of polyvinyl chloride (PVC) pipe.

Wastewater treatment for Union Township is accomplished through the wastewater treatment plant (WWTP). This 2.4 Million Gallon per Day (MGD) facility is an oxidation ditch treatment system with additional phosphorous removal, filtering, and disinfection. Secondary treatment includes aerobic digestion, thickening and onsite storage of solids. It discharges the treated effluent to the Chippewa River. At present, the township is treating an average of 1.25 MGD (approximately 50% of the facility's available capacity).




The scope of this study is limited to the Pump Station #7 Service Area, which services approximately 200 customers. This area is predominantly single-family residential housing. As illustrated on the map in the Appendix, the limits of service are from River Road to Pickard Road (north to south) and Scully Road to Bamber Road (west to east). This infrastructure includes 8" sanitary gravity sewer (collection), two pump stations, and 6" pressurized forcemain (distribution). The flows in the 6" forcemain are transported directly to the township wastewater treatment plant via a 10" pressurized forcemain. This

10" forcemain is shared with Pump Station #14, which is south of the PS #7 service area and serves customers along Remus Road.

## 3.1 EXISTING ASSET INVENTORY

Below is a summary of the sanitary sewer collection, pumping and distribution system that services the Pump Station #7 service area.

**Collection System / Distribution System Summary**

| Pump Station #7 Service Area Collection / Distribution System | | | | | |
|---|---|---|---|---|---|
| | **Gravity Sewer** | **Manholes** | **Forcemain** | **Cleanouts** | **Air Releases** |
| **Date Constructed** | 1980 / 1997 | 1980 / 1997 | 1980 | 1980 | 1980 |
| **Diameter** | 8" | 4' | 6" | 6" | 6" |
| **Material**<br>PVC = Polyvinyl chloride<br>DI = Ductile Iron | PVC, SDR 35 | Concrete | DI&PVC(#7)/SCH80 BLK PVC(#8) | DI(#7)/ N/A(#8) | APCO Model 400 |
| **Depth** | 6' Min. | 6' Min. | 6' Min. | 6' Min. | 6' Min. |
| **Quantity** | 12,815 LF | 34 | 200 LF - 4"; 2,800 LF - 6" | 1 | 1 |

**Pump Stations**

| Pump Station #7 Service Area Pump Station Components | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Pump / Motor** | **Controls** | **Piping / Valves** | **Control Panel** | **Wetwell** | **Backup Power** | **SCADA** |
| **Year Built** | 2007 | 1980 | 1980 | 1980 | 1980 | 2009 | 1998 |
| **Capacity (Each)** | Hydromatic 220 - 250 GPM | N/A | N/A | N/A | 8' Diameter | 80kW | N/A |
| **Quantity** | Two (2) | One (1) | One (1) | One (1) | One (1) | One (1) | One (1) |
| **Rating (Each)** | 15 Hp, 460 V/ 3 P | N/A | N/A | 30Amp | N/A | 480V/ 3 P | N/A |
| **Type** | Submersible | Submersible Float Control | 6" Ductile Iron | Above Ground: NEMA 12 | Submersible | None | OPTO 22 |
| **Alarms** | N/A | N/A | N/A | Light, Horn and SCADA HWL, LWL and Power Fail | N/A | SCADA | Email + Text |
| **Status** | Active | Active | Active | Active | Active | Active | Active |
| **Operation Notes:** | Run Time Average = 8.5 hours per work. Spare pump in stock. Pump rails/guides replaced in 2001. | | | | | | |

| Pump Station #8 Service Area Pump Station Components | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Pump / Motor** | **Controls** | **Piping / Valves** | **Control Panel** | **Wetwell** | **Backup Power** | **SCADA** |
| **Year Built** | 1993 | 1993 | 1993 | 1993 | 1980 | N/A | 1998 |
| **Capacity (Each)** | Hydromatic 80 GPM | N/A | N/A | N/A | 4' Diameter | | N/A |
| **Quantity** | Two (2) | One (1) | One (1) | One (1) | One (1) | | One (1) |
| **Rating (Each)** | 230 V/ 1 Phase | N/A | N/A | 30Amp | N/A | | 5 Hp, 230 Volt, Single Phase |
| **Type** | Submersible | Submersible Float Control | 4" Schedule 80 | Above Ground: NEMA 12 | Submersible | | OPTO 22 |
| **Alarms** | N/A | N/A | N/A | Light, Horn and SCADA HWL, LWL and Power Fail | N/A | SCADA | Email + Text |
| **Status** | Active | Active | Active | Active | Active | Active | Active |
| **Operation Notes:** | Run Time Average = 2.0 hours per work. Spare pump in stock. | | | | | | |

## 3.2 Asset Operations, Maintenance, Assessment

**Collection System (Gravity Sewer System)**

**Collection System - Regulatory Guidelines**

MDEQ has recommendations and guidelines for design, capacity, and operating parameter for gravity sanitary sewer. Sanitary sewers shall have adequate capacity to accommodate peak hour flows for the service area and include the following:

- Minimum 2 feet per second velocity when flowing full
- Minimum 8-inch diameter

A review of the sanitary sewer capacity will be further evaluated in Sections 4 and 6.

**Collection System – Televised Inspection**

The performance of this infrastructure is vital, therefore the Department of Public Works (DPW) executes a routine infrastructure and maintenance regiment this includes Condition assessment activities for the gravity collection system including sewer main and manholes. The sewer condition assessment program includes Closed Circuit Television (CCTV) inspection of main line pipes to determine their condition and to identify cleaning issues. The Township routinely performs this inspection,

televising and cleaning of these gravity sewer lines with the most recent completed in 2014, 2015 and 2017.

The Township retained the services of Plummer's Environmental Service to analyze the entire sanitary sewer system in 2014, 2015 and 2017. Plummer's performed a condition assessment of each trunkline and applied a scoring system using the industry-standard National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP). All structural and O&M defects discovered in main lines are assigned a condition grade. Each pipe segment, defined as a length of pipe from manhole to manhole, is also assigned a NASSCO PACP Quick Rating.


*Sample shot from televised inspection – within gravity sewer between MH#227B & MH#227A on River Road*

Their techniques recorded defects throughout the pipes/ manholes and applied the information to develop and overall condition rating. Pipes and manholes with poor condition ratings are likely sources of excess flows and were targeted for rehabilitation and/or replacement. Maps and reports were prepared and provided. These included tabulated results for Defects by Inspection, Grade Count, and Overall Rating. The survey completed in 2014 included segments within the Pump Station #7 and #8 service areas. GFA reviewed the documents and we've included a synopsis on the following pages. Copies of the original reports are included in the Appendix.

**Collection System Televised Inspection - Inspection Definitions**

The National Association of Sewer Service Companies (NASSCO) establishes the industry standards for the assessment, maintenance and rehabilitation of underground infrastructure. NASSCO utilizes the Pipeline Assessment Certification Program (PACP) which sets the North American Standard for pipeline defect identification and assessment, providing standardization and consistency to the methods in which pipeline conditions are identified, evaluated and managed.

| Pipeline Assessment Certification Program - Defects by Inspection | |
|---|---|
| Continuous Defect Coding | Continuous defect coding is made up of two separate coding classifications. The first is called "Truly" continuous defects - defects that run along the sewer and the second is "Repeated" continuous defects - continuous defects that occur at regular intervals along the pipe. |
| Structural Defect Coding | Structural defect codes include many separate coding classifications. Codes define the type of defects that are related to structural degradation of the pipe due to various reasons such cracks (C), fractures (F), breaks (B), etc. |
| Operational and Maintenance Defect Coding | O&M codes define the type of defects that are related to lack of maintenance such as deposits (D), roots (R), infiltration (I), etc. |
| Construction Features Coding | Construction features codes indicate features located in or around the pipe system such as tap (T), intruding seal material (IS), etc. |
| Miscellaneous Features Coding | Miscellaneous features coding includes many sub-coding classifications. This section uses coding to indicate miscellaneous (M) features in the pipe system. Under this subtitle, the miscellaneous designation is combined with other letters to further define the type of defect. |

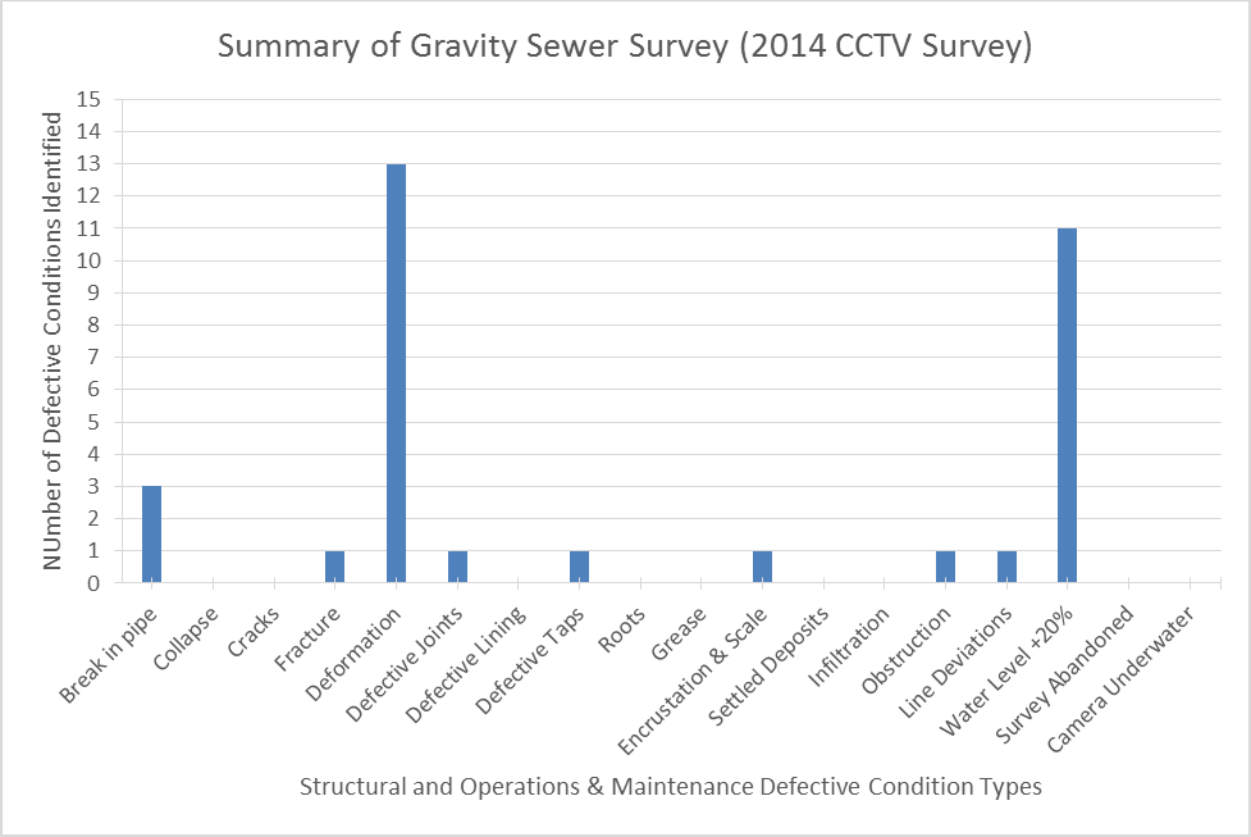
Severity Grade: Summarized as a numerical grading system to define the severity of pipe defects identified by the shorthand codes above. Condition grades for structural defects and Operation and Maintenance (O&M) defects are assigned based on the risk of further deterioration or failure. The numerical system uses numbers ranging from 0 to 5 with 0 being excellent condition and 5 being a severe defect. The severity ranking considers the immediate defect, risk of failure, and rate of deterioration.

| Condition Grades for Structural/O&M Defects | |
|---|---|
| Severity Grade 5 | Pipe segment has failed or will likely fail within the next five years - requires immediate attention. |
| Severity Grade 4 | Pipe segment has severe defects - risk of failure within the next five to ten years. |
| Severity Grade 3 | Pipe segment has moderate defects - deterioration may continue, at a ten to twenty year timeframe. |
| Severity Grade 2 | Pipe segment has minor defects - pipe unlikely to fail for at least 20 years. |
| Severity Grade 1 | Pipe segment has minor defects - failure unlikely in the foreseeable future. |
| Severity Grade 0 | Excellent. No defects - failure unlikely in the foreseeable future. |

**Collection System Televised Inspection - Analysis**

GFA completed a detailed review of the reports and maps that were completed by Plummer's in 2014 relevant to the Pump Station #7 service area. The following figures and tables provide a synopsis of the data as it pertains to the condition assessment related to structural and O&M defects. The detailed reports and maps are included in the Appendix.

**Graph 3-1- Defects by Inspection Summary, PS #7 & #8 Service Area**




Please see the following pages for the televised inspection sewer grade report summary.

| 2014 CCTV Survey Pump Station #7 & #8 – Gravity Sewer Grade Count Report | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Setup | Manhole to Manhole Segment | Pipe | | | Grade count | | | | | |
| | | Length (ft.) | Diameter (in.) | Material Type | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | MH#216-SCU TO MH#215-SCU | 291.8 | 8 | Polyvinyl Chloride | 2 | 0 | 0 | 0 | 0 | 6 |
| 2 | MH#215-SCU TO MH#214-SCU | 201.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 3 |
| 3 | MH#214-SCU TO PS#8 | 42.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 1 | 2 |
| 4 | MH#212-SCU TO MH#211-SCU | 413.2 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 0 | 0 | 10 |
| 5 | MH#211-SCU TO MH#210-SCU | 470.0 | 8 | Polyvinyl Chloride | 0 | 2 | 0 | 0 | 0 | 8 |
| 6 | MH#210-SCU TO MH#209-SCU | 469.8 | 8 | Polyvinyl Chloride | 1 | 3 | 0 | 0 | 0 | 8 |
| 7 | MH#219-WIL TO MH#220-CYP | 167.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 3 |
| 8 | MH#219-WIL TO MH#218-WIL | 358.3 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 7 |
| 9 | MH#218-WIL TO MH#217-WIL | 396.1 | 8 | Polyvinyl Chloride | 1 | 0 | 0 | 1 | 1 | 8 |
| 10 | MH#209-SCU TO MH#217-WIL | 383.9 | 8 | Polyvinyl Chloride | 0 | 4 | 0 | 0 | 0 | 4 |
| 11 | MH#209-SCU TO MH#208-LIN | 386.3 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 5 |
| 21 | MH#225-LIN TO MH#224-LIN | 380.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 8 |
| 22 | MH#224-LIN TO MH#223-LIN | 316.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 6 |
| 23 | MH#222-LIN TO MH#223-LIN | 333.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 4 |
| 24 | MH#222-LIN TO MH#221-LIN | 447.1 | 8 | Polyvinyl Chloride | 1 | 0 | 0 | 0 | 0 | 7 |
| 25 | MH#221-LIN TO MH#208-LIN | 250.6 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 0 | 0 | 4 |
| 26 | MH#207-LIN TO MH#208-LIN | 230.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 3 |
| 27 | MH#207-LIN TO MH#206-LIN | 480.9 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 1 | 0 | 6 |
| 28 | MH#206-LIN TO | 228.6 | 8 | Polyvinyl | 0 | 0 | 0 | 0 | 0 | 2 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | MH#205-MCD | | | Chloride | | | | | | |
| 29 | MH#203-MCD TO MH#205-MCD | 443.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 9 |
| 30 | MH#203-MCD TO MH#202-MCD | 421.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 9 |
| 31 | MH#202-MCD TO MH#201-MCD | 425.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 8 |
| 32 | MH#201-MCD TO PS#7 | 19.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 1 |
| **Total surveyed length** | | **7558.8** | | **Grade count totals** | **5**<br><br>**3.2% Require immediate attention.** | **12**<br><br>**7.6% Risk of failure in 5 to 10 years.** | **0**<br><br>**0** | **8**<br><br>**5.1% unlikely to fail for at least 20 years.** | **2**<br><br>**1.3% Unlikely failure risk.** | **131**<br><br>**82.9%** |

## 2014 CCTV Survey Pump Station #7 & #8 – Gravity Sewer Overall Rating

| Setup | PSR | From MH | To MH | Length (ft.) | Size (in.) | Material | Structural | Operation & Maintenance | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 6 | 113 | MH#210-SCU | MH#209-SCU | 469.8 | 8 | PVC | 17 | 0 | 17 |
| 10 | 116 | MH#209-SCU | MH#217-WIL | 383.9 | 8 | PVC | 16 | 0 | 16 |
| 1 | 122 | MH#216-SCU | MH#215-SCU | 291.8 | 8 | PVC | 10 | 0 | 10 |
| 9 | 117 | MH#218-WIL | MH#217-WIL | 396.1 | 8 | PVC | 8 | 0 | 8 |
| 5 | 114 | MH#211-SCU | MH#210-SCU | 470.0 | 8 | PVC | 8 | 0 | 8 |
| 27 | 087 | MH#207-LIN | MH#206-LIN | 480.9 | 8 | PVC | 6 | 0 | 6 |
| 31 | 083 | MH#202-MCD | MH#201-MCD | 425.4 | 8 | PVC | 2 | 4 | 6 |
| 24 | 090 | MH#222-LIN | MH#221-LIN | 447.1 | 8 | PVC | 5 | 0 | 5 |
| 21 | 093 | MH#225-LIN | MH#224-LIN | 380.5 | 8 | PVC | 4 | 0 | 4 |
| 25 | 089 | MH#221-LIN | MH#208-LIN | 250.6 | 8 | PVC | 4 | 0 | 4 |
| 4 | 115 | MH#212-SCU | MH#211-SCU | 413.2 | 8 | PVC | 4 | 0 | 4 |
| 22 | 092 | MH#224-LIN | MH#223-LIN | 316.9 | 8 | PVC | 0 | 2 | 2 |
| 3 | 120 | MH#214-SCU | PS#8 | 42.5 | 8 | PVC | 0 | 1 | 1 |
| 7 | 119 | MH#219-WIL | MH#220-CYP | 167.7 | 8 | PVC | 0 | 0 | 0 |
| 2 | 121 | MH#215-SCU | MH#214-SCU | 201.4 | 8 | PVC | 0 | 0 | 0 |
| 11 | 112 | MH#209-SCU | MH#208-LIN | 386.3 | 8 | PVC | 0 | 0 | 0 |
| 8 | 118 | MH#219-WIL | MH#218-WIL | 358.3 | 8 | PVC | 0 | 0 | 0 |
| 30 | 084 | MH#203-MCD | MH#202-MCD | 421.1 | 8 | PVC | 0 | 0 | 0 |
| 29 | 085 | MH#203-MCD | MH#205-MCD | 443.0 | 8 | PVC | 0 | 0 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 28 | 086 | MH#206-LIN | MH#205-MCD | 228.6 | 8 | PVC | 0 | 0 | 0 |
| 26 | 088 | MH#207-LIN | MH#208-LIN | 230.5 | 8 | PVC | 0 | 0 | 0 |
| 23 | 091 | MH#222-LIN | MH#223-LIN | 333.7 | 8 | PVC | 0 | 0 | 0 |
| 20 | 094 | MH#225-LIN | MH#226-RIV | 338.8 | 8 | PVC | 0 | 0 | 0 |

*Components highlighted in yellow indicate areas that were repaired as a result of the inspection report. Additional information is included on detailed reports in the Appendix.

**Collection System Televised Inspection - Review and Findings**

Based on our review of the Defects by Inspection report, the most common defects found were:

- Deformation in the pipe (13 occurrences)
- Water levels greater than 20% (11 occurrences)
- Breaks in pipe (3 occurrences)
- Pipe fractures, defective joints, encrustation and scale, obstruction, and line deviations (1 occurrence each).

The Grade Count Report identified 158 defects within this segment of sanitary sewer:

- 3.2% were Severity Grade 5 – requires immediate attention.
- 7.6% were Severity Grade 4 – risk of failure within the next five to ten years.
- 0.0% were Severity Grade 3 – deterioration may continue, at a ten to twenty year timeframe.
- 5.1% were Severity Grade 2 – pipe unlikely to fail for at least 20 years.
- 1.3% were Severity Grade 1 – failure unlikely in the foreseeable future.
- 82.9% were Severity Grade 0

In summary, review of the televising and inspection reports for the collection system indicated minimal deformities and/or breaks in pipe with 83% of the system in excellent condition at the time of inspection by Plummers in 2014. As noted in the detailed reports in the Appendix, several locations that were identified as a result of the inspection subsequently had repairs implemented, therefore improving the to a rating of 90%+ of the system in excellent condition.

**Pump Stations**

GFA staff conducted an inspection of the two (2) pump stations and collected information relevant to both operation and condition. A summary of this information is provided in the table below and more detailed information is included in the Appendix along with photos of the infrastructure. Pertinent to the station infrastructure itself, GFA was provided detailed historical operations and maintenance records for Pump Station #8 and #7. This information is extremely useful to establish a baseline and mechanism for comparison to normal operations versus the June 2017 rain event. In addition, this

information will be applied to the hydraulic model to provide more accurate simulations of how the pump station performance impacts the system, which will be further discussed in Section 6.

**Pump Station Regulatory Guidelines**

MDEQ has recommendations and guidelines for design, capacity, and operating parameter for sanitary pump stations. Wet wells or the receiving manhole shall be sized appropriately to meet the peak hour flows for the service district and take into consideration storage volume in event of mechanical / power failure and prevent short cycling of pumps yet prevent septic action. Guidelines for pump station operating parameters are as follows:

- Distribution (forcemain) shall be sized to discharge the peak hour flows for the service district and maintain a minimum velocity of 2 feet per second
- Firm capacity (largest pump taken offline) shall be sized to handle peak hour flows of service district
- Minimum 2 minute run time
- 6 pump starts per day / 3 to 5 minutes between pump cycles
- Minimum 2 minute effective storage volume (pump on & pump off setting)
- Filling time not to exceed 30 minutes

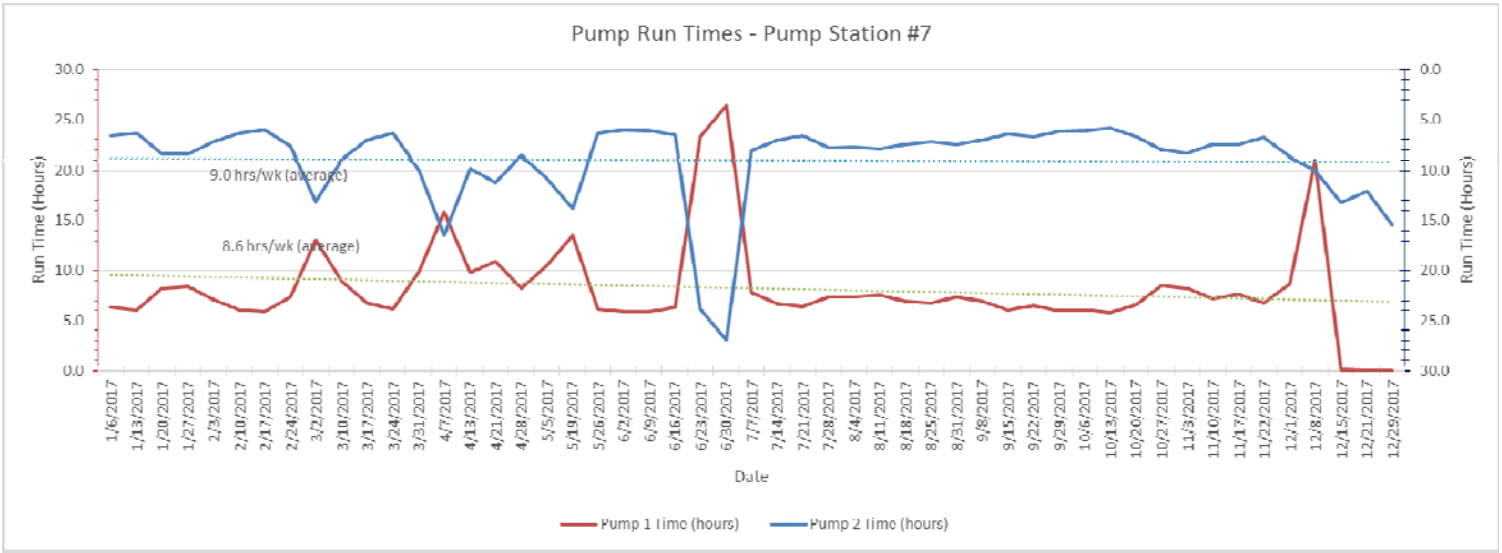
A review of the stations capacity will be further evaluated in Sections 4 and 6.

A review of the operating parameters in comparison to DEQ guidelines is provided below.

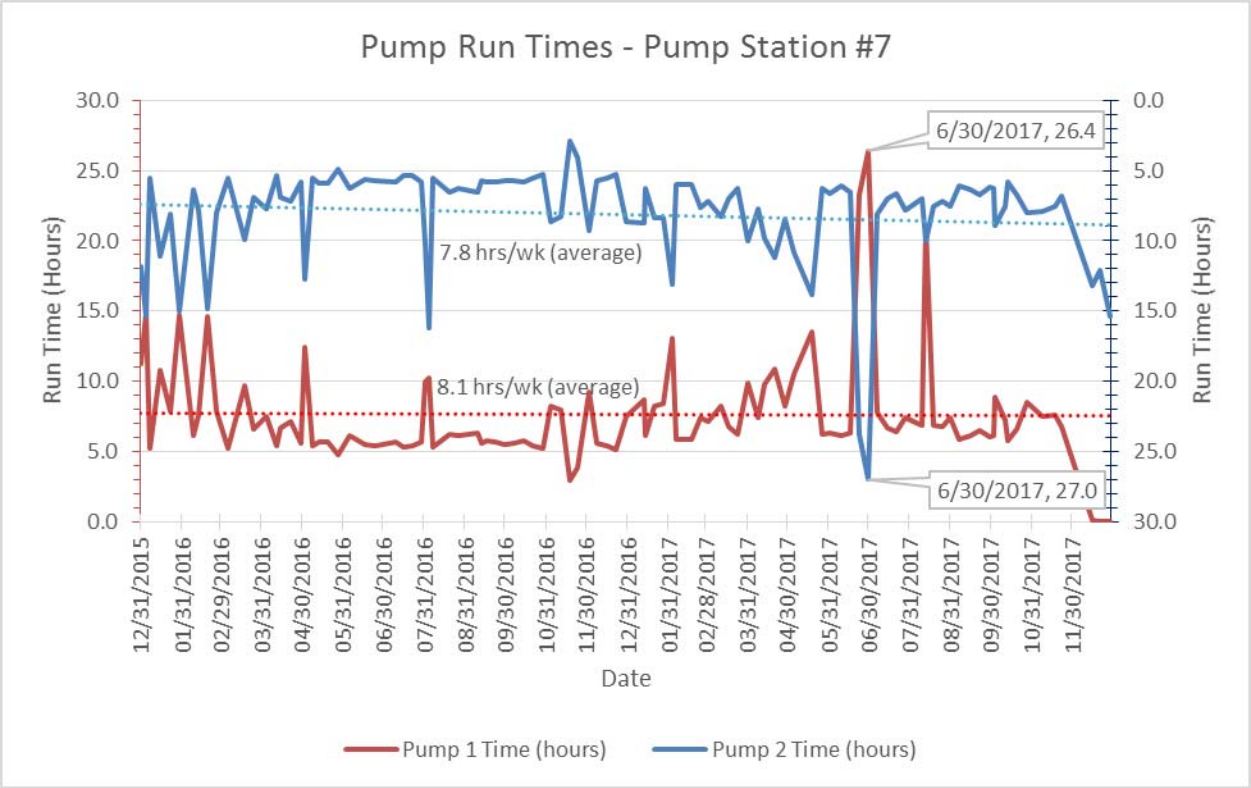
**Pump Station Run Times**

Data collected and illustrated in Graphs 3-1 through 3-4 show the average weekly run time (in hours) for the two pumps located in each pump station during the historical time period of 2016 and 2017.

**Graph 3-1- Pump Station #7 Pump Run Times, Dec. 1- 12, 2017**

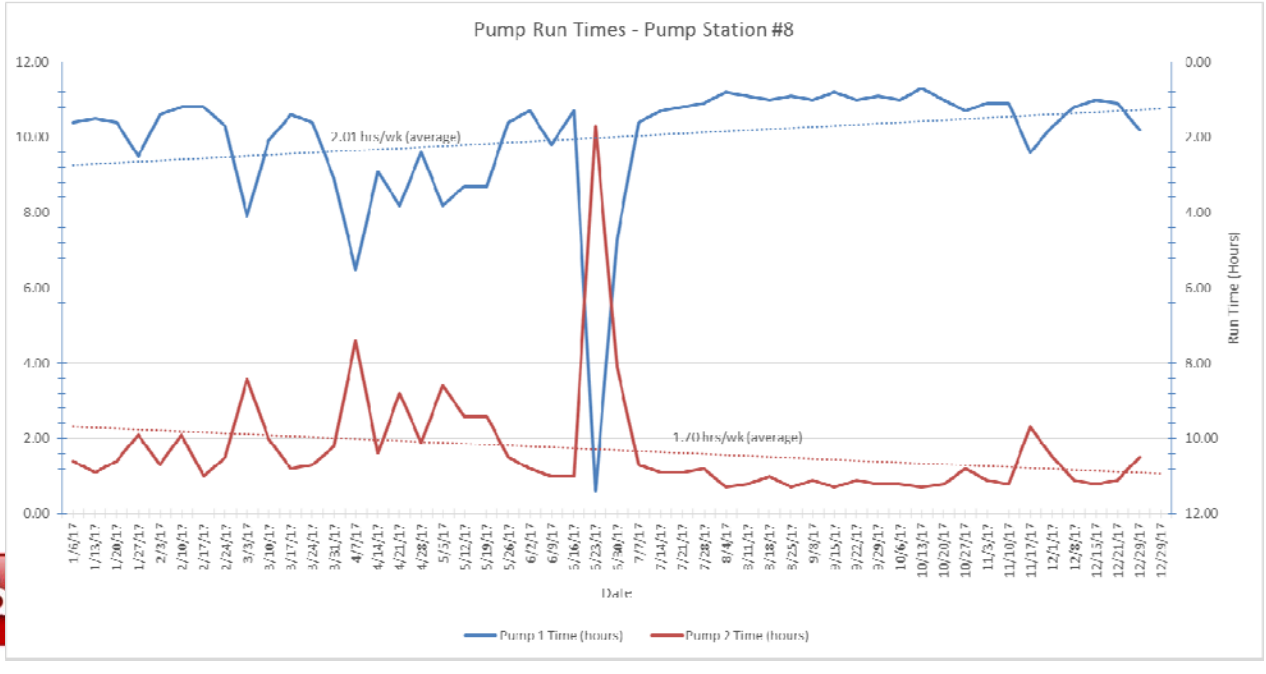


**Graph 3-2- Pump Station #7 Pump Run Times, Dec. 31, 2015 – Nov. 30, 2017**

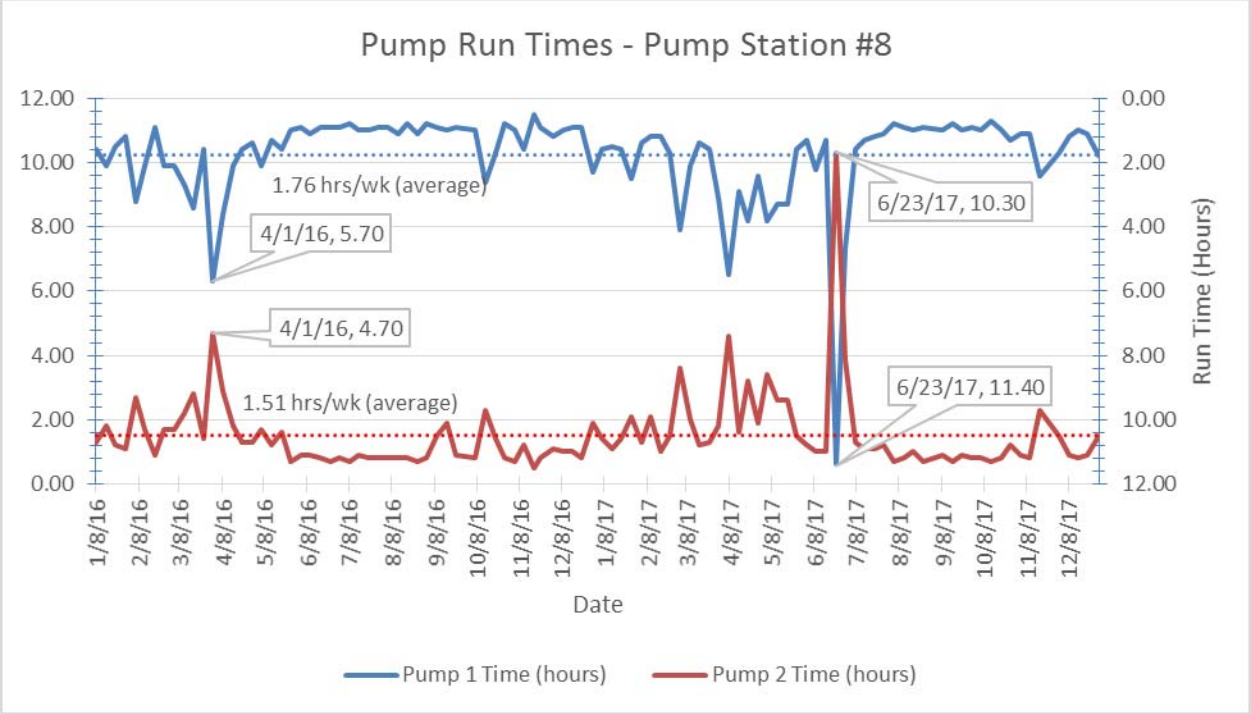



On average the two pumps in Pump Station #7 ran approximately 9 hours per week (approx. 1 hour per day) during June 2017. During the week prior to June 30, 2017 (the week containing the storm event) the pumps ran approximately 24-27 hours (approximately 3.4-3.9 hours per day).

**Graph 3-3- Pump Station #8 Pump Run Times, Jan. 6, 2017 to Dec. 29, 2017**



**Graph 3-4- Pump Station #8 Pump Run Times, Jan. 8, 2016 to Dec. 8, 2017**




On average the two pumps in Pump Station #8 ran approximately 1.70-2.01 hours per week (approximately 0.25 hours per day) during June 2017. During the week prior to June 30, 2017 (the week containing the storm event) the pumps ran about 10.32 to 11.40 hours (approx. 1.47 to 1.63 hours per day).

| Pump Stations #7 & #8 Run Times (Hrs/Day) - June 2017 | | | |
|---|---|---|---|
| | Average (Hrs/Day) | During Week of Storm (Hrs/Day) | MDEQ Minimum Guidelines (Hrs/Day) |
| Pump Station #7 | 1 | 3.4-3.9 | Min. 2 minute run time, 6 starts/day = 12 minutes/day (0.20 hrs/day) |
| Pump Station #8 | 0.25 | 1.47-1.63 | |

On average, during the month of June 2017, Pump Station #7 ran approximately 5 times more than the MDEQ minimum guidelines while Pump Station #8 ran consistent with the MDEQ minimum guidelines. During the week of the June 2017 storm event Pump Station #7 and #8 ran approximately 18 and 8 times the MDEQ minimum guidelines, respectively.

**Pump Station Maintenance**

A summary of the collected information from the DPW pertinent to historical station maintenance and replacement is provided in the tables below.

| Pump Station #7 Maintenance & Replacement | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Pump / Motor** | **Controls** | **Piping / Valves** | **Control Panel** | **Wet well** | **Backup Power** | **SCADA** |
| **Maintenance** | | | | | | | |
| Maintenance Performed | Run & check for operational issues | Varies | Check condition, plugging, etc. | Check amperage draw | Clean Floats | Changed filters & system checks | Test Alarms and Communication Signal |
| Frequency | Weekly | Weekly | Weekly | As needed or as problems arise | Weekly | As Needed / Weekly | Daily |
| **Repairs** | | | | | | | |
| Improvements | Re-wired new motor starter, replaced pumps & motor | N/A | N/A | N/A | New guiderails and supports | Installed new permanent battery charger on generator | N/A |
| Date last Completed | 2018 / 2007 | | | | 2001 | 08/09/2017 | |

| Pump Station #8 Maintenance & Replacement | | | | | | |
|---|---|---|---|---|---|---|
| | **Pump / Motor** | **Controls** | **Piping / Valves** | **Control Panel** | **Wet well** | **SCADA** |
| **Maintenance** | | | | | | |
| Maintenance Performed | Run & Check for operational issues | Varies | Check condition/ plugging/etc. | Check amperage draw | Clean Floats | Test Alarms and Communication Signal |
| Frequency | Weekly | Weekly | Weekly | As needed/problems arise | Weekly | Daily |
| **Repairs** | | | | | | |
| Improvements Performed | N/A | N/A | N/A | N/A | N/A | N/A |
| Date last Completed | | | | | | |

**Pump Station Operations**

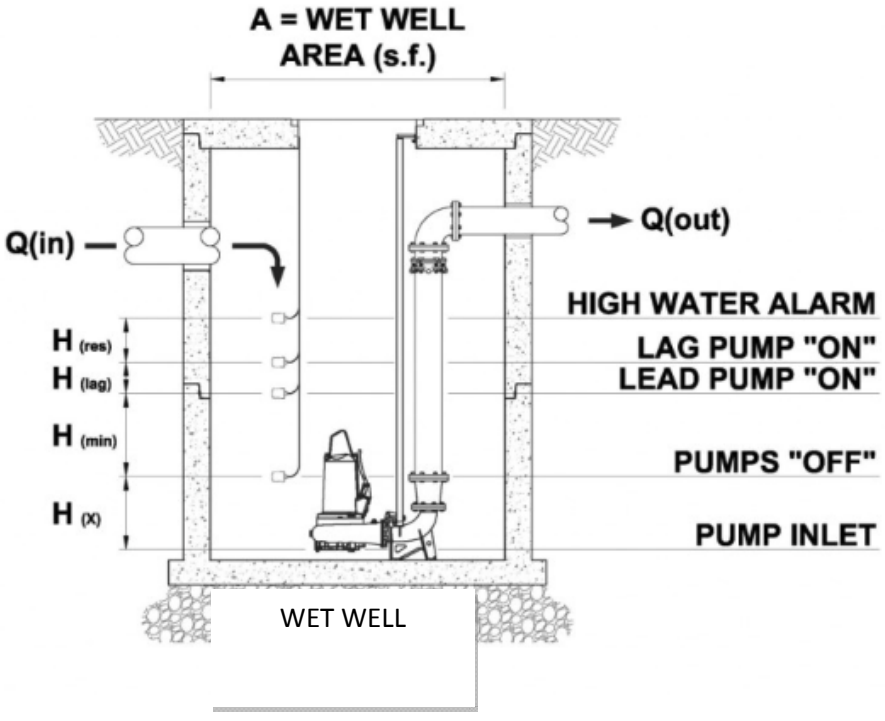
The DPW extracted Pump Station #7 and #8 data for the two-year period of December 31, 2015 through December 29, 2017 from township records, and provided a copy to GFA to review. This helps establish a baseline of pumping characteristics and typical operations as well as what occurred during the June 2017 rain event. However, as the programming is simplistic and flowmeters do not exist the data was limited to run times and alarm callouts. To help complete the picture we conducted flow monitoring as part of this study, which we will discuss in Section 4. Based upon the limited data provided, we used extrapolations to estimate the volumes of sewage discharged on a daily basis over this two-year period.

**Pump Station Alarms**

Both pump stations are equipped with remote and local alarming technology to alert DPW staff of operational issues and failures. Alarms are triggered by the following:

- High Water Alarm – Level alert used to monitor the liquid levels in a wet well and alerts the DPW of an issue. As denoted by the illustration below, this alarm is located at an elevation below the incoming sewer line. Typically this alarm is acknowledged if both pumps are running and unable to keep up with, a pump has failed, or a plugged line (discharge side).
- Low Water Alarm – Level alert alarms used to monitor the liquid levels in a wet well. This alarm will notify staff of a failing submersible pump or a plugged line (suction side).
- Power Failure – An alarm triggered by loss of power/failure.
- General Failure – An alarm triggered for anything other than above

**Figure 3-5- Pump Station Diagram**



The DPW extracted alarm data for all of the township's pump stations from December 31, 2015 through May 29, 2018 from township records, and provided a copy to GFA to review. Please see the following page for a summary of the alarms.

| Pump Station #7 & #8 June 2017 Alarm Summary | | | | |
|---|---|---|---|---|
| **Time** | **Date** | **Alarm Code** | **True/False** | **Status** |
| 14:35:39 | 06/28/2017 | 062 Station 7 Power Fail | TRUE | In Alarm |
| 14:36:18 | 06/28/2017 | 062 Station 7 Power Fail | FALSE | Normal |
| 15:21:11 | 06/28/2017 | 062 Station 7 Power Fail | TRUE | ACK In Alarm |
| 14:48:02 | 06/27/2017 | 062 Station 7 Power Fail | TRUE | In Alarm |
| 14:48:37 | 06/27/2017 | 062 Station 7 Power Fail | FALSE | Normal |
| 15:56:12 | 06/27/2017 | 062 Station 7 Power Fail | TRUE | ACK In Alarm |
| 04:46:09 | 06/23/2017 | 071 Station 8 General Alarm | TRUE | In Alarm |
| 07:42:38 | 06/23/2017 | 071 Station 8 General Alarm | TRUE | ACK In Alarm |
| 10:44:55 | 06/23/2017 | 071 Station 8 General Alarm | FALSE | Normal |
| 18:27:54 | 05/15/2018 | 062 Station 7 Power Fail | TRUE | In Alarm |
| 18:29:08 | 05/15/2018 | 062 Station 7 Power Fail | FALSE | Normal |
| 18:31:41 | 05/15/2018 | 062 Station 7 Power Fail | FALSE | Normal |
| 07:54:34 | 05/16/2018 | 062 Station 7 Power Fail | TRUE | ACK In Alarm |
| 10:29:25 | 05/18/2018 | 062 Station 7 Power Fail | TRUE | In Alarm |
| 10:29:57 | 05/18/2018 | 062 Station 7 Power Fail | FALSE | Normal |
| 10:48:55 | 05/18/2018 | 062 Station 7 Power Fail | TRUE | ACK In Alarm |

As illustrated above, Pump Station #7 did not have any alarms the day of the storm event (June 23, 2018). However, on June 27 and 28, 2018 the station did experience power failure (which was addressed). Pump Station #8 had three general alarms the day of the storm event - two were true alarms and one was a false alarm. We reviewed crew activity reports in an effort to determine what these "General Alarms" were, however no information was found.

In summary, based upon this available information, the stations were able to maintain operations and sustain the amount of both sewage and intrusion of stormwater without backup. Had a backup as a result of the sewer system operation and specifically in Pump Station #7 occurred, a high water alarm would have been acknowledged.

**Pump Station Estimated Flow Rates**

The limited data available included run times and alarms. GFA completed extrapolations to estimate the volumes of sewage discharged daily during the two-year period. Based upon these estimations, the spreadsheets below demonstrate that both stations have consistently and historically operated at a rate below their capacity rating. A further analysis will be completed with the flow monitoring that was conducted and input into the hydraulic model.

Data collected and illustrated in 3-1 and 3-2 shows the average weekly run time (in hours) for the two pumps located in each station.

**Table 3-1- Pump Station #7 Run Times and Flow Rates, Dec. 31, 2015-Dec. 29, 2017**

| Date | Days (Length of time between recordings) | Pump 1 Time (hours) | Pump 2 Time (hours) | Total Station Run Times (hours) | Total Station Run Times (minutes) | Total Station Flow (Gallons) |
|---|---|---|---|---|---|---|
| 12/31/2015 | | 11.2 | 11.8 | 23.00 | 1380.00 | 303600.00 |
| 01/08/2016 | 8.00 | 10.0 | 10.2 | 20.20 | 1212.00 | 266640.00 |
| 01/15/2016 | 7.00 | 10.8 | 11.1 | 21.90 | 1314.00 | 289080.00 |
| 01/22/2016 | 7.00 | 7.9 | 8.1 | 16.00 | 960.00 | 211200.00 |
| 01/29/2016 | 7.00 | 14.7 | 15.0 | 29.70 | 1782.00 | 392040.00 |
| 02/05/2016 | 7.00 | 12.4 | 12.7 | 25.10 | 1506.00 | 331320.00 |
| 02/12/2016 | 7.00 | 9.2 | 9.3 | 18.50 | 1110.00 | 244200.00 |
| 02/19/2016 | 7.00 | 14.6 | 14.8 | 29.40 | 1764.00 | 388080.00 |
| 02/26/2016 | 7.00 | 7.9 | 8 | 15.90 | 954.00 | 209880.00 |
| 03/04/2016 | 7.00 | 7.5 | 7.7 | 15.20 | 912.00 | 200640.00 |
| 03/11/2016 | 7.00 | 8.2 | 8.6 | 16.80 | 1008.00 | 221760.00 |
| 03/18/2016 | 7.00 | 9.7 | 9.9 | 19.60 | 1176.00 | 258720.00 |
| 03/25/2016 | 7.00 | 6.6 | 6.9 | 13.50 | 810.00 | 178200.00 |
| 04/01/2016 | 7.00 | 14.9 | 15.4 | 30.30 | 1818.00 | 399960.00 |
| 04/08/2016 | 7.00 | 10.2 | 16.2 | 26.40 | 1584.00 | 348480.00 |
| 04/14/2016 | 6.00 | 6.7 | 6.9 | 13.60 | 816.00 | 179520.00 |
| 04/22/2016 | 8.00 | 7.1 | 7.2 | 14.30 | 858.00 | 188760.00 |
| 04/29/2016 | 7.00 | 5.6 | 5.8 | 11.40 | 684.00 | 150480.00 |
| 05/06/2016 | 7.00 | 6.1 | 6.3 | 12.40 | 744.00 | 163680.00 |
| 05/13/2016 | 7.00 | 5.7 | 5.9 | 11.60 | 696.00 | 153120.00 |
| 05/20/2016 | 7.00 | 5.7 | 5.9 | 11.60 | 696.00 | 153120.00 |
| 05/27/2016 | 7.00 | 4.8 | 4.9 | 9.70 | 582.00 | 128040.00 |
| 06/03/2016 | 7.00 | 5.2 | 5.5 | 10.70 | 642.00 | 141240.00 |
| 06/10/2016 | 7.00 | 5.6 | 5.7 | 11.30 | 678.00 | 149160.00 |
| 06/17/2016 | 7.00 | 5.5 | 5.6 | 11.10 | 666.00 | 146520.00 |
| 06/24/2016 | 7.00 | 5.4 | 5.7 | 11.10 | 666.00 | 146520.00 |
| 07/01/2016 | 7.00 | 5.2 | 5.5 | 10.70 | 642.00 | 141240.00 |
| 07/08/2016 | 7.00 | 5.3 | 5.5 | 10.80 | 648.00 | 142560.00 |
| 07/15/2016 | 7.00 | 5.3 | 5.4 | 10.70 | 642.00 | 141240.00 |
| 07/22/2016 | 7.00 | 5.4 | 5.4 | 10.80 | 648.00 | 142560.00 |
| 07/29/2016 | 7.00 | 5.7 | 5.8 | 11.50 | 690.00 | 151800.00 |
| 08/05/2016 | 7.00 | 5.4 | 5.5 | 10.90 | 654.00 | 143880.00 |
| 08/12/2016 | 7.00 | 5.6 | 5.7 | 11.30 | 678.00 | 149160.00 |
| 08/19/2016 | 7.00 | 6.2 | 6.5 | 12.70 | 762.00 | 167640.00 |
| 08/26/2016 | 7.00 | 6.1 | 6.3 | 12.40 | 744.00 | 163680.00 |
| 09/02/2016 | 7.00 | 6.1 | 6.4 | 12.50 | 750.00 | 165000.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 09/09/2016 | 7.00 | 6.3 | 6.5 | 12.80 | 768.00 | 168960.00 |
| 09/16/2016 | 7.00 | 5.8 | 5.8 | 11.60 | 696.00 | 153120.00 |
| 09/23/2016 | 7.00 | 5.7 | 5.8 | 11.50 | 690.00 | 151800.00 |
| 09/30/2016 | 7.00 | 5.5 | 5.7 | 11.20 | 672.00 | 147840.00 |
| 10/07/2016 | 7.00 | 5.7 | 5.8 | 11.50 | 690.00 | 151800.00 |
| 10/14/2016 | 7.00 | 5.8 | 5.8 | 11.60 | 696.00 | 153120.00 |
| 10/21/2016 | 7.00 | 5.4 | 5.5 | 10.90 | 654.00 | 143880.00 |
| 10/28/2016 | 7.00 | 5.2 | 5.3 | 10.50 | 630.00 | 138600.00 |
| 11/04/2016 | 7.00 | 5.4 | 5.4 | 10.80 | 648.00 | 142560.00 |
| 11/11/2016 | 7.00 | 8.0 | 8.3 | 16.30 | 978.00 | 215160.00 |
| 11/18/2016 | 7.00 | 2.9 | 2.9 | 5.80 | 348.00 | 76560.00 |
| 11/23/2016 | 5.00 | 3.9 | 4.1 | 8.00 | 480.00 | 105600.00 |
| 12/02/2016 | 9.00 | 7.6 | 7.8 | 15.40 | 924.00 | 203280.00 |
| 12/09/2016 | 7.00 | 5.6 | 5.7 | 11.30 | 678.00 | 149160.00 |
| 12/16/2016 | 7.00 | 5.4 | 5.5 | 10.90 | 654.00 | 143880.00 |
| 12/22/2016 | 6.00 | 5.1 | 5.3 | 10.40 | 624.00 | 137280.00 |
| 12/30/2016 | 8.00 | 7.5 | 8.6 | 16.10 | 966.00 | 212520.00 |
| 01/06/2017 | 7.00 | 6.3 | 6.6 | 12.90 | 774.00 | 170280.00 |
| 01/13/2017 | 7.00 | 6.1 | 6.3 | 12.40 | 744.00 | 163680.00 |
| 01/20/2017 | 7.00 | 8.2 | 8.4 | 16.60 | 996.00 | 219120.00 |
| 01/27/2017 | 7.00 | 8.4 | 8.4 | 16.80 | 1008.00 | 221760.00 |
| 02/03/2017 | 7.00 | 7.1 | 7.2 | 14.30 | 858.00 | 188760.00 |
| 02/10/2017 | 7.00 | 6.1 | 6.3 | 12.40 | 744.00 | 163680.00 |
| 02/17/2017 | 7.00 | 5.9 | 6.0 | 11.90 | 714.00 | 157080.00 |
| 02/24/2017 | 7.00 | 7.4 | 7.6 | 15.00 | 900.00 | 198000.00 |
| 03/02/2017 | 6.00 | 13.1 | 13.1 | 26.20 | 1572.00 | 345840.00 |
| 03/10/2017 | 8.00 | 8.9 | 8.9 | 17.80 | 1068.00 | 234960.00 |
| 03/17/2017 | 7.00 | 6.8 | 7.0 | 13.80 | 828.00 | 182160.00 |
| 03/24/2017 | 7.00 | 6.2 | 6.3 | 12.50 | 750.00 | 165000.00 |
| 03/31/2017 | 7.00 | 9.9 | 10.0 | 19.90 | 1194.00 | 262680.00 |
| 04/07/2017 | 7.00 | 15.9 | 16.5 | 32.40 | 1944.00 | 427680.00 |
| 04/13/2017 | 6.00 | 9.8 | 9.8 | 19.60 | 1176.00 | 258720.00 |
| 04/21/2017 | 8.00 | 10.9 | 11.2 | 22.10 | 1326.00 | 291720.00 |
| 04/28/2017 | 7.00 | 8.2 | 8.5 | 16.70 | 1002.00 | 220440.00 |
| 05/05/2017 | 7.00 | 10.5 | 10.8 | 21.30 | 1278.00 | 281160.00 |
| 05/19/2017 | 14.00 | 13.5 | 13.8 | 27.30 | 1638.00 | 360360.00 |
| 05/26/2017 | 7.00 | 6.2 | 6.3 | 12.50 | 750.00 | 165000.00 |
| 06/02/2017 | 7.00 | 5.9 | 6.0 | 11.90 | 714.00 | 157080.00 |
| 06/09/2017 | 7.00 | 5.9 | 6.1 | 12.00 | 720.00 | 158400.00 |
| 06/16/2017 | 7.00 | 6.3 | 6.5 | 12.80 | 768.00 | 168960.00 |
| 06/23/2017 | 7.00 | 23.3 | 23.8 | 47.10 | 2826.00 | 621720.00 |
| 06/30/2017 | 7.00 | 26.4 | 27.0 | 53.40 | 3204.00 | 704880.00 |
| 07/07/2017 | 7.00 | 7.8 | 8.1 | 15.90 | 954.00 | 209880.00 |
| 07/14/2017 | 7.00 | 6.7 | 7.0 | 13.70 | 822.00 | 180840.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 07/21/2017 | 7.00 | 6.4 | 6.6 | 13.00 | 780.00 | 171600.00 |
| 07/28/2017 | 7.00 | 7.4 | 7.8 | 15.20 | 912.00 | 200640.00 |
| 08/04/2017 | 7.00 | 7.4 | 7.7 | 15.10 | 906.00 | 199320.00 |
| 08/11/2017 | 7.00 | 7.5 | 7.9 | 15.40 | 924.00 | 203280.00 |
| 08/18/2017 | 7.00 | 6.9 | 7.5 | 14.40 | 864.00 | 190080.00 |
| 08/25/2017 | 7.00 | 6.8 | 7.2 | 14.00 | 840.00 | 184800.00 |
| 08/31/2017 | 6.00 | 7.4 | 7.5 | 14.90 | 894.00 | 196680.00 |
| 09/08/2017 | 8.00 | 6.9 | 7.0 | 13.90 | 834.00 | 183480.00 |
| 09/15/2017 | 7.00 | 6.1 | 6.4 | 12.50 | 750.00 | 165000.00 |
| 09/22/2017 | 7.00 | 6.5 | 6.7 | 13.20 | 792.00 | 174240.00 |
| 09/29/2017 | 7.00 | 6 | 6.2 | 12.20 | 732.00 | 161040.00 |
| 10/06/2017 | 7.00 | 6.1 | 6.1 | 12.20 | 732.00 | 161040.00 |
| 10/13/2017 | 7.00 | 5.8 | 5.8 | 11.60 | 696.00 | 153120.00 |
| 10/20/2017 | 7.00 | 6.6 | 6.7 | 13.30 | 798.00 | 175560.00 |
| 10/27/2017 | 7.00 | 8.5 | 8.0 | 16.50 | 990.00 | 217800.00 |
| 11/03/2017 | 7.00 | 8.2 | 8.3 | 16.50 | 990.00 | 217800.00 |
| 11/10/2017 | 7.00 | 7.2 | 7.5 | 14.70 | 882.00 | 194040.00 |
| 11/17/2017 | 7.00 | 7.6 | 7.5 | 15.10 | 906.00 | 199320.00 |
| 11/22/2017 | 5.00 | 6.8 | 6.8 | 13.60 | 816.00 | 179520.00 |
| 12/01/2017 | 9.00 | 8.7 | 8.7 | 17.40 | 1044.00 | 229680.00 |
| 12/08/2017 | 7.00 | 21.0 | 10.0 | 31.00 | 1860.00 | 409200.00 |
| 12/15/2017 | 7.00 | 0.1 | 13.2 | 13.30 | 798.00 | 175560.00 |
| 12/21/2017 | 6.00 | Off | 12.1 | 12.10 | 726.00 | 159720.00 |
| 12/29/2017 | 8.00 | Off | 15.4 | 15.40 | 924.00 | 203280.00 |
| Average Daily Flow, GPM | | 20.40 | | | | |
| Maximum Average Day Demand, GPD | | 100,697 | | | | |
| Maximum Average Day Demand, GPM | | 69.92 | | | | |
| Meter reading computations are based upon pump hour meter read with a pump rating of 220 GPM. Check these values | | | | | | |

**Table 3-2- Pump Station #8 Run Times and Flow Rates, Jan. 8, 2016-Dec. 29, 2017**

| Date | Days (Length of time between recordings) | Pump 1 Time (hours) | Pump 2 Time (hours) | Total Station Run Times (hours) | Total Station Run Times (minutes) | Total Station Flow (GPM) |
|---|---|---|---|---|---|---|
| 1/8/16 | | 1.60 | 1.30 | 2.90 | 174.00 | 13920.00 |
| 1/15/16 | 7.00 | 2.10 | 1.80 | 3.90 | 234.00 | 18720.00 |
| 1/22/16 | 7.00 | 1.50 | 1.20 | 2.70 | 162.00 | 12960.00 |
| 1/29/16 | 7.00 | 1.20 | 1.10 | 2.30 | 138.00 | 11040.00 |
| 2/5/16 | 7.00 | 3.20 | 2.70 | 5.90 | 354.00 | 28320.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2/12/16 | 7.00 | 2.10 | 1.70 | 3.80 | 228.00 | 18240.00 |
| 2/19/16 | 7.00 | 0.90 | 0.90 | 1.80 | 108.00 | 8640.00 |
| 2/26/16 | 7.00 | 2.10 | 1.70 | 3.80 | 228.00 | 18240.00 |
| 3/4/16 | 7.00 | 2.10 | 1.70 | 3.80 | 228.00 | 18240.00 |
| 3/11/16 | 7.00 | 2.70 | 2.20 | 4.90 | 294.00 | 23520.00 |
| 3/18/16 | 7.00 | 3.40 | 2.80 | 6.20 | 372.00 | 29760.00 |
| 3/25/16 | 7.00 | 1.60 | 1.40 | 3.00 | 180.00 | 14400.00 |
| 4/1/16 | 7.00 | 5.70 | 4.70 | 10.40 | 624.00 | 49920.00 |
| 4/8/16 | 7.00 | 3.60 | 2.90 | 6.50 | 390.00 | 31200.00 |
| 4/15/16 | 7.00 | 2.10 | 1.80 | 3.90 | 234.00 | 18720.00 |
| 4/22/16 | 7.00 | 1.60 | 1.30 | 2.90 | 174.00 | 13920.00 |
| 4/29/16 | 7.00 | 1.40 | 1.30 | 2.70 | 162.00 | 12960.00 |
| 5/6/16 | 7.00 | 2.10 | 1.70 | 3.80 | 228.00 | 18240.00 |
| 5/13/16 | 7.00 | 1.30 | 1.20 | 2.50 | 150.00 | 12000.00 |
| 5/20/16 | 7.00 | 1.60 | 1.60 | 3.20 | 192.00 | 15360.00 |
| 5/27/16 | 7.00 | 1.00 | 0.70 | 1.70 | 102.00 | 8160.00 |
| 6/3/16 | 7.00 | 0.90 | 0.90 | 1.80 | 108.00 | 8640.00 |
| 6/10/16 | 7.00 | 1.10 | 0.90 | 2.00 | 120.00 | 9600.00 |
| 6/17/16 | 7.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 6/24/16 | 7.00 | 0.90 | 0.70 | 1.60 | 96.00 | 7680.00 |
| 7/1/16 | 7.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 7/8/16 | 7.00 | 0.80 | 0.70 | 1.50 | 90.00 | 7200.00 |
| 7/15/16 | 7.00 | 1.00 | 0.90 | 1.90 | 114.00 | 9120.00 |
| 7/22/16 | 7.00 | 1.00 | 0.80 | 1.80 | 108.00 | 8640.00 |
| 7/29/16 | 7.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 8/5/16 | 7.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 8/12/16 | 7.00 | 1.10 | 0.80 | 1.90 | 114.00 | 9120.00 |
| 8/19/16 | 7.00 | 0.80 | 0.80 | 1.60 | 96.00 | 7680.00 |
| 8/26/16 | 7.00 | 1.10 | 0.70 | 1.80 | 108.00 | 8640.00 |
| 9/2/16 | 7.00 | 0.80 | 0.80 | 1.60 | 96.00 | 7680.00 |
| 9/9/16 | 7.00 | 0.90 | 1.50 | 2.40 | 144.00 | 11520.00 |
| 9/16/16 | 7.00 | 1.00 | 1.90 | 2.90 | 174.00 | 13920.00 |
| 9/23/16 | 7.00 | 0.90 | 0.90 | 1.80 | 108.00 | 8640.00 |
| 10/7/16 | 14.00 | 1.00 | 0.80 | 1.80 | 108.00 | 8640.00 |
| 10/14/16 | 7.00 | 2.60 | 2.30 | 4.90 | 294.00 | 23520.00 |
| 10/21/16 | 7.00 | 1.70 | 1.40 | 3.10 | 186.00 | 14880.00 |
| 10/28/16 | 7.00 | 0.80 | 0.80 | 1.60 | 96.00 | 7680.00 |
| 11/4/16 | 7.00 | 1.00 | 0.70 | 1.70 | 102.00 | 8160.00 |
| 11/11/16 | 7.00 | 1.60 | 1.20 | 2.80 | 168.00 | 13440.00 |
| 11/18/16 | 7.00 | 0.50 | 0.50 | 1.00 | 60.00 | 4800.00 |
| 11/23/16 | 5.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 12/2/16 | 9.00 | 1.20 | 1.10 | 2.30 | 138.00 | 11040.00 |
| 12/9/16 | 7.00 | 1.00 | 1.00 | 2.00 | 120.00 | 9600.00 |
| 12/16/16 | 7.00 | 0.90 | 1.00 | 1.90 | 114.00 | 9120.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 12/22/16 | 6.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 12/30/16 | 8.00 | 2.30 | 1.90 | 4.20 | 252.00 | 20160.00 |
| 1/6/17 | 7.00 | 1.60 | 1.40 | 3.00 | 180.00 | 14400.00 |
| 1/13/17 | 7.00 | 1.50 | 1.10 | 2.60 | 156.00 | 12480.00 |
| 1/20/17 | 7.00 | 1.60 | 1.40 | 3.00 | 180.00 | 14400.00 |
| 1/27/17 | 7.00 | 2.50 | 2.10 | 4.60 | 276.00 | 22080.00 |
| 2/3/17 | 7.00 | 1.40 | 1.30 | 2.70 | 162.00 | 12960.00 |
| 2/10/17 | 7.00 | 1.20 | 2.10 | 3.30 | 198.00 | 15840.00 |
| 2/17/17 | 7.00 | 1.20 | 1.00 | 2.20 | 132.00 | 10560.00 |
| 2/24/17 | 7.00 | 1.70 | 1.50 | 3.20 | 192.00 | 15360.00 |
| 3/3/17 | 7.00 | 4.10 | 3.60 | 7.70 | 462.00 | 36960.00 |
| 3/10/17 | 7.00 | 2.10 | 2.00 | 4.10 | 246.00 | 19680.00 |
| 3/17/17 | 7.00 | 1.40 | 1.20 | 2.60 | 156.00 | 12480.00 |
| 3/24/17 | 7.00 | 1.60 | 1.30 | 2.90 | 174.00 | 13920.00 |
| 3/31/17 | 7.00 | 3.10 | 1.80 | 4.90 | 294.00 | 23520.00 |
| 4/7/17 | 7.00 | 5.50 | 4.60 | 10.10 | 606.00 | 48480.00 |
| 4/14/17 | 7.00 | 2.90 | 1.60 | 4.50 | 270.00 | 21600.00 |
| 4/21/17 | 7.00 | 3.80 | 3.20 | 7.00 | 420.00 | 33600.00 |
| 4/28/17 | 7.00 | 2.40 | 1.90 | 4.30 | 258.00 | 20640.00 |
| 5/5/17 | 7.00 | 3.80 | 3.40 | 7.20 | 432.00 | 34560.00 |
| 5/12/17 | 7.00 | 3.30 | 2.60 | 5.90 | 354.00 | 28320.00 |
| 5/19/17 | 7.00 | 3.30 | 2.60 | 5.90 | 354.00 | 28320.00 |
| 5/26/17 | 7.00 | 1.60 | 1.50 | 3.10 | 186.00 | 14880.00 |
| 6/2/17 | 7.00 | 1.30 | 1.20 | 2.50 | 150.00 | 12000.00 |
| 6/9/17 | 7.00 | 2.20 | 1.00 | 3.20 | 192.00 | 15360.00 |
| 6/16/17 | 7.00 | 1.30 | 1.00 | 2.30 | 138.00 | 11040.00 |
| 6/23/17 | 7.00 | 11.40 | 10.30 | 21.70 | 1302.00 | 104160.00 |
| 6/30/17 | 7.00 | 4.70 | 3.90 | 8.60 | 516.00 | 41280.00 |
| 7/7/17 | 7.00 | 1.60 | 1.30 | 2.90 | 174.00 | 13920.00 |
| 7/14/17 | 7.00 | 1.30 | 1.10 | 2.40 | 144.00 | 11520.00 |
| 7/21/17 | 7.00 | 1.20 | 1.10 | 2.30 | 138.00 | 11040.00 |
| 7/28/17 | 7.00 | 1.10 | 1.20 | 2.30 | 138.00 | 11040.00 |
| 8/4/17 | 7.00 | 0.80 | 0.70 | 1.50 | 90.00 | 7200.00 |
| 8/11/17 | 7.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 8/18/17 | 7.00 | 1.00 | 1.00 | 2.00 | 120.00 | 9600.00 |
| 8/25/17 | 7.00 | 0.90 | 0.70 | 1.60 | 96.00 | 7680.00 |
| 9/8/17 | 14.00 | 1.00 | 0.90 | 1.90 | 114.00 | 9120.00 |
| 9/15/17 | 7.00 | 0.80 | 0.70 | 1.50 | 90.00 | 7200.00 |
| 9/22/17 | 7.00 | 1.00 | 0.90 | 1.90 | 114.00 | 9120.00 |
| 9/29/17 | 7.00 | 0.90 | 0.80 | 1.70 | 102.00 | 8160.00 |
| 10/6/17 | 7.00 | 1.00 | 0.80 | 1.80 | 108.00 | 8640.00 |
| 10/13/17 | 7.00 | 0.70 | 0.70 | 1.40 | 84.00 | 6720.00 |
| 10/20/17 | 7.00 | 1.00 | 0.80 | 1.80 | 108.00 | 8640.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 10/27/17 | 7.00 | 1.30 | 1.20 | 2.50 | 150.00 | 12000.00 |
| 11/3/17 | 7.00 | 1.10 | 0.90 | 2.00 | 120.00 | 9600.00 |
| 11/10/17 | 7.00 | 1.10 | 0.80 | 1.90 | 114.00 | 9120.00 |
| 11/17/17 | 7.00 | 2.40 | 2.30 | 4.70 | 282.00 | 22560.00 |
| 12/1/17 | 14.00 | 1.70 | 1.50 | 3.20 | 192.00 | 15360.00 |
| 12/8/17 | 7.00 | 1.20 | 0.90 | 2.10 | 126.00 | 10080.00 |
| 12/15/17 | 7.00 | 1.00 | 0.80 | 1.80 | 108.00 | 8640.00 |
| 12/21/17 | 6.00 | 1.10 | 0.90 | 2.00 | 120.00 | 9600.00 |
| 12/29/17 | 8.00 | 1.80 | 1.50 | 3.30 | 198.00 | 15840.00 |

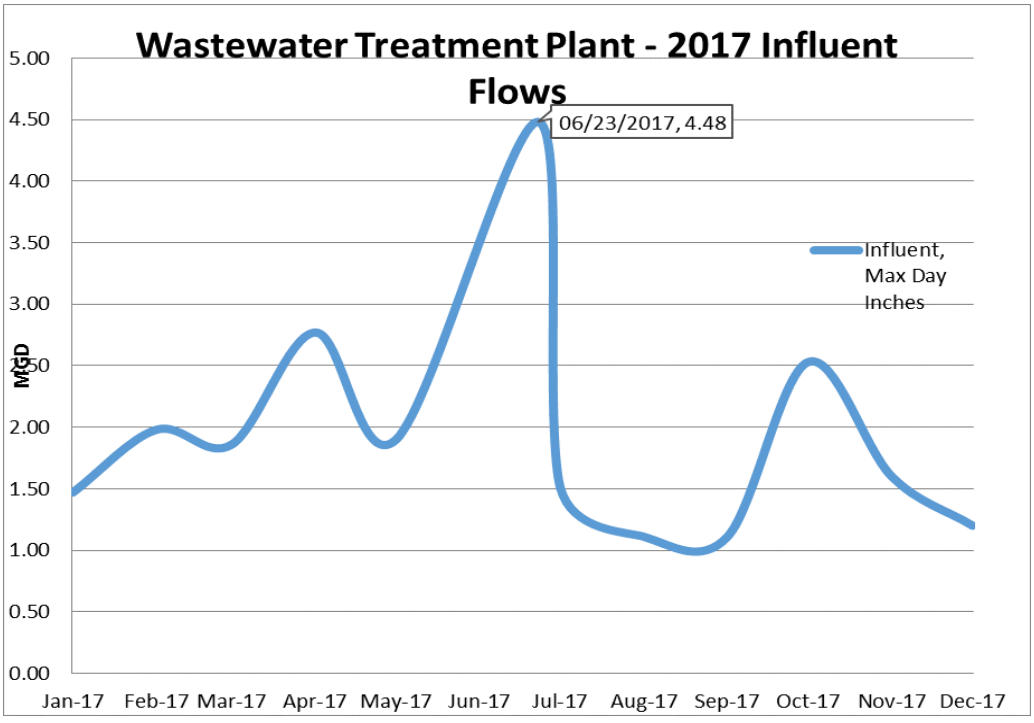
| | |
|---|---|
| Average Daily Flow, GPM | 1.54 |
| Maximum Average Day Demand, GPD | 14,880 |
| Maximum Average Day Demand, GPM | 10.33 |

Computations for Meter Reading were performed based upon pump hour meter read with a pump rating of 80 GPM

**Wastewater Treatment Plant**

The full effect of the June 2017 rain event is evident in the sanitary flows recorded at the WWTP. Figure 3-6 shows that the peak of the rainfall on June 23 created a significant spike in influent (incoming) flow at the WWTP.

**Graph 3-6- Wastewater Treatment Plant 2017 Influent Flows**




As demonstrated in the graph, flows recorded at the WWTP rose after the rain event occurred. As the precipitation ceased, flows at the WWTP receded to normal values. Based on available data, it is estimated that at least 6.4 million gallons of storm water entered the sanitary sewer over the course of three days. This amount of water is not typical nor consistent with normal operations for this plant during dry or wet weather conditions.

## 3.3 Overall System Review & Findings

This system has been in operation for almost 40 years. Overall, it is in very good condition and appears to have been well maintained. It operates within the original design parameters. Key items from the inventory analysis include:

- Condition
  - Review of the televising and inspection reports for the collection system indicated minimal deformities and/or breaks in pipe with 83% of the system in excellent condition.
  - The pump stations have been well maintained as indicated by the records. Critical components are routinely inspected and replaced and/or repaired when warranted.
- Operations
  - Both pump stations during the June 2017 experienced higher than typical run times per both DEQ guidelines and historical data, indicative of the presence of groundwater infiltration and/inflow.
  - Although Pump Station #8 experienced alarms during the June 2017, Pump Station #7 did not. Accounting for the pump run times, it is evident both pumps in this station were running the majority of the time during the event however no operational issues were found to occur as evidenced by the lack of alarms. Based upon the available information, the station was able to maintain operations and sustain the amount of both sewage and intrusion of stormwater without backup. Had a backup as a result of the sewer system operation and specifically in Pump Station #7 occurred, a high water alarm would have been acknowledged.
  - As evident from the wastewater treatment plant incoming flows experienced during the June 2017 event, all infrastructure in the system was susceptible to the intrusion of stormwater as a 100 year rain event was experienced. New and/or existing sanitary sewer infrastructure is not sized to accommodate that volume of water.

The next sections will provide a more in-depth review of the flow monitoring that was completed, patterns and affect from possible Inflow and Infiltration.

# 4 FLOW MONITORING

As part of the Pump Station #7 service area study, GFA conducted a flow monitoring program to measure existing flow conditions for multiple key reasons:

- To calibrate the hydraulic model
- Assist with overall system analysis
    - evaluate the available capacity of existing infrastructure
    - provide data for wet weather analysis of the collection system
    - evaluate the extent of inflow/infiltration (I&I) which may be present in the system, to help determine cost-effective remedies

It was important to collect this data since several areas within the area were reported to experience flooding and basement backups during the June 2017 event, yet did not appear to have capacity issues historically. Flow data was collected for three (3) months to obtain both dry and wet weather patterns, and help establish daily (diurnal) patterns for relating average day and peak flows. Rainfall was also monitored.

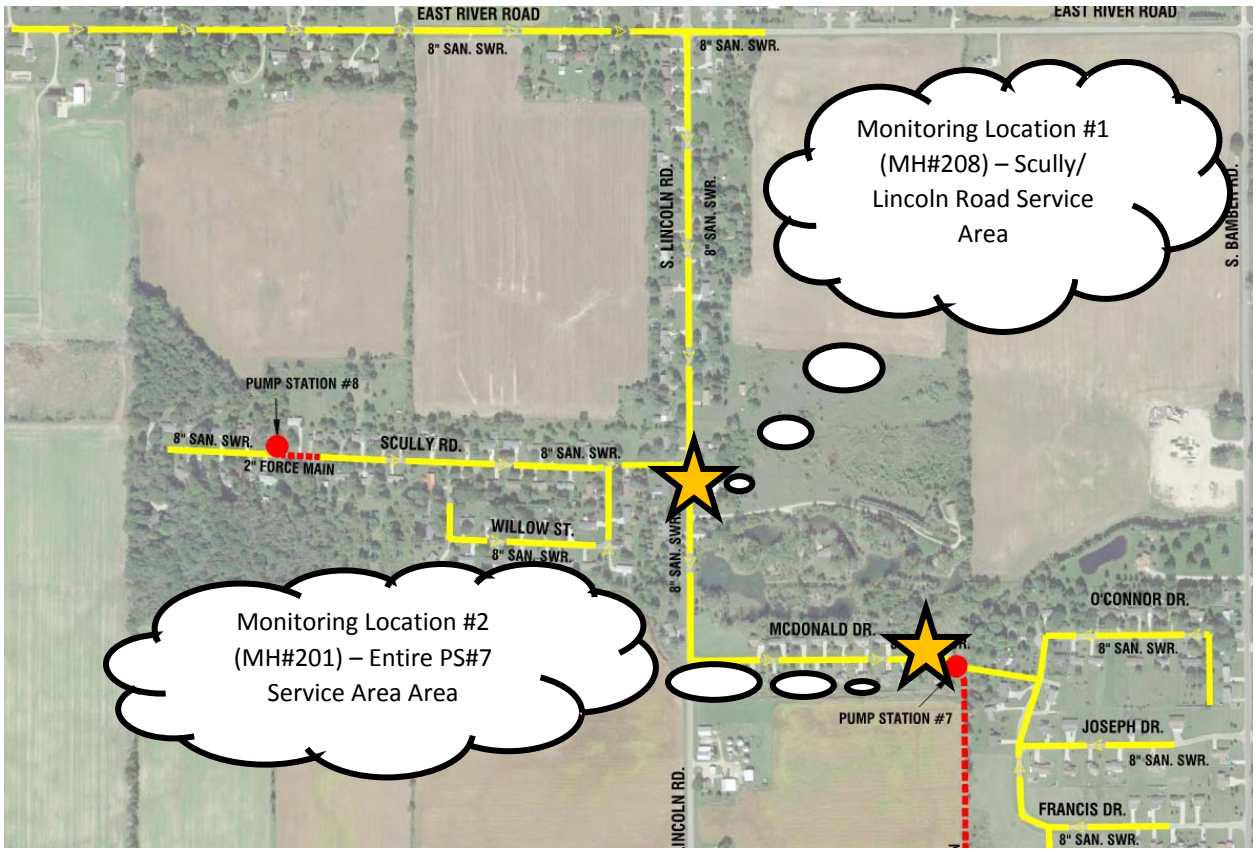
## 4.1 DATA COLLECTION METHODOLOGIES

Data was collected during the monitoring period using open-channel flowmeters manufactured by ISCO. These were furnished, installed, and maintained by GFA and DPW staff during the monitoring period. These flowmeters measure the depth and velocity of the flow in the open channel at one-minute intervals, and use the measurements to calculate the instantaneous flow rate in the sewer pipe via a proprietary software (ISCO FlowLink).

The flow area is computed using the depth measurement and the known channel geometry. Flow is then calculated by multiplying the recorded velocity by the flow area. GFA and Union Township WWTP personnel collected data for the gravity sanitary sewer system upstream of Pump Station #7. Both open-channel flow metering and magnetic flowmeter readings recorded data from April 30, 2018 through June 18, 2018, providing information that allowed us to develop daily (diurnal) patterns for relating average day and peak hour sewer system demands.

Figure 4-1 illustrates the sewer configuration in this area, as well as the location of monitored structures. The first monitoring location was inside MH #208, near the intersection of South Lincoln and Scully Roads. The second monitoring location was inside MH #201, just upstream of Pump Station #7, within an 8” PVC sewer. We selected these two monitoring locations because of the shallow slope of the sewer, accessibility, and DPW recommendations. The shallow slope allows a greater level, providing a more accurate analysis that is easy to access for daily inspections.

***Figure 4-1: Sewer Configuration and Flow Monitoring Location Map***




## Data Collection - Definitions & Regulatory Guidelines

Sanitary sewer flows vary throughout the day in repeating patterns termed “diurnal patterns”. Flows are generally are lower in the late night to early morning and peak in late morning to early afternoon, typically corresponding with water usage. The variations in the measured flows are described with the terms outlined below. In domestic wastewater systems, in residential areas such as prominent for the Pump Station #7 Service Area, generally peaks in the morning and again in the evening hours are normal. There are also differences between typical weekday and weekend diurnal flow patterns.

| | Definition | Regulatory Guidelines – MDEQ Act 451 Permitting |
|---|---|---|
| ***Minimum*** | Minimum flow conveyed by the system expressed as a flow rate in gallon per minute (gpm). | |
| ***Maximum*** | Maximum flow conveyed by the system expressed as a flow rate in gpm. | |
| ***Average Day*** | Defined as the total volume of sewer discharged into the system over the monitoring period divided by the total minutes monitored. Expressed as a rate in gpm. | Typical values for peak hour factor (newly constructed sanitary sewer system) average daily flow per benefit - defined for Union Township as 250 gallons/day per benefit. This uses typical values of 2.5 capita per household/benefit as defined by the 2010 Census and 100 gal/capita/day of sewer consumption. |
| ***Maximum Day*** | The maximum volume of sewer discharged into the system in any single day during the monitoring period, expressed as a rate in gpm. | |
| ***Peak Hour*** | The maximum volume of sewer discharged into the system in any single hour during the monitoring period, expressed as a rate in gpm. | Typical values for peak hour factor (newly constructed sanitary sewer system) are around 4.0. Peaking factor classifications observed from monitored flow data:<br>• Good - a factor less than 4.0<br>• Slightly high - a factor ranging from 4.0 to 8.0<br>• Problematic - factors over 8.0, or twice the typical value. |

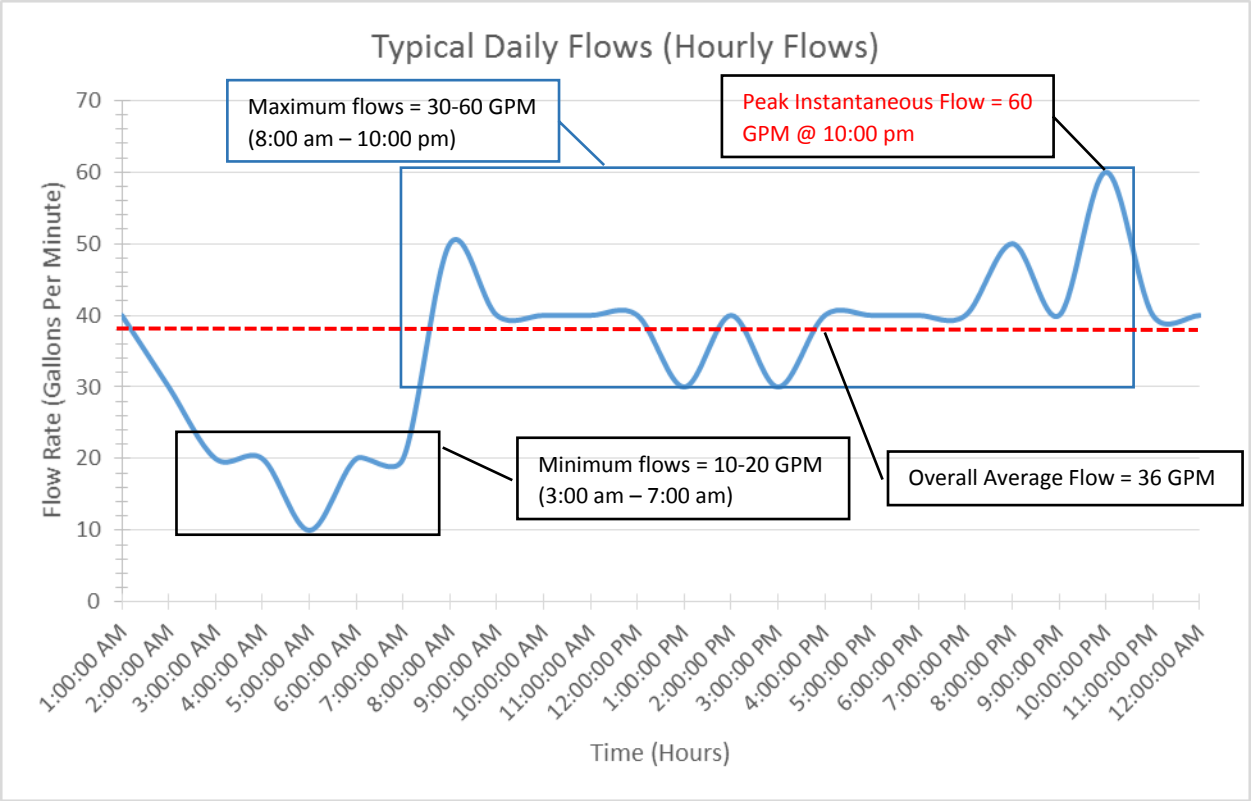
## Data Collection - Precipitation Data

Rainfall data is based on the rain gauge monitored and located at the Mount Pleasant Municipal Airport, and compared to regional figures. The rain data collected during the monitoring periods was of variable quality. Weather conditions during the 2018 monitoring periods was relatively dry, with monthly rainfall totals below average. Rainfall did increase during the fall season. However, despite the lack of large rainfall events, monitoring periods at the meter locations were sufficient to capture at least moderate rainfall. As a result, measured sewer flows generally reflected both dry and wet weather influences on domestic wastewater production. The largest rainfall event recorded during the monitoring period was approximately 1.75 inches on May 31, 2018. On this date, open channel flow metering was being performed at both MH#208 and MH#201 sampling locations. In terms of intensity classification, this would be a fairly common event, with a less than a two-year frequency (2.27 inches over a 24-hour duration).

## 4.2 Flow Data & Analysis

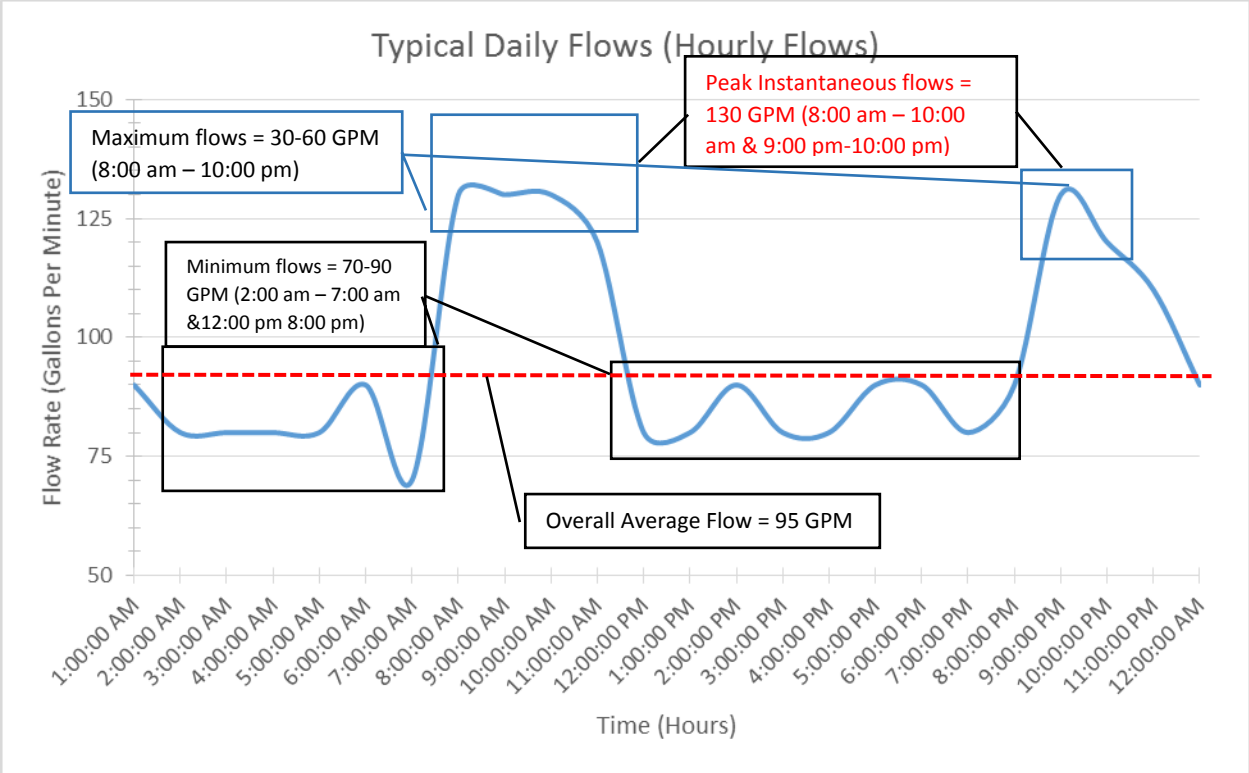
Graphs 4-1 and 4-2 illustrate a snapshot of a typical diurnal pattern for a 24 hour period as observed at both MH #208 and MH #201. The raw data shown consists of multiple peaks and valleys with significant variation at each 15-minute measurement. The minimum and maximum flows, overall average and peak hour flows for both data sets are depicted on the graphs.

**Graph 4-1- MH #208 Lincoln Road, April 30, 2018 Hourly Sewer Flow Monitoring**




From this information a peaking factor can be determined (peak hour flow divided by the overall average flow). For example, using the data above this yields a peaking factor of 1.67 for the sampling at MH #208 for this particular day.

**Graph 4-2- MH #201 McDonald Drive, April 30, 2018 Hourly Sewer Flow Monitoring**




Tables 4-1 and 4-2 detail the flow characteristics at the monitoring locations during the monitoring period and available capacity of the infrastructure that services the meter locations. Record drawing information was used to calculate the available capacity of the sanitary sewer and pump station in the respective monitoring locations.

**Table 4-1: MH #208 Lincoln Road, Flow Upstream of Monitoring Device (8" PVC Inlet)**

| Statistic | Level (in) | % Full Depth | Flow Rate (GPM) | Velocity (ft/s) | % of Available Trunkline Capacity*** |
|---|---|---|---|---|---|
| Minimum | 0.34 | 4.3% | 10 | 0.06 | |
| Maximum | 4.3 | 53.8% | 60 | 13.05 | |
| Average Day | 1.2 | 15% | 8 | 0.60 | **98%** |
| *Maximum Day (Avg. Max Flow) | 2.6 | 32.5% | 28 | 11.03 | |
| **Peak Hour | 2.77 | 34.6% | 35 | 2.40 | **90%** |

* Maximum Day calculations use data from May 19, 2018 (day of maximum conditions).
** Peak hour calculations use data from June 15, 2018, 4:00 pm – 5:00 pm (day/hour of maximum conditions).
****Trunkline capacity is available capacity of the sanitary sewer flowing full and capable to handle peak hour flows = 356 GPM

**Table 4-2: MH #201 McDonald Drive, Flow Upstream of Monitoring Device (8" PVC Inlet)**

| Statistic | Level (in) | % Full Depth | Flow Rate (GPM) | Velocity (ft/s) | % of Available Trunkline Capacity | % of Available Pump Station #7 Firm Capacity*** |
|---|---|---|---|---|---|---|
| Minimum | 1.3 | 15.6% | 10 | 0.12 | | |
| Maximum | 6.9 | 86.5% | 100 | 1.78 | | |
| Average Day | 2.2 | 27.6% | 25 | 0.76 | **93%** | **90%** |
| *Maximum Day (Avg. Max Flow) | 3.6 | 45.0% | 93 | 1.56 | | |
| **Peak Hour | 3.6 | 45.0% | 93 | 1.56 | **75%** | **63%** |

* Maximum Day calculations use data from May 31, 2018 (day of maximum conditions).
** Peak hour calculations use data from May 31, 2018 2:15 am – 3:15 am (day/hour of maximum conditions).
***Firm Capacity is the ability for the station to handle peak hour flow with the largest pump offline = 250 GPM
****Trunkline capacity is available capacity of the sanitary sewer flowing full and capable to handle peak hour flows = 368 GPM

**Table 4-3: Flow Monitoring Data 2018 vs. 2009**

| Location | Trunkline Size (Inches) | Capacity (GPM) | Existing Average Daily Flow (GPM) | | Existing Peak Hour Flow (GPM) | | Peaking Factor | | Benefits | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **2018** | **2009** | **2018** | **2018** | **2018** | **2009** | **2018** | **2009** |
| MH #208 | 8 | 356 | 8 | N/A | 35 | N/A | 4.38 | N/A | 65 | N/A |
| MH #201 | 8 | 368 | 25 | 38.0 | 93 | 95 | 3.72 | 2.5 | 200 | 148 |

The above summary spreadsheet was created to illustrate a comparison to flow monitoring that was completed in 2009 by the Township. As can observed, there no increase in average user demands however increase in peaking factor was observed. This is mostly attributed to low flow amenities (toilets, faucets, showerhead, etc) and increase in benefits over the past 9 years.

Flow Data & Analysis - **Sewer Demands**

GFA established a known flow-per-benefit by using the existing sewer user counts in conjunction with the measured average daily and peak hour sewer flows from the information above. These per-benefit flows are based on the average day and daily peak hour divided by the benefit assignment for the respective monitoring location.

The following table summarizes these calculated sewer flow per benefit values at MH#208 and MH#201. As observed from the previous tables, both monitored areas experience low to average flow-per-benefit values in comparison to the typical 250 gpd.

**Table 4-4: - Wastewater Flow per Benefit 2018 vs. 2009**

| Location | Average Daily Flow per Benefit (GPD/REU) | | Peak Hour Flow Per Benefit (GPD/REU) | |
|---|---|---|---|---|
| | **2018** | **2009** | **2018** | **2009** |
| MH #208 | 177 | N/A | 775 | N/A |
| MH #201 | 180 | 370 | 670 | 924 |

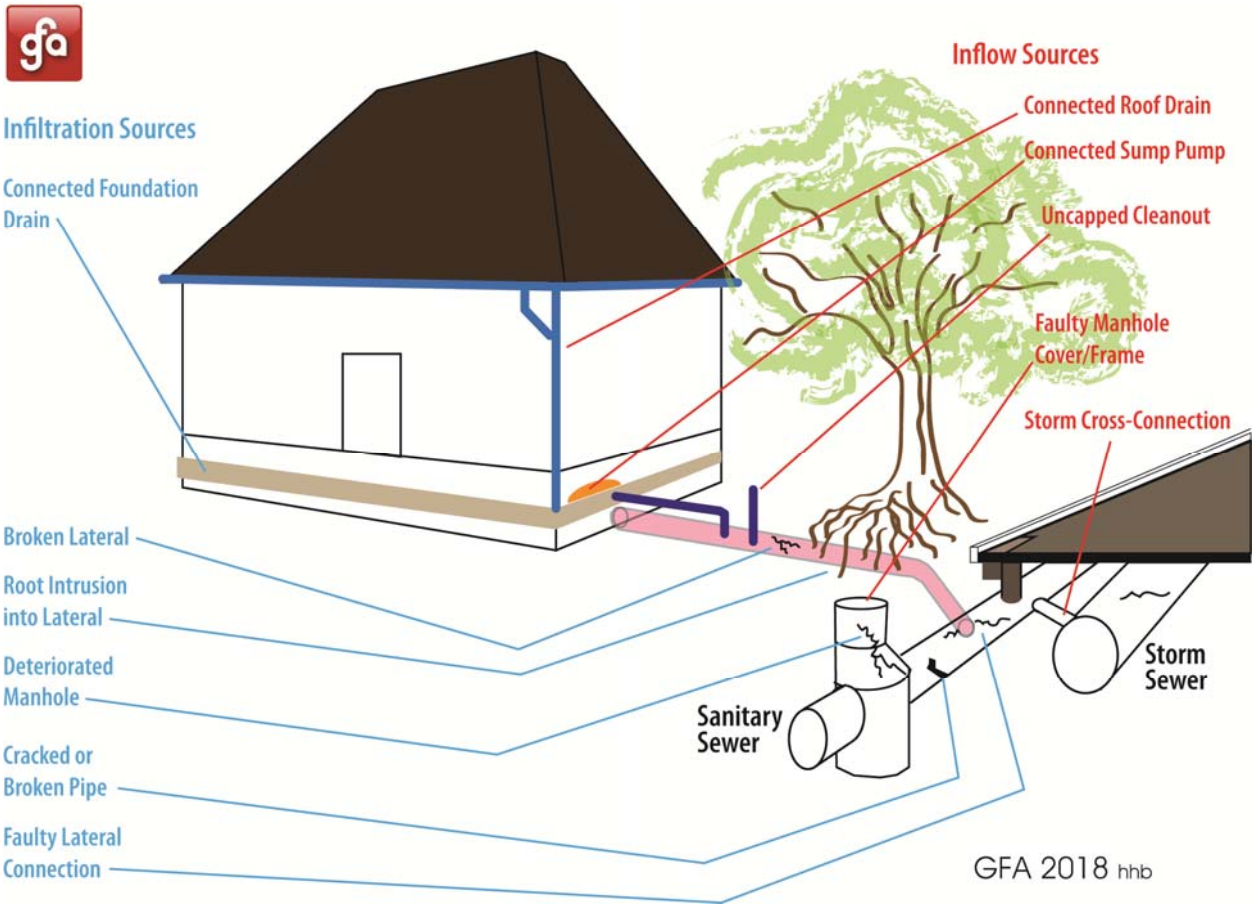
## 4.3 REVIEW AND FINDINGS

The open-channel flowmeters performed well during the monitoring periods. All monitoring periods provided solid dry and wet weather flow information generally consistent with data available from corresponding pump stations. In general, a more in depth review of the flow patterns (wet weather versus dry weather) and affect from possible Inflow and Infiltration presented in the hydrographs will be performed in the next two (2) sections of the report. The following key items are noted:

- Flow & Capacity
  - It appears that the existing sanitary sewer main had more than adequate capacity to meet peak hour flow values during both wet and dry weather conditions during the monitoring period. No adverse impacts, backups, surcharging was reported or identified by the DPW or residents.
  - It appear that existing pump station #7 had more than adequate capacity to meet peak hour flows at firm capacity (largest pump offline) during wet and dry weather conditions during the monitoring period. No adverse impacts, backups, surcharging was reported by the DPW or residents
- Sewer Use
  - Both service areas exhibit average peaking factors, and should be able to withstand high wet weather inflow.
  - Both service areas experienced lower than typical average day flow per their user values.

# 5 INFLOW & INFILTRATION STUDY

As noted previously in this report, Union Township has a substantial amount of gravity sewer, pump stations and manholes located within 100' of the 100-year floodplain and other open-channel water features (drains, streams, rivers, etc). During any significant rainfall and flooding event, these sewers, manholes, and stations can be a significant source of excess flows – creating conditions that can overwhelm the sewer and hydraulically stress the wastewater treatment plant. As part of this investigation, we conducted an Inflow/Infiltration (I/I) to evaluate the impact of rainfall events on the existing sewer trunk line and the associated impacts on the capacity of the sanitary sewer system itself.




## 5.1 DEFINITIONS

Groundwater infiltration (GWI) enters the sewer system from the water table through cracks and defects in sewer pipes, manholes, and service laterals. GWI varies depending on the location and condition of the lines. It is typically greater in late winter and spring following the rainy season when

groundwater levels are higher. GWI may vary from a very minor component of flows in the sewer system to a significant percentage of the flow during non-rainfall periods. The magnitude of GWI can only be determined based on actual flow monitoring data. It is quantified by comparing flow monitoring data for non-rainfall periods at both monitor sites to modeled, calculated dry weather flows.

Rainfall-induced infiltration is caused by storm water percolating down through the ground and entering the sewer pipes, manholes, and service laterals through cracks and defective joints. The magnitude of of this type of infiltration is related to several factors, such as: the intensity and duration of the rainfall; the relative soil moisture at the time of the rainfall event (typically a function of the amount of antecedent rainfall prior to the event); the condition of the sewers; and other factors such as soil type and topography. In most areas, peak flows during rainfall events are the highest flow rates that occur in the sewer system. In communities where the sewers are relatively new and inflow and infiltration is minimal, peak wet weather flows may not be appreciably higher than peak dry weather flows.

Stormwater inflow consists of storm water entering the collection system, when storm water flows directly into the collection system through connected catch basins, manhole covers, area drains, or downspouts. Inflow usually occurs very rapidly during rain events and can become more severe if surface flooding occurs and manholes are submerged (or used to drain low-lying areas).

## 5.2 Regulatory Guidelines

This measure of excessive I&I is quantified per the criteria defined by the MDEQ, which includes any one of the following:

- Wastewater flows during high groundwater conditions are > 120 gallons per capita per day (300 gallons per benefit per day)
- Wastewater flow during any storm event is > 275 gallons per capita per day (688 gallons per benefit per day)
- Storm events cause backup problems, overflows, or poor treatment performance due to hydraulic overloading

If any of these conditions exist then I&I is considered excessive, and it is recommended to pursue removal of these extraneous water sources to relieve the system of additional costs and capacity. For our purposes the second bullet item (Wastewater flow during any storm event is > 275 gallons per capita per day/688 gallons per benefit per day) will be used to determine the severity of I&I for our two study locations, since it is the applicable criteria for the observed flow conditions.

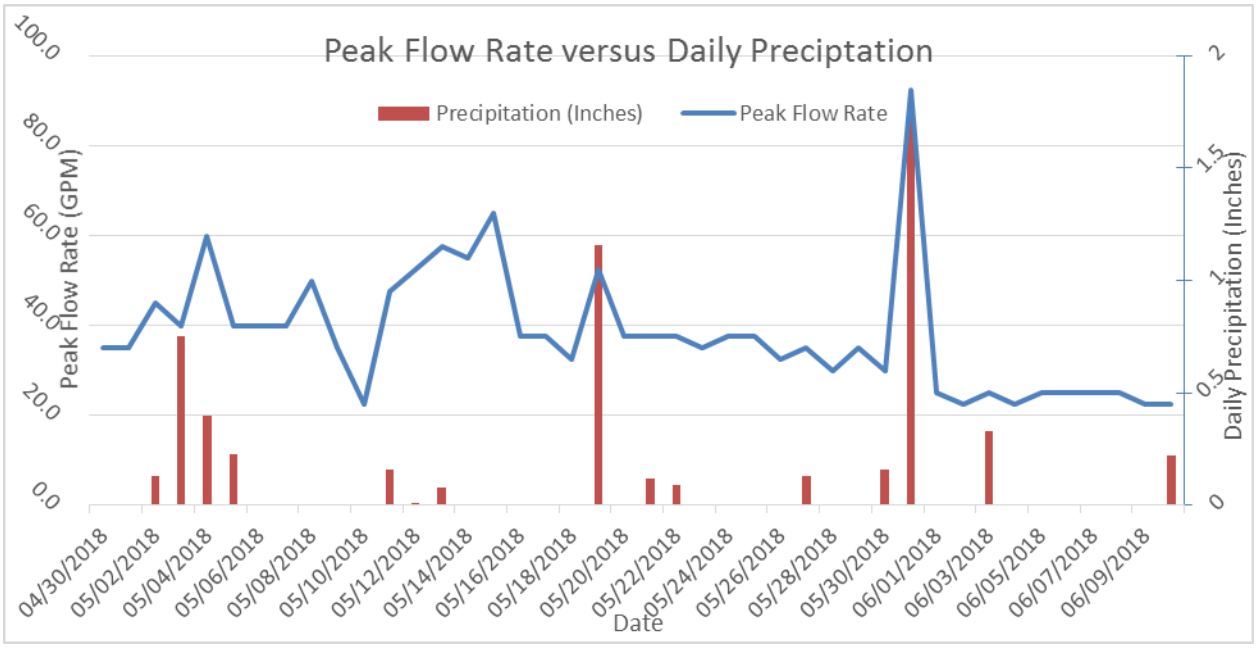
## 5.3 DATA & ANALYSIS

Graphs 5-1 and 5-2 illustrate some flow fluctuations during wet weather periods. Other times are consistent with typical higher user-demand times (e.g. morning showers, dinner time, bath time, etc). The flow throughout the monitoring period included both wet and dry weather with steady patterns throughout. The graphs do illustrate a discernable response and increase in flow during times of significant rain events.

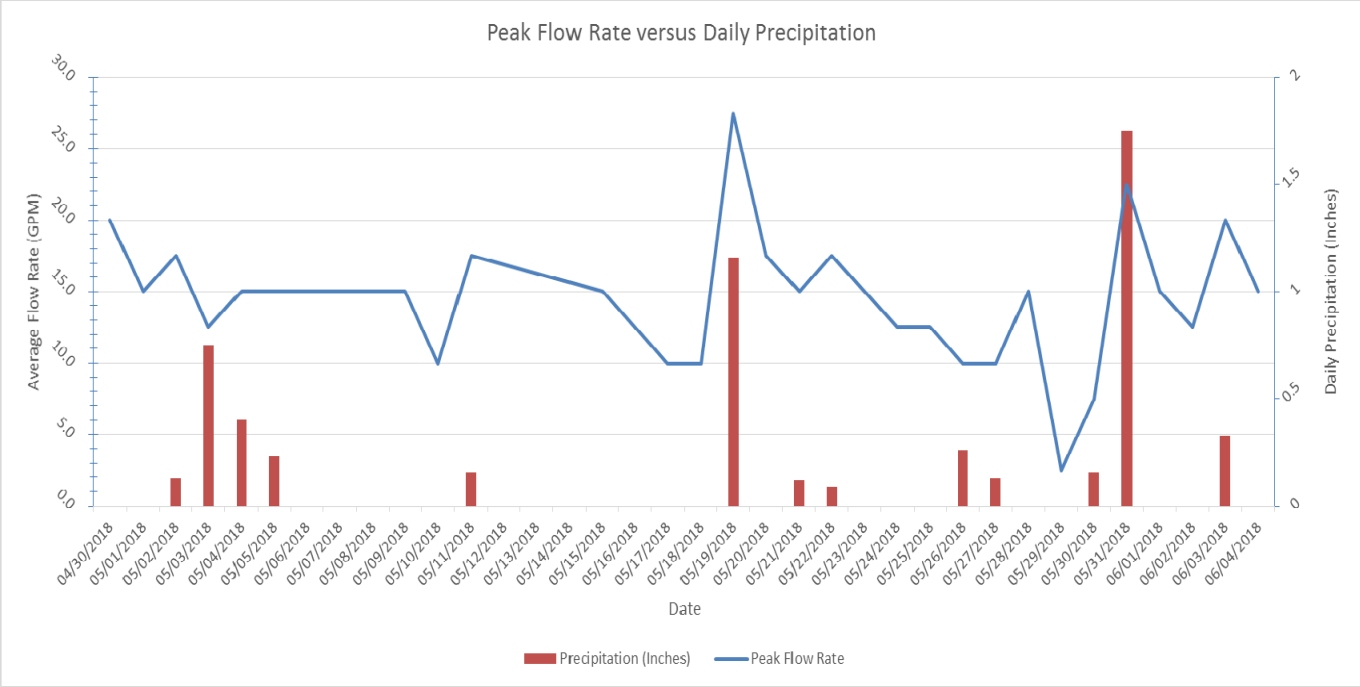
As part of the review, evaluation of the flow response during and immediately following rainfall event is important to assist with determining the type of I/I. As with the flow data at MH #201, the rapid increase and decrease in peak flow during and after a rain event within a 24-hour period is indicative of possible inflow sources and/or rainfall induced infiltration into shallow sewers and service laterals. The flows at MH#208 appeared to take longer to recede to normal dry weather flow after more than 24 hours. This slower response is possibly due to elevated groundwater, highly saturated soils, and the influence of nearby creeks.

**Graph 5-1: MH #201 (McDonald Drive), Peak Hour Flow Rate vs. Daily Precipitation**

**(April 30-June 3, 2018)**



**Graph 5-2: MH #208 (Lincoln Road), Peak Hour Flow Rate vs. Daily Precipitation (April 30-June 3, 2018)**




As a means of comparison and determine the extent of I/I that was occurring in the system, further extrapolation of the flow monitoring data was completed to compare the peak hour flow that was recorded during a dry weather condition versus a wet weather (rain event) condition. As presented from the table below, there was some impact (30% increase) in flow monitored in the system during a rain event. The infrastructure operated as designed and had reserve capacity when handling the additional load without incident nor impacts to users.

**Table 5-1- Monitored Wastewater Flow – Wet Versus Dry Event**

| Location | Dry Weather Average Day Flow (GPM) | Dry Weather Peak Hour Flow (GPM)* | Wet Weather Peak Hour Flow (GPM)* | % Increase of Flow with Wet Weather |
|---|---|---|---|---|
| **MH #208** – Scully / Lincoln Road Service Area (65 benefits) | 8 | 20 | 28 | 30% |
| **MH #201** – PS #7 Service Area (200 benefits) | 25 | 65 | 93 | 30% |

* Dry Weather measured on 4/30/2018 and Wet Weather measured on 5/19/2018 (1.16" of rain recorded)
* Dry Weather measured on 5/15/2018 and Wet Weather measured on 5/31/2018 (1.75" of rain recorded)

A further comparison of the measured values and per benefit flows from Section 4 to typical regulatory values are provided below. As presented from the table below, the flow per benefit is slightly elevated for MH#208 monitoring location but not of significant concern. The values are within acceptable tolerances to not consider the amount of I/I that is occurring is excessive.

**Table 5-2- Wastewater Flow per Benefit During a Single Rainfall Event**

| Location | Typical Flow per Benefit (GPD/REU) | Typical Peaking Factor (GPD) | Measured Flow per Benefit (GPD/REU) | Peaking Factor (GPD) |
|---|---|---|---|---|
| **MH #208** – Scully / Lincoln Road Service Area (95 benefits) | 688 | 4.0 | 775 | 4.38 |
| **MH #201** – PS #7 Service Area (200 benefits) | 688 | 4.0 | 670 | 3.72 |

## 5.4 Review and Findings

As demonstrated in Section 3 and 4, our evaluation of the condition and operation of both the sanitary sewer collection system and pump stations indicate the system has ample capacity to meet the peak hour sewer flow demands of the area as well as reserve capacity for some storm water inflow and/or infiltration. A more detailed evaluation of the system capacity and volume of sewer and/or storm volumes will be performed in Section 6 of this report.

Based on the above flow monitoring data, other key findings include:

- Inflow: The hydrographs for the MH#201 metered location do indicate the possible presence of some wet weather inflow, although the peaking factor does not reflect it to be overly excessive . Inflow, or peaking sources of clear water (storm drain cross-connection, flooding manhole, etc.), do not appear to be significant based on the rainfall, metered flow data during the monitoring period, pump station data, and calculated peaking factors. However with time as infrastructure ages, it could become more problematic and further investigation is warranted to assess cost effectiveness of further action.

- Infiltration: High groundwater has been reported (observed) at locations within the existing collection system. Infiltration of some of this groundwater may be reflected in the metered data collected during the monitoring period. Based on the flows per benefit, infiltration is not excessive and with negligible signs of presence.

# 6 HYDRAULIC MODELING & CAPACITY ANALYSIS

We developed a SewerCAD™ computer model of the Pump Station #7 sewer network to analyze the capacity requirements of the collection system. SewerCAD™ (by Bentley Software) is a fully dynamic hydraulic model that can simulate the performance of both gravity and pumped systems, providing an accurate representation of the flow rates, velocities, and water levels in the system under a variety of flow conditions. Major components of the model include the sewer network (pipes and manholes), pump stations, sewer subbasins, and associated data. Each of these model components is discussed below.

**Base Data -** Modelled **Sewer System**

The modeled sewer network for the Pump Station #7 Service area study includes the gravity sewer system (collection), pressurized forcemain (distribution), and Pump Stations #8, #7, and #14 (which all convey flow to the wastewater treatment plant (WWTP) via the same forcemain). GFA created an overall SewerCAD hydraulic model for the township in 2006 that encompassed 75% of the sewer system. We used this model as a base and then updated it with current data particular to the Pump Station #7 service area. For the purposes of this study the other service districts and tributaries in the system were eliminated as they have no impact to this area - with the exception of Pump Station #14.

**Data Updates**

Data within the hydraulic model was updated based upon GFA's field inspections and available record drawings. For the pump stations, GFA staff took a visual estimate of inlet and outlet pipe diameters, and field-measured depths to each pipe invert, float setting, and wetwell. The necessary manhole and pipe attribute data for the model for both the collection (gravity) and distribution (forcemain) portion (including pipe diameter, slope, inverts, and rim elevations) were added from record drawing information. Each manhole or other system structure has a unique identifier. Additional nodes were added for air relief valves and other structures, as well as some low and high points along the force mains as needed to create a realistic model.

**Evaluation Criteria**

From the flow monitoring data and I/I analysis in the previous sections, it is clear that rainfall impacts and increases peak flows in the township wastewater collection system. Therefore, the wastewater collection system needs to be evaluated with respect to the peak flows that occur during storm events. Subsequently, it is prudent to evaluate designs to accommodate those storm events or review the potential cost effectiveness of reducing I/I to minimize required improvements for increased capacity. The hydraulic model was used to evaluate collection system performance using the design flow conditions identified in Section 3 in compliance with MDEQ regulatory guidelines. The following typical

industry guidelines were used when evaluating the collection system model under dry and wet weather conditions.

- Criterion Peak Flow during Design Storm: If pipe is surcharged, distance between the manhole rim and the top of water should be greater than 10 feet.
- Peak Dry Weather Flow: No greater than full pipe.

The criteria listed above are used to initially identify problem areas. The criteria were developed to avoid extended periods of surcharging while allowing for brief periods of surcharging that would not be high enough to cause a significant risk of overflows and/or backups in dwellings.

**Definitions**

Design storm: the expected recurrence interval of a storm of a given magnitude. For sanitary sewer systems, the Level of Service is regulated by the Michigan Department of Environmental Quality and is set at a 25-year storm (4% chance of being exceeded in any given year, or about 4.2 inches of rain in a 24-hour period). This means that the sewer system should not experience any overflows up to and including a 25-year storm.

Surcharge: Surcharge refers to situations when the flow depth is higher than the top of the pipe.

Level of Service: Level of Service is defined as the ability for a sewer system to adequately manage wet weather flows without causing harm to private property and the public well-being.

**System Evaluation as per the Hydraulic Model**

The Pump Station #7 Service Area was evaluated under existing dry weather and design storm scenarios. Based on the model runs, the peak flow condition was determined for each pipe, and locations with deficiencies were identified. The following flow data was compared to the criteria above and applied for each scenario:

- Peak Flow during Design Storm
    - For Union Township a twenty five-year stormwater event equates to 4.2” in a 24-hour period. Assuming that this volume of stormwater would be applied over the 1:1 influence of the collection system as there is existing available infrastructure to address stormwater control including basins, drains, piping. This volume would equate to additional load of 85 gallons per minute into the sanitary sewer system for the Pump Station #7 Service Area.
- Peak Dry Weather Flow
    - Determined from the flow monitoring performed in Section 4.
        - MH #201 Service Area: Peak Hour Flow = 93 GPM
        - MH #208 Service Area: Peak Hour Flow = 28 GPM
- June 2017 Rain Event

- In terms of the model results, values developed cannot be replicated for this and are limited based upon the flow monitor data collected during both wet and dry weather conditions as discussed in Section 5. These values represent a localized system, whereas, this event was widespread across several counties all tributary to the watersheds that flow through Union Township. The effect of this type of widespread rainfall and impact must be simulated in a stormwater model that considers the entire watershed, accounting for land type, impervious amount, soil conditions, etc. It is important to note that the USGS has developed an online tool called the Flood Inundation Mapper (FIM) that can even be used as an early warning tool that will approximate the extent of flooding for any river stage. This tool is relatively new and constantly being expanded to include more areas throughout the United States.

No capacity deficiencies were identified for either dry or wet weather conditions. The supporting documentation is included in the Appendix. Additional key considerations from the model:

| **Key Considerations from the Model** | | |
|---|---|---|
| | **Dry Weather Simulation** | **Wet Weather Simulation** |
| **Sewer Trunkline** | • All the sewer lines handled the sanitary sewer flows with ample reserve capacity operating at 20% or less. Velocities ranged from 0.5 to 2.9 feet per second (fps), which is below DEQ guidelines of 2 fps.<br>• No alerts of operation and /or surcharge. | • All the sewer lines handled the sanitary sewer flows with ample reserve capacity operating at 40% or less. Velocities ranged from 0.9 to 3.1 feet per second (fps), which is below DEQ guidelines of 2 fps.<br>• No alerts of operation and /or surcharge. |
| **Pump Station / Forcemain** | • Both pump stations operated effectively without alerts from the model and within the firm capacity requirements of the station.<br>• Pump Station #7 operated seamlessly with Pump Station #14 (no interference and/or disruption to operation with one another), as they discharged flows into the same common forcemain during the simulation.<br>• No alerts of operation and /or surcharge. | • Both pump stations operated effectively without alerts.<br>• Pump Station #7 operated seamlessly with Pump Station #14 (no interference and/or disruption to operation with one another), as they discharged flows into the same common forcemain during the simulation.<br>• No alerts of operation and /or surcharge.<br>• All the forcemain handled the |

| | | |
|---|---|---|
| | • All the forcemain handled the sanitary sewer flows with ample reserve capacity operating at 20% or less. Velocities ranged from 1.5 to 3.5 feet per second (fps), which is within DEQ guidelines of 2 fps. | sanitary sewer flows with ample reserve capacity operating at 30% or less. Velocities ranged from 1.5 to 4 feet per second (fps), which is within DEQ guidelines of 2 fps. |

Figures 6-1 and 6-2 show a profile view including sewer levels, hydraulic and energy grade lines of the sanitary sewer simulation for both dry weather and five-year storm event flows. Additional supporting documentation is included in the Appendix. The locations are specific for the 12" primary sewer line that discharges into Pump Station #7 and captures all the flows for the service area.

**Figure 6-1- Profile View, Sanitary Sewer Simulation – Five-Year Storm Event**

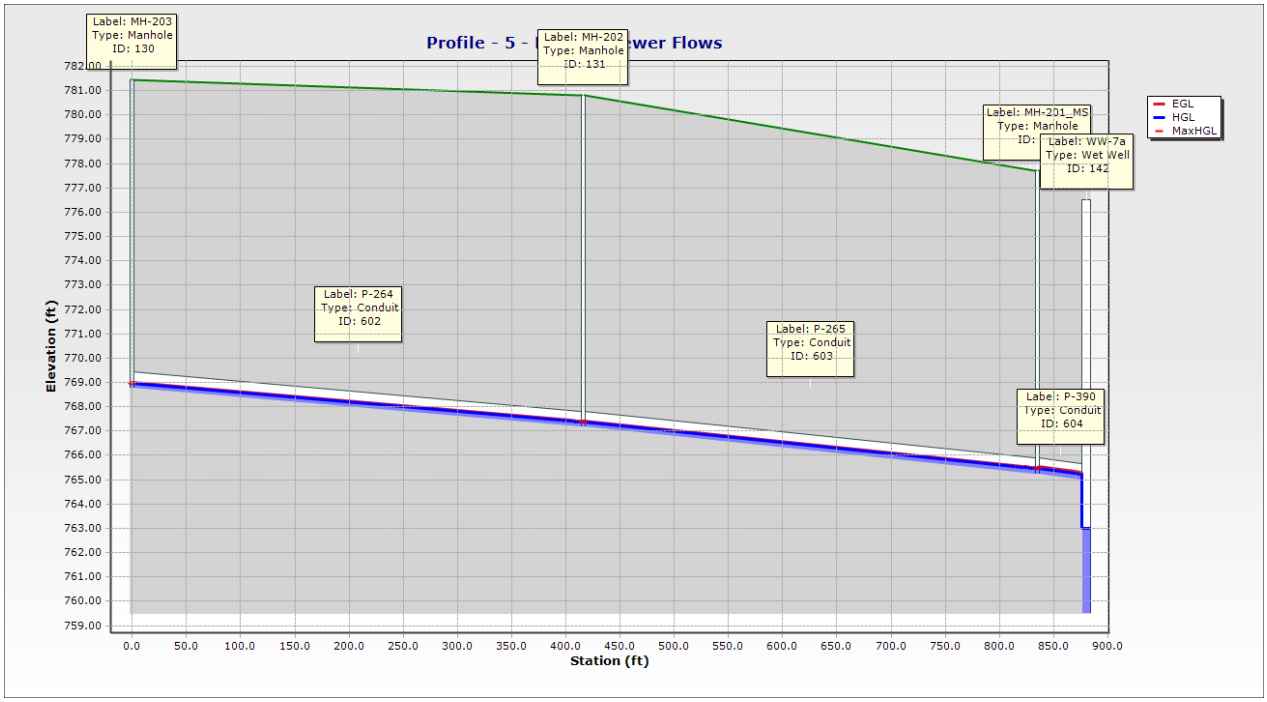
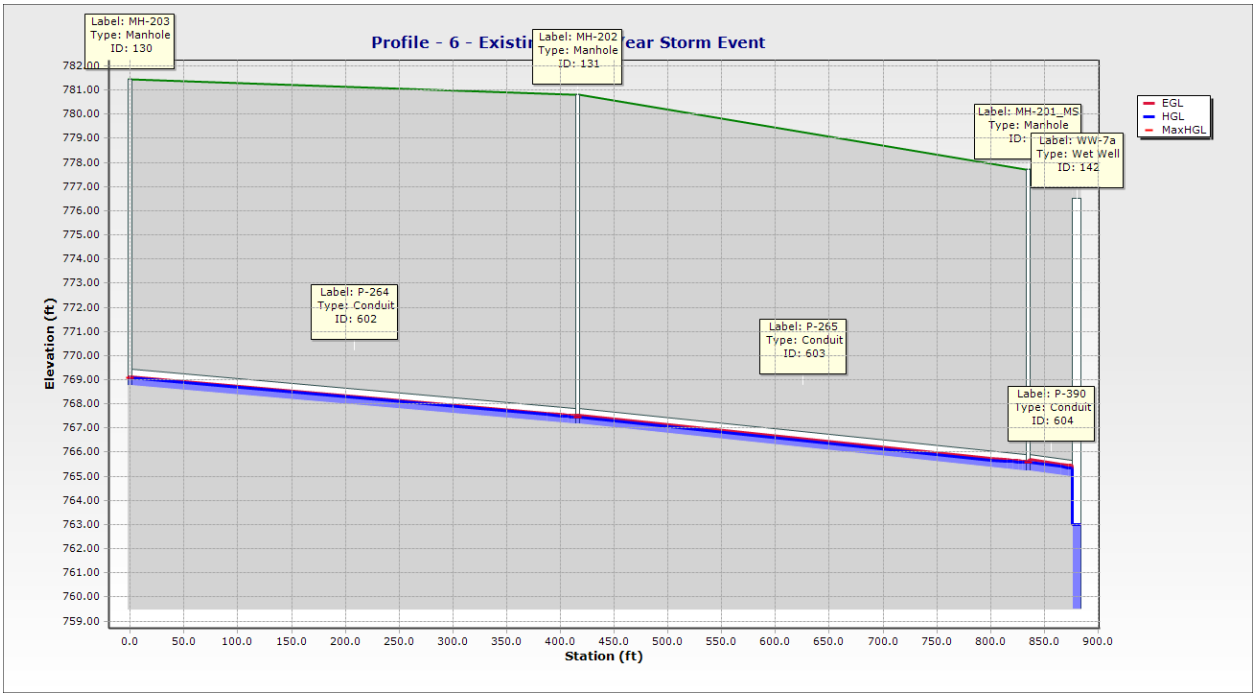


**Figure 6-2- Profile View, Sanitary Sewer Simulation – 25-Year Storm Event**



# 7 CONCLUSIONS AND RECOMMENDATIONS

As a result of the heavy rains and flooding that occurred in late June 2017, the Charter Township of Union commissioned this sewer study to be completed for the Pump Station #7 service area. During this time period, basement flooding and surface flooding in the township was experienced. Many areas of the storm and sanitary sewer systems were overwhelmed with high flows and were therefore unable to provide an adequate level of service.

The township is responsible only for the sanitary sewer systems and although they are intended to be separate systems, they can be connected via unknown connections above and below the surface. These connections can include:

- Surface flooding entering sanitary sewer manholes.
- Floodplain waters entering sanitary pump stations and sewer manholes
- Groundwater infiltration through breached sanitary sewer pipes and manholes

The June 2017 rainfall was a 100-year recurrence interval event with 6.69 inches of rainfall observed over a short period; this volume far exceeded the level of service expected to be provided. This study included an in-depth analysis of sanitary sewers, and pump stations particular to the Pump Station #7 service area to provide direct feedback on where problems exist and where investment is needed to improve future levels of service. It included:

- Infrastructure Review relevant to condition and operations and maintenance
- Flow Monitoring
- Inflow / Infiltration Analysis
- Flow Monitoring and Capacity Assessment.

## 7.1 PUBLIC OUTREACH & INFORMATIONAL MEETING

In June 2018 the township and GFA engaged in a community outreach / meeting with residents within the Pump Station #7 service area. Approximately 10-12 people (10% of those invited) attended. The goal was to be informative and engaging. The intent, scope and goals of the study were discussed along with a final Q/A. We discussed types of residential connections to the sewer system and associated impacts – such as sumps in basements, installing check valves, disconnecting the footing drains from the sanitary piping, and installing a sump pump and discharge line.

## 7.2 SUMMARY

The following provides a summary for each phase of the study along with recommendations on what to implement and associated proposed cost estimates to address deficiencies (as applicable). Detailed cost estimates are included in the Appendix.

**General**

This system has been in operation for almost 40 years. Overall, it is in very good condition and appears to have been well maintained, operating within the original design parameters. Estimating the remaining useful life of mechanical components is not an exact science but the maintenance history does provide an idea of how long they may continue to perform. The DPW has committed to providing continued maintenance to achieve the maximum amount of useful life. Below is a list of the critical components of the system along with typical and remaining life expectancy. This does not account for wear items such as gaskets, brackets, etc.

| System Components – Typical vs. Remaining Life Expectancy | | |
|---|---|---|
| **Component** | **Typical Life Expectancy** | **Remaining Life Expectancy** |
| **Collection System** | | |
| Force Main | 75 years + | 30 years + |
| Clean Out Structure | 75 years + | 30 years + |
| Air Relief Structure | 20 years + (valve) / 75 years + (manhole) | 1-10 years if cleaned and painted |
| **Pump Station #7 and #8** | | |
| Wetwell | 75 years + | 30 years + |
| Controls | 10-20 years | 5+ years |
| Control Panel | 35 - 40 years | 5+ years |
| Piping / Valves | 50 years + (piping) / 30 years + (valves) | 20 years + (piping) / 10 years + (valves) |
| Pump / Motor #1 | 15-20 years | 10 years+ |
| Pump / Motor #2 | 15-20 years | 2-5 years+ |

There were no deficiencies noted, however, the following items are recommendations to be consider as measures to minimize impact of future potential substantial (25 year or greater) flooding events.

## 7.3 RECOMMENDATIONS

**Asset Inventory & Analysis**

**Collection System**

Union Township has implemented a routine and thorough inspection and maintenance program for all infrastructure as well as a collection system cleaning program. This is an important effort and helps to prevent issues that would otherwise occur by blockages that build up over time. The township schedules cleaning of its mainline sewers on an approximate 6-month or 12-month preventive maintenance schedule, based on the history of the individual line segment.

**Collection System - Waterproofing**

The township should review and consider implementing a mainstream program to flood-proof manholes, pump stations and other sewer structures that are in or near open-channel features. This could include:

- By raising the rim above the expected elevation manholes can be made more flood resistant.
- Apply waterproof coating to the interior of manholes, pump stations, and similar structures
- Apply an encapsulation system around manholes (Wrapid Seal or equivalent)
    - In or near open water features:
        - Routinely televise and check watertightness for all sewers, especially the sanitary sewers that cross an open water feature
        - Smoke-test all sanitary manholes to verify that there are no cross-connections in these flood-prone areas.

**Collection System - Rehabilitation**

Excess flows generated from defects in the sewer system can be significant, especially if there are unknown cross-connections with storm sewers. These can occur in such situations as storm connections that inadvertently have not been disconnected or a failed diversion chamber bulkhead.

Based upon review of the sewer televising that was completed for the system, 90% of the trunklines were good or better condition. However, there were some isolated areas within the system that have deformations and cracks with some already addressed and corrective measures implemented as noted on the individual inspection sheets in the Appendix.

**Pump Stations / Distribution System**

In general, the two pump stations evaluated appear to be fully operational per the original design. However, there are components in both stations that are aged, and will eventually fail. Furthermore,

numerous conditions have been noted either by DPW staff or GFA staff that should be addressed to ensure reliable operations.

**Pump Stations/Distribution - Maintenance Program**

We recommend a cleaning program (similar to the one already in place for the collection system) be initiated and added to the existing pump station/forcemain inspection and maintenance program. Aspects of this program would include:

- Condition assessment the of station every 4 years
- Annual removal of sand and debris at each station
- Annual flow testing, pressure readings and amp draw recordings
- Annual firm capacity flow testing at each station
- Exercise and inspect all valves
- Assess and record any noticeable defect, leak, other issue

**Pump Stations/Distribution – Mechanical/Electrical Reliability**

Pump station mechanical and electrical reliability is extremely important. The following specific items are noted and the corresponding checklist and is provided identifying if these conditions are currently met or not. Although these are not specifically related to the June 2017 event and did not cause the flooding / backup in the system, the addition of these provisions will provide additional reliability in the system for future events.

- With largest pump-out services, each station and force main should be capable of handling peak hour flows plus some degree of stormwater inflow/infiltration, without overflow.
- Each pump station should have an automatic alarm and communication system that notifies operations staff in the event of an electrical or mechanical failure.
- Like Pump Station #7, Pump Station #8 should have backup or redundant equipment (pumps and power supply) including a permanent backup generator or alternative means for backup power.

**Pump Station Mechanical/Electrical Recommendations**

| | Pump Station Has Firm Capacity to Meet PWWF* | Has Bypass Pumping Connection & Plan | Has Backup Power Supply and/or Alternate Means | Adequate Control and Alarm System | Means to Monitor Flow (Flowmeter) |
|---|---|---|---|---|---|
| Pump Station #7 | Yes | Yes | Yes | NO | NO |
| Pump Station #8 | Yes | Yes | NO | NO | NO |

## Flow Monitoring

Flow monitoring was conducted and provided solid dry and wet weather flow information. No adverse impacts and / or deficiencies were noted.

## Inflow / Infiltration Analysis

Based on the pattern and magnitude of flows in the Pump Station #7 Service Area that were analyzed in Section 5, there was a definite response and increase in sanitary sewer flows during significant rain events. Likely sources can present themselves as footing drain connections, sump connections, roof drain connections, storm sewer connections, etc. In particular, footing drains (FDs) are a major contributing source of excess flows for most communities and when sanitary sewage backs up into basements, the primary cause is likely due to connected FDs. Recommendations for this area include:

### Direct Inflow Connection Detection

Direct inflow sources can contribute significantly to both volume and peak rates of I/I, especially during significant rain events as the one experienced in June 2017. In particular, footing drains (FDs) are a major contributing source of excess flows for most communities and when sanitary sewage backs up into basements, the primary cause is likely due to connected FDs. While footing drain disconnection provides significant advantages as an alternative, this option is typically the least desirable for communities to select due to the impact on residential homeowners with fully finished basements. Mandating disconnection can expose a community to potential resistance and lawsuits. Many older communities throughout the state are struggling with the same issue of connected FDs and the potential complications associated with a disconnection program.

Before considering this route, it is recommended that the Township conduct additional investigation to confirm the presence of connections. As previously described, methods include smoke and dye testing (dye testing is used primarily as a confirmatory test). Smoke testing is considered to be a relatively easy and inexpensive method (in terms of cost per foot of sewer tested). As there is some indication of the existence of direct connections within the service area, finding them may require an extensive, system-wide program. Smoke testing can prove challenging as traps and sump pumps within the dwellings create an obstruction and prevent the smoke from exiting. Dye testing would be the preferred method and be performed within the dwelling, typically the sump pump and then is tracked into the municipal sewer system.

This requires public notification measures and access to private property to document the smoke returns. Eliminating direct inflow connections requires disconnection of the source and re-direction of

the drainage to an appropriate location. This may simply be to the ground surface (as in the case of roof drains), or connection to a nearby storm drain or street gutter.

**Hydraulic Modeling and Capacity Analysis**

Hydraulic modelling and capacity assessment was performed with flow data for both dry and wet weather events. Analysis of the data reflected that both the sanitary sewer main and pump stations have more than adequate capacity and reserve to handle the existing flows including influence of stormwater. The model included the influence of Pump Station #14 to verify that the operation of the station in conjunction with Station #7 did not cause interference as well. No adverse impacts and / or deficiencies were noted.

## 7.4 Capital Improvements

The condition, operations and capacity of the sanitary sewer system is in healthy conditions with the ability to handle dry weather and moderate wet weather (25-year stormwater event) with no deficiencies noted or excessive ongoing I/I problems. There a few measures and recommendations that the township can implement to protect the system from stormwater and mitigate system backups when it does occur, but overall the system is functioning as design and within typical industry/regulatory guidelines. The table below includes quantifiable improvements with respective costs for review and consideration.

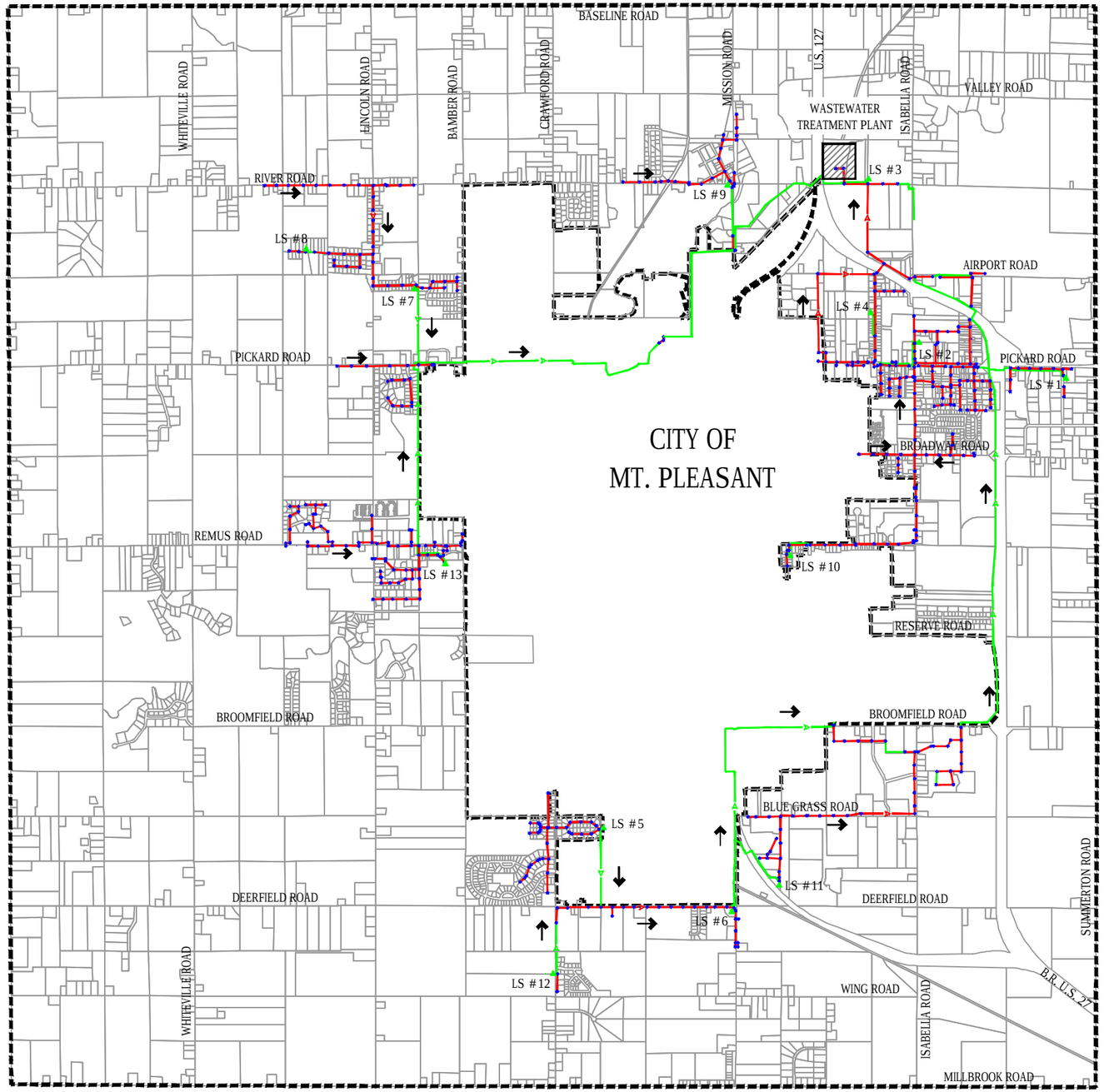
| RECOMMENDED CAPITAL IMPROVEMENTS | | |
|---|---|---|
| | **Estimated Cost** | |
| **Collection System** | | |
| Manholes | $223,700.00 | Waterproof including rim adjustment and adding gaskets |
| Sewer | $69,700 | Rehabilitating existing deformed / sewer with lining |
| **Pump Station #7 and #8** | | |
| Upgrades | $66,000 | Added reliability including flow meter installation, pump control and backup power access |

# APPENDIX

- Existing Overall Sewer System Map
- Pump Station #7 Service Area & Location Maps
- 2014 Sewer Televising Reports and Map
- Pump Station #7 Inspection Report and Photos
- Pump Station #8 Inspection Report and Photos
- Hydraulic Sewer Model Map
- Hydraulic Model Output Data – Existing Sewer Flows
- Hydraulic Model Output Data – Existing Sewer Flows + 25 Storm Event
- Opinion of Probable Construction Costs (OPCC)

# Existing Sanitary Sewer System
# Charter Township Of Union, Isabella County

Gourdie-Fraser




N

W E

NOT TO SCALE

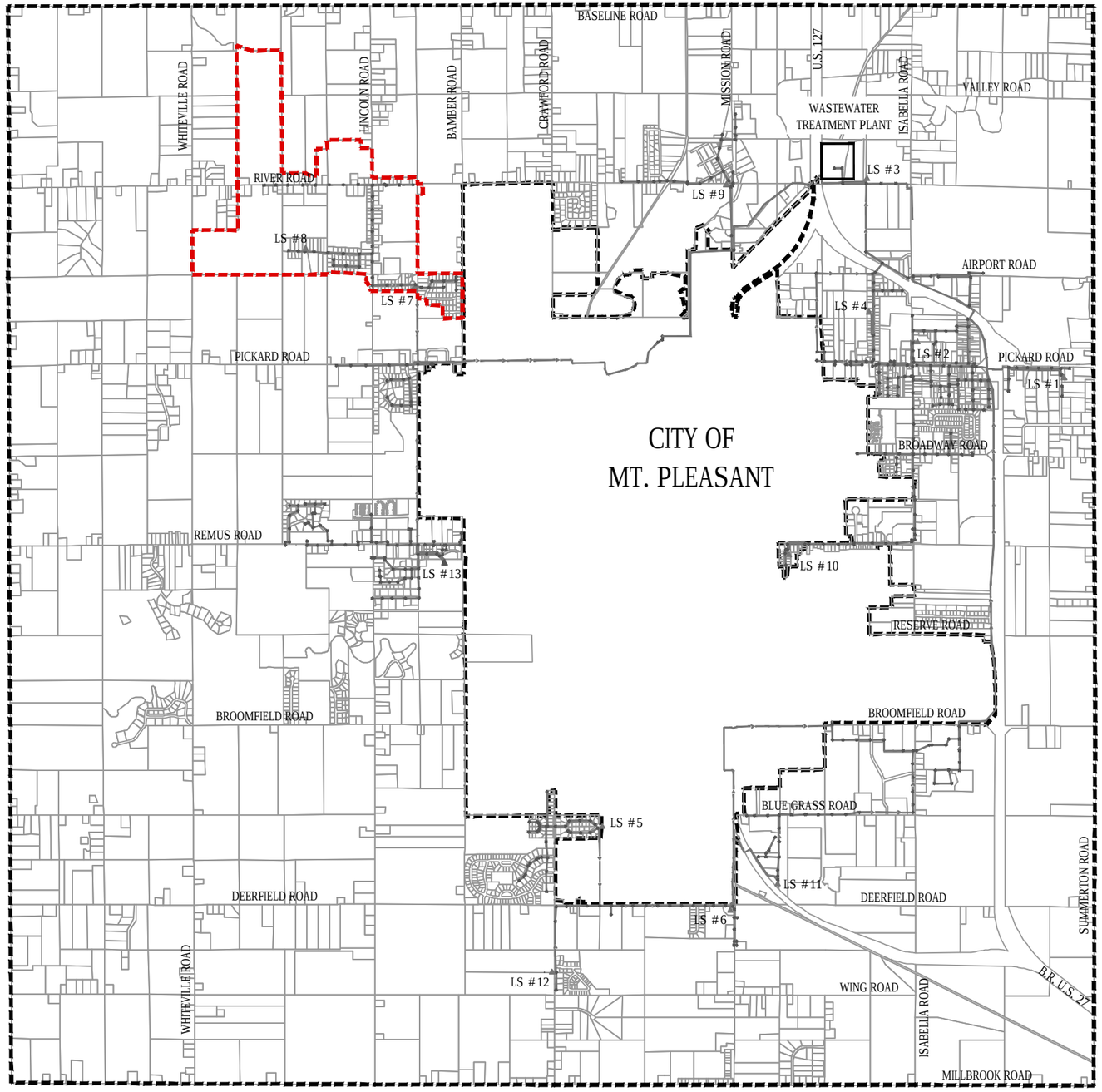
## LEGEND

- UNION TOWNSHIP LIMITS
- SANITARY SEWER
- SANITARY FORCEMAIN
- SANITARY MANHOLE
- LIFT STATION
- FLOW ARROW

I:\PROJECTS\18159 UNION TOWNSHIP\DWG\EXISTING SEWER SYSTEM.DWG (08-29-18 1:46 PM) CBALLANCE

# Existing Sanitary Sewer System - Existing Service Area Map
# Charter Township Of Union, Isabella County

Gourdie-Fraser




N

W E

NOT TO SCALE

## SERVICE AREAS

MCDONALD DRIVE/O'CONNOR

## LEGEND

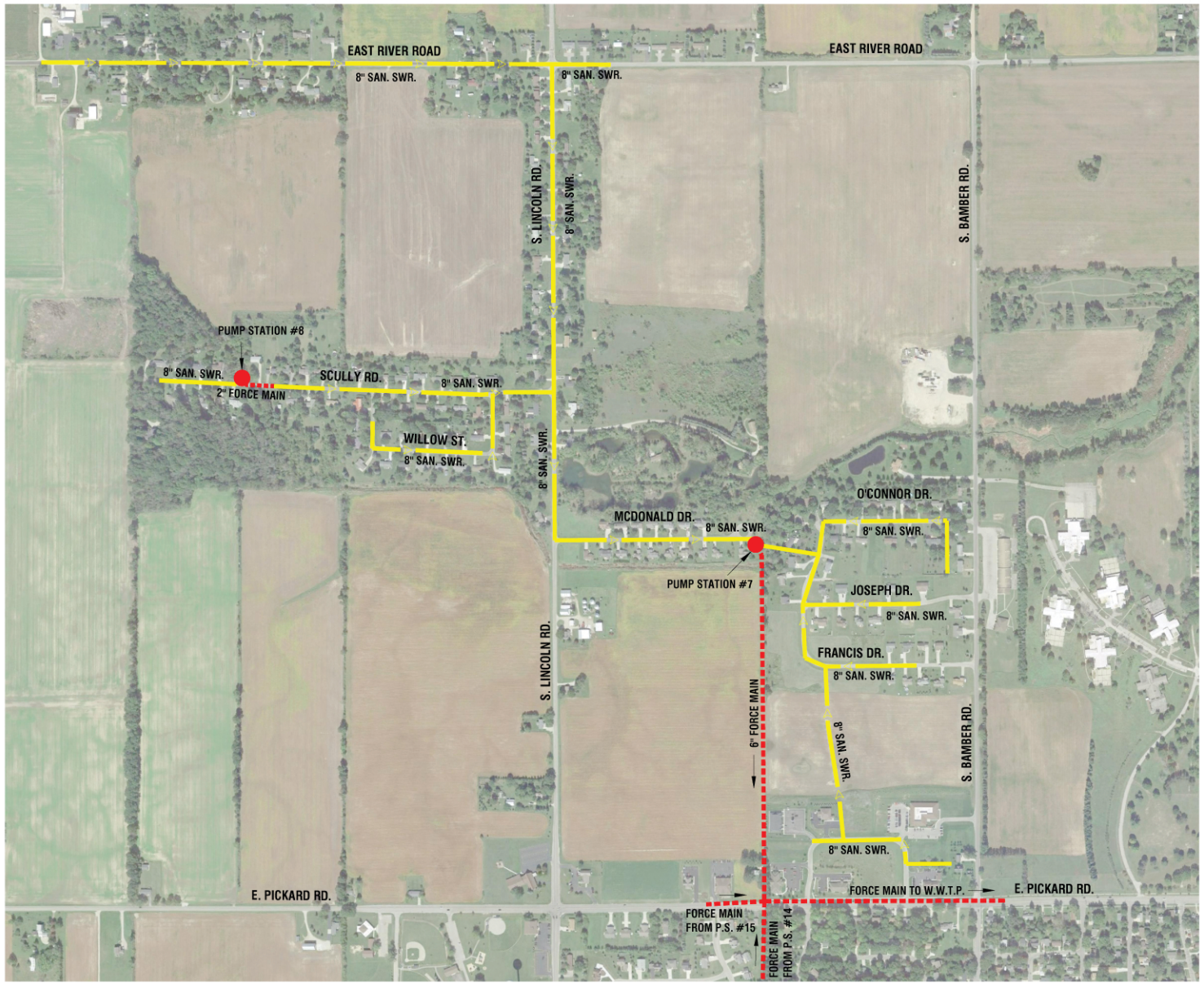
- UNION TOWNSHIP LIMITS
- SANITARY SEWER/FORCEMAIN
- SANITARY MANHOLE
- LIFT STATION

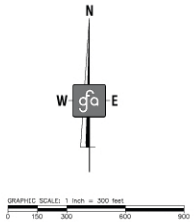
T:\PROJECTS\18159 UNION TOWNSHIP\DWG\EXISTING SERVICE AREA MAP.DWG (08-29-18 1:45 PM) CBALLANCE

# Charter Township of Union

## Pump Station #7 Service Area

ENGINEERING
SURVEYING
TESTING & OPERATIONS
123 West Front Street
Traverse City, MI 49684
http://gfa.tc
231.946.5874
231.946.3703



# PUMP STATION INSPECTION REPORT

Station No / Location: #7 McDonald Road Date: 6/7/18

## EXISTING EQUIPMENT

### Wet Well

Wet Well Diameter? 8’

Inlet Size? 8” PVC

Forcemain Size? 6” D.I. - transitions to 6” PVC outside of station

Floats? Yes ☒ 5 No ☐

Settings

| | | |
|---|---|---|
| HWL Float Setting | 11’ 2” ft | (Start Lag) |
| Normal HWL Float Setting | 12’ ft | ft (Start Lead) |
| High / HWL Float Setting | 12’ 10” ft | ft |
| LWL Float Setting | 14’ ft | ft (Stop Lag) |
| Low / LWL Float Setting | 14’ 8” ft | ft (Stop All) |

Level Transducer? Yes ☐ No ☒

Flow Meter? Yes ☐ No ☒

Type / Manufacturer

### Pump / Motor

Type (Vertical Centrifuge / Submersible)? submersible

*Pump Plate Info*

Manufacturer hydromatic

Capacity 220-250 gpm 86 TDH

Impellor Size inch

Voltage / Phase 460V / 3ph volt / phase

Motor Size 15 Hp / each

### Control Panel

Size: 5’x5’x1’

VFDs?

Manufacturer no VFD / contact starter

Hour Meters? Yes ☒ No ☐

Battery Backup? Yes ☒ No ☐ SCADA Only

Surge Suppression? Yes ☒ No ☐ SCADA Only

GFI? Yes ☐ No ☒ Has AUX outlet, no GFI

Generator ~~or Receptacle~~ / Transfer Switch? Yes ☒ No ☐

Voltage 480 / 3 ph volt

### Control Panel

SCADA? Yes ☒ No ☐

Type: Radio (lisc) OPTO 22 – email / txt

Autodialer? Yes ☐ No ☒

Alarms? Yes ☒ No ☐

List: High Water / Low Water / Power Fail - has light & horn



Gourdie-Fraser
Municipal | Development | Transportation

## ADDITIONAL NOTES:

**List any current station problems:**

No existing blueprints for electrical panel / controls

**List any proposed upgrades requested to existing stations (e.g. piping, bypass, flowmeters, etc):**

Remove floats, add Endress-Hauser Level Transducer
Bypass Manhole Reconstruction / Flowmeter installation slated for 2019 Construction

**List proposed alarms / controls SCADA system is required to monitor / control for stations ( e.g. alarms, flows, trending diagrams, etc):**

Tie level transducer to SCADA, make pump levels adjustable remotely

**List Recent Upgrades / Operation Comments:**

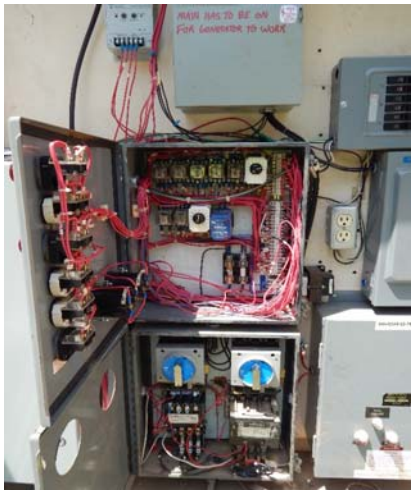
Pumps Upgraded in 2007 / Pump Rails & Guides replaced in 2001
*Run Time Avg 8.5hrs/ea per week

**SITE**

**WET WELL**

**BYPASS**

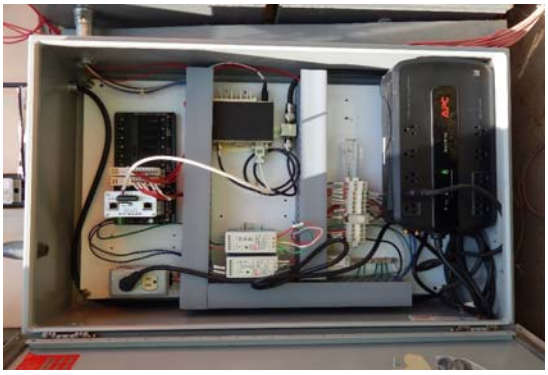
# PUMP STATION NO. 7




**ELECTRICAL**



**GENERATOR**



**SCADA PANEL**

# PUMP STATION NO. 7

# PUMP STATION INSPECTION REPORT

Station No / Location: #8 Scully Drive Date: 6/7/18

*Most Recent Update: 1993
*30'x48" Clear Opening Hatch
*Run Time Avg 2 hrs/ea per week

## EXISTING EQUIPMENT

### Wet Well

Wet Well Diameter? 4'
Inlet Size? 8" PVC @ 8' down
Forcemain Size? 2" SCH 80 BLK PVC
Floats? Yes ☒ 4 No ☐

Settings

HWL Float Setting 8' 6" ft _____(Start Lag)
Normal HWL Float Setting 9 ft _____ft (Start Lead)
High / HWL Float Setting 8 ft _____ft
LWL Float Setting _____ft _____ft (Stop Lag)
Low / LWL Float Setting 10' 6" ft _____ft (Stop All)

Level Transducer? Yes ☐ No ☒
Flow Meter? Yes ☐ No ☒
Type / Manufacturer _____

### Pump / Motor

Type (Vertical Centrifuge / Submersible)? submersible

*Pump Plate Info*

Manufacturer hydromatic grinder
Capacity 80 gpm _____TDH Force Main is short w/ little elev. lift
Impellor Size 10 inch
Voltage / Phase 230V / 1ph volt / phase
Motor Size 5 Hp / each
32 FLA

### Control Panel

Size: 35"x60"x12"
VFDs?
Manufacturer no VFD / contact starter
Hour Meters? Yes ☒ No ☐
Battery Backup? Yes ☒ No ☐ SCADA Only
Surge Suppression? Yes ☒ No ☐ SCADA Only
GFI? Yes ☐ No ☒ Has AUX outlet, no GFI
Generator or Receptacle / Transfer Switch? Yes ☐ No ☒ Planned to install gen. receptable in 2018
Voltage _____volt

### Control Panel

SCADA? Yes ☒ No ☐
Type: Radio (lisc) OPTO 22 – email / txt
Autodialer? Yes ☐ No ☒
Alarms? Yes ☒ No ☐

List: High Water / Low Water / Power Fail - has light & horn

**ADDITIONAL NOTES:**

**List any current station problems:**

**List any current station problems:**

None –Services few users

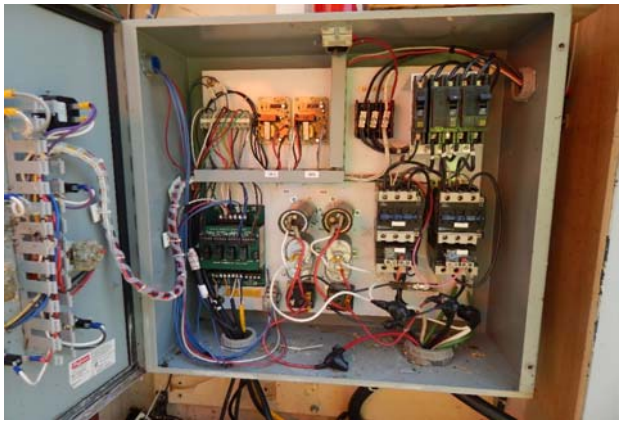
**List any proposed upgrades requrested to existing stations (e.g. piping, bypass, flowmeters, etc):**

Remove floats, add Endress-Hauser Level Transducer, add flow meter, add gen. receptacle

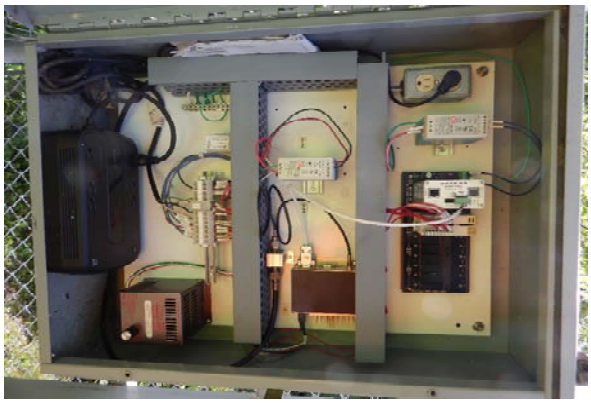
**List proposed alarms / controls SCADA system is required to monitor / control for stations ( e.g. alarms, flows, trending diagrams, etc):**

Tie level transducer to SCADA,

**WET WELL**



**ELECTRICAL**



**SCADA PANEL**

# PUMP STATION NO. 8

# Sewer Pump Station No. 7 Service Area: Charter Township of Union Isabella County, Michigan


Legend - Pump Station No. 7 Service Zone

- Pump Station (PS)
- Manhole (MH)
- Pump Station No. 7 Service Zone -
  - All sewer cleaned & televised
  - Blue triangles show flow direction
  - Labels indicate video & report IDs
- Sanitary Sewer
- Abandoned Sewer
- Sanitary Force Main
- River, Creek, or Drain
- Lake or Pond
- Township Parcel
- Central Michigan University
- City of Mt. Pleasant

NORTH

Map Production Date: May 22, 2018

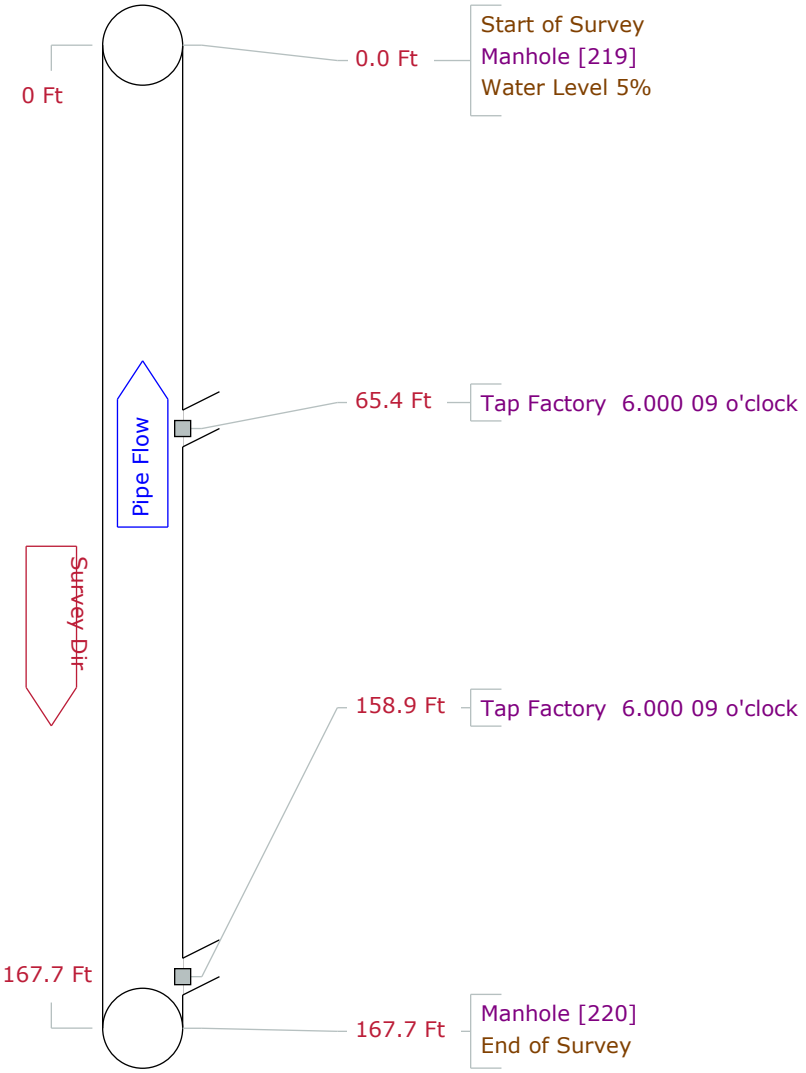
Pipe Graphic Report of PSR 119 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 7 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/16 | Time | 12:41 |
| Street | cypress dr | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#220-CYP | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#219-WIL | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Upstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean J | Date Cleaned 2014/10/16 |
| Material | Polyvinyl Chloride | Joint length | | Total length | 167.7 Ft | Length Surveyed | 167.70 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Constructional | | | |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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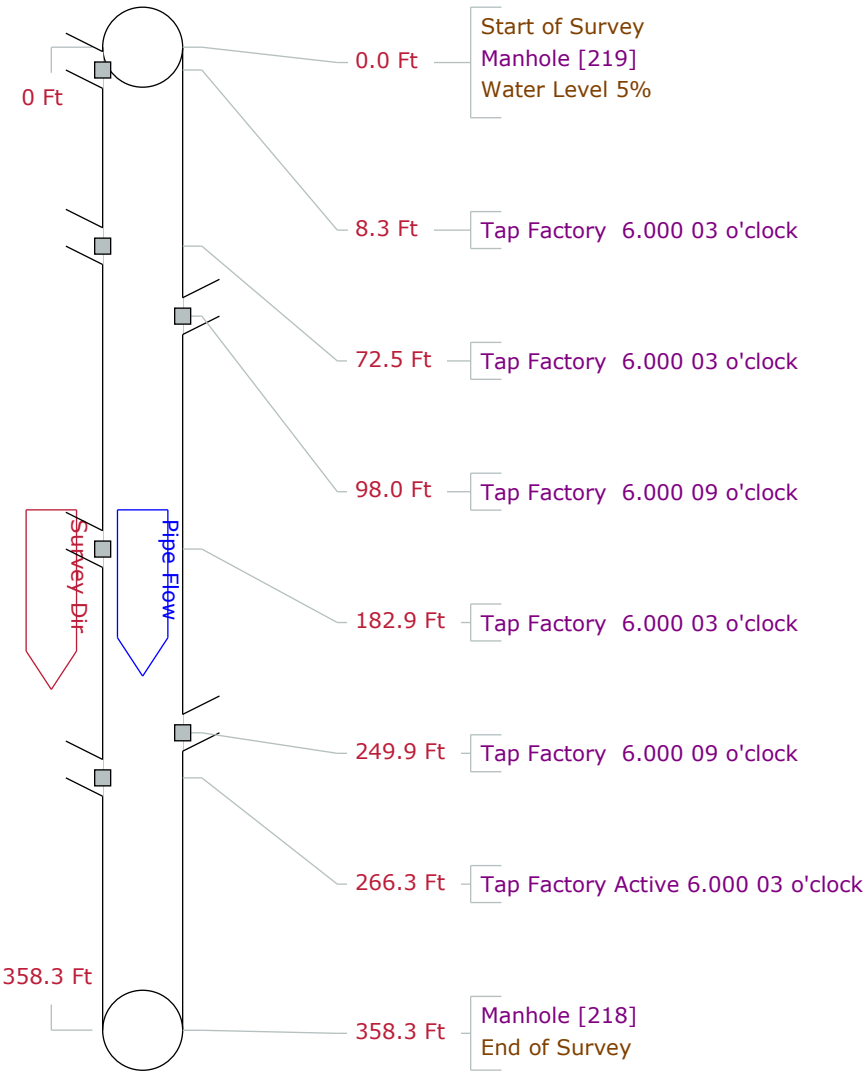
Pipe Graphic Report of PSR 118 for Union Twp

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Setup | 8 | Surveyor | Matt | Certificate # | U-1213-06019567 | System Owner | |
| Drainage | | Survey Customer | | | | | |
| P/O # | | Date | 2014/10/16 | Time | 12:51 | Street | willow |
| City | mt pleasant | Further location details | | | | | |
| Up | MH#219-WIL | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Down | MH#218-WIL | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Use | Sanitary | Direction | Downstream | Flow control | | Media | No |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Material | Polyvinyl Chloride | Joint length | | Total length | 358.3 Ft | Length Surveyed | 358.30 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |
| Additional info | | | | | | | |
| Location | Main Highway - Urban | | | | | | |
| Project | CLEANING AND TELEVISING 2014 | | | | | Work Order | |
| Northing | | Easting | | | | Elevation | |
| Coordinate System | | | | | | GPS Accuracy | |

Structural O & M Constructional
Miscellaneous Hydralic





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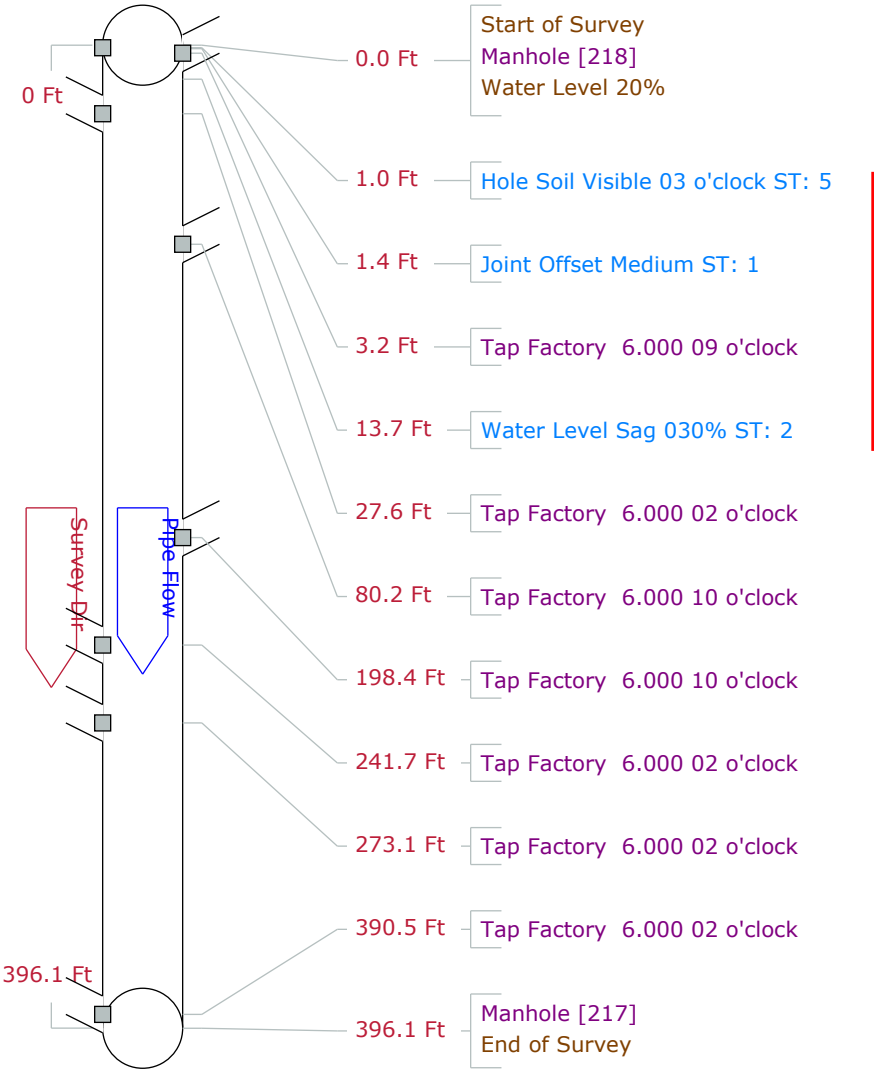
Pipe Graphic Report of PSR 117 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 9 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/16 | Time | 13:06 |
| Street | willow | | | | |
| City | mt pleasant | Further location details | | | |
| Up | MH#218-WIL | Rim to invert | | Grade to invert | Rim to grade Ft |
| Down | MH#217-WIL | Rim to invert | | Grade to invert | Rim to grade Ft |
| Use | Sanitary | Direction | Downstream | Flow control | Media No |
| Shape | Circular | Height | 8 | Width | ins |
| Preclean | J | Date Cleaned | 2014/10/16 | | |
| Material | Polyvinyl Chloride | Joint length | | Total length | 396.1 Ft |
| Length Surveyed | 396.10 | | | | |
| Lining | | Year laid | | Year rehabilitated | Weather Dry |
| Purpose | | Cat | | | |
| Additional info | | | | | |
| Location | Main Highway - Urban | | | | |
| Project | CLEANING AND TELEVISING 2014 | | | | |
| Northing | | Easting | | | |
| Coordinate System | | | | | |

Structural O & M Constructional
Miscellaneous Hydralic

Work Order
Elevation
GPS Accuracy




Notes as per township staff:
Repaired by township in 2014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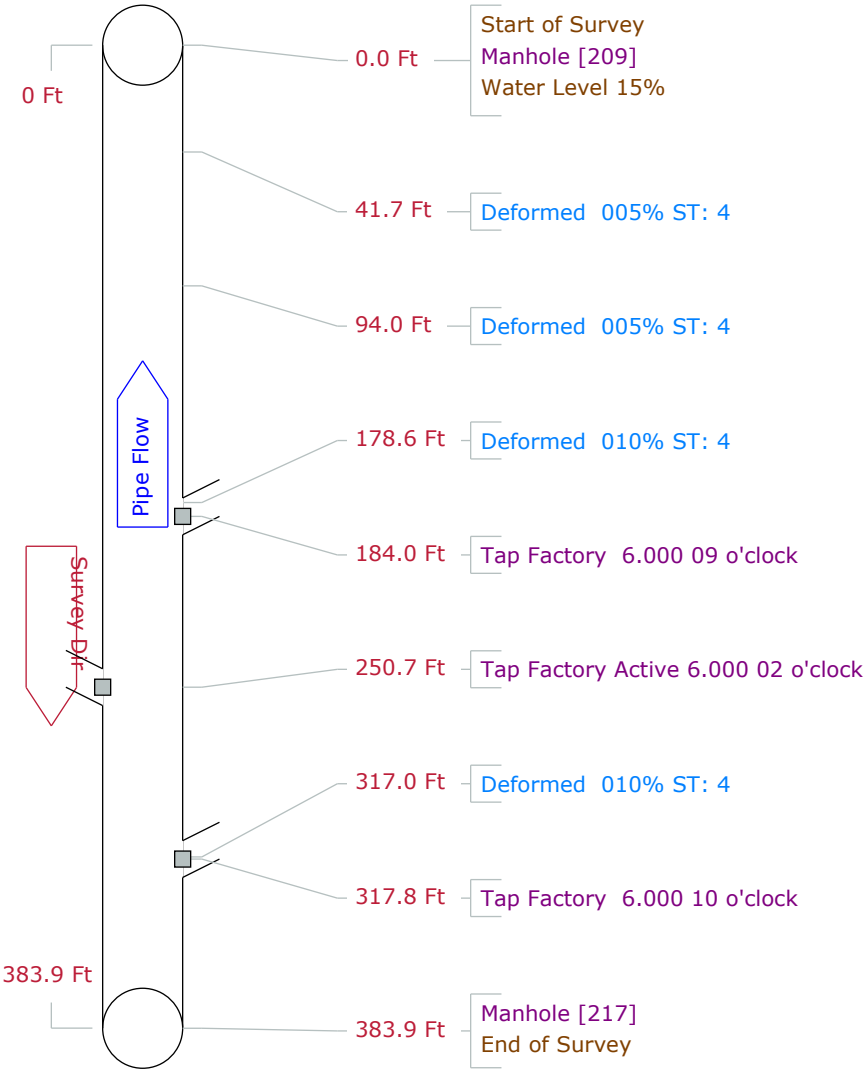
Pipe Graphic Report of PSR 116 for Union Twp

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Setup | 10 | Surveyor | Matt | Certificate # | U-1213-06019567 | System Owner | |
| Drainage | | Survey Customer | | | | | |
| P/O # | | Date | 2014/10/16 | Time | 13:37 | Street | birchwood |
| City | mt pleasant | Further location details | | | | | |
| Up | MH#217-WIL | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Down | MH#209-SCU | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Use | Sanitary | Direction | Upstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Material | Polyvinyl Chloride | Joint length | | Total length | 383.9 Ft | Length Surveyed | 383.90 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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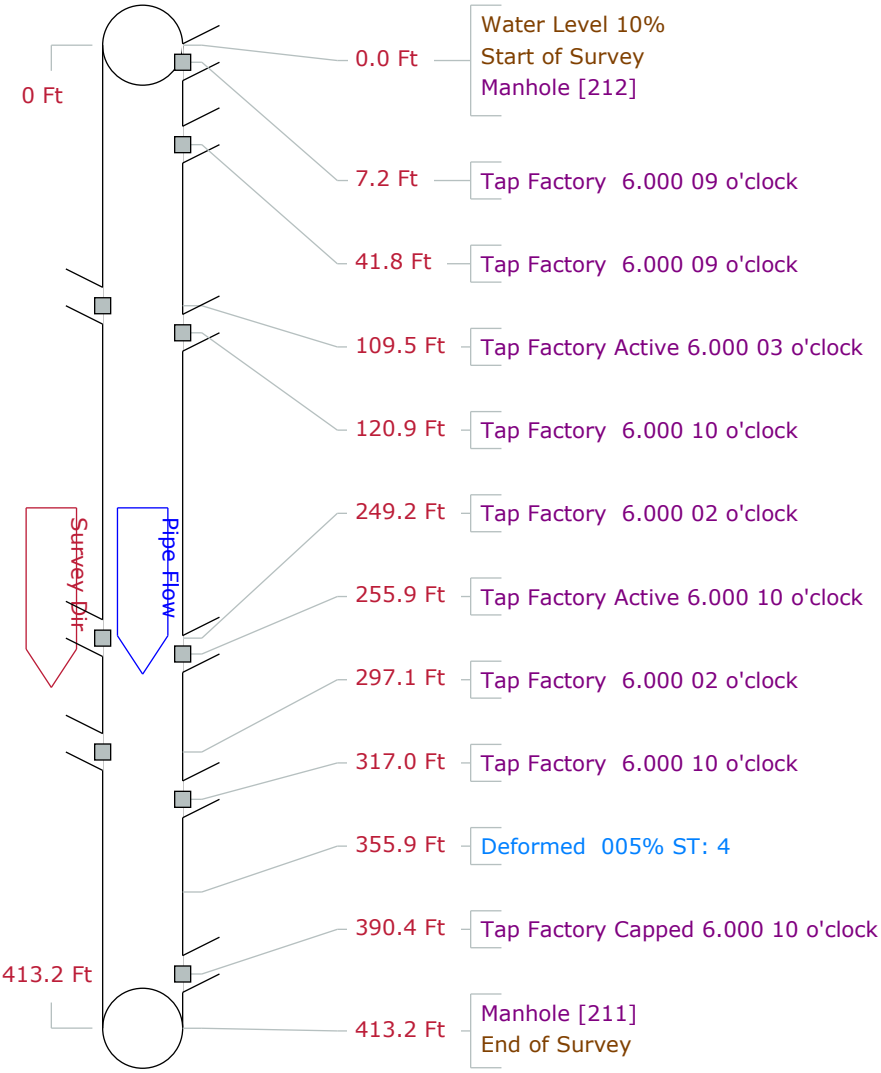
Pipe Graphic Report of PSR 115 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 4 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/16 | Time | 9:48 |
| Street | scully rd | | | | |
| City | mt pleasant | Further location details | | | |
| Up | MH#212-SCU | Rim to invert | | Grade to invert | Rim to grade Ft |
| Down | MH#211-SCU | Rim to invert | | Grade to invert | Rim to grade Ft |
| Use | Sanitary | Direction | Downstream | Flow control | Media No |
| Shape | Circular | Height | 8 | Width | ins |
| Preclean | J | Date Cleaned | 2014/10/16 | | |
| Material | Polyvinyl Chloride | Joint length | | Total length | 413.2 Ft |
| Length Surveyed | 413.20 | | | | |
| Lining | | Year laid | | Year rehabilitated | Weather Dry |
| Purpose | | Cat | | | |
| Additional info | | | | | |
| Location | Main Highway - Urban | | | | |
| Project | CLEANING AND TELEVISING 2014 | | | | |
| Northing | | Easting | | | |
| Coordinate System | | | | | |

Structural O & M Constructional
Miscellaneous Hydralic

Work Order
Elevation
GPS Accuracy





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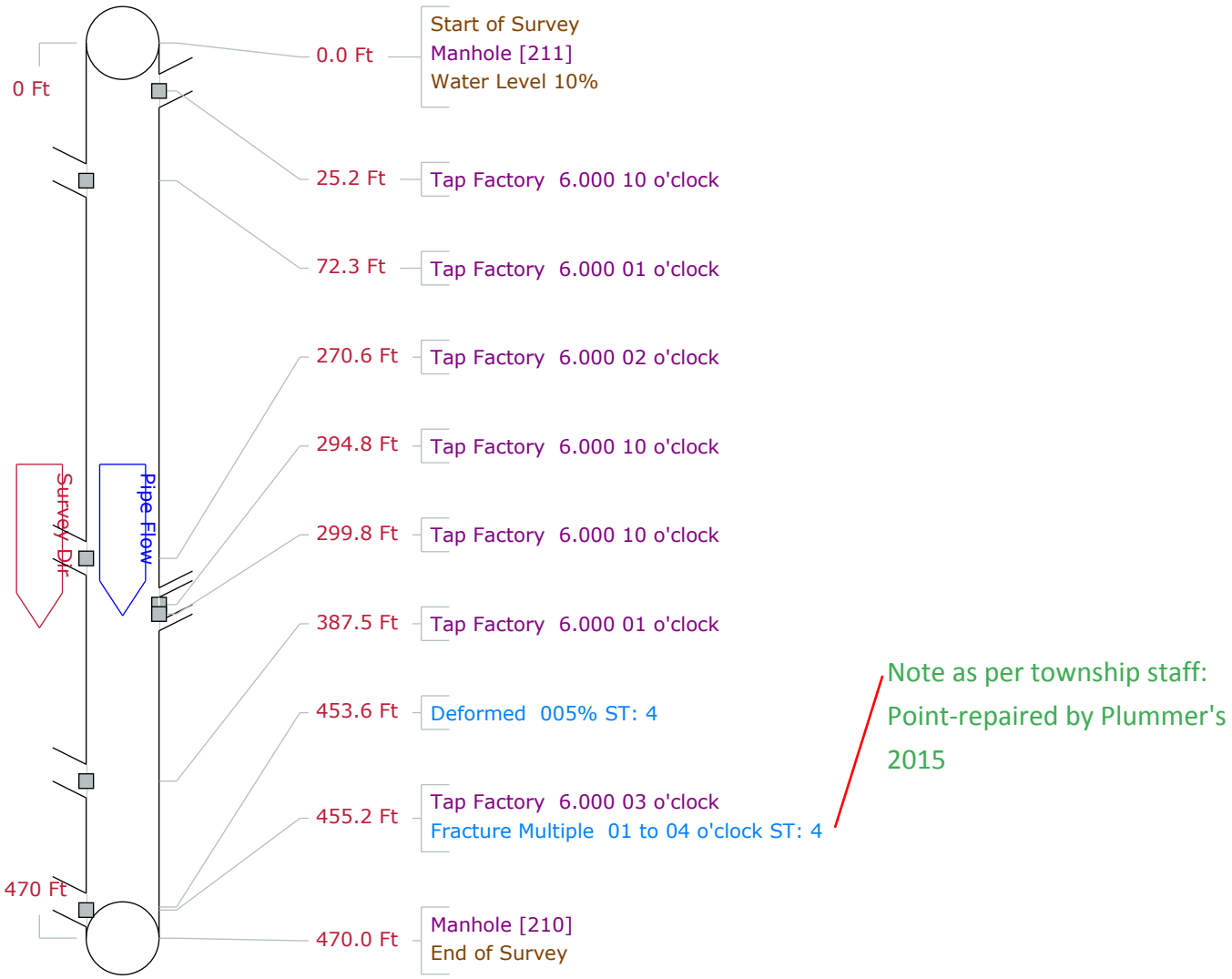
Pipe Graphic Report of PSR 114 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 5 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/16 | Time | 10:03 |
| Street | scully rd | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#211-SCU | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#210-SCU | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean J | Date Cleaned 2014/10/16 |
| Material | Polyvinyl Chloride | Joint length | | Total length | 470.0 Ft | | Length Surveyed 470.00 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Constructional | | | |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | GPS Accuracy | | |





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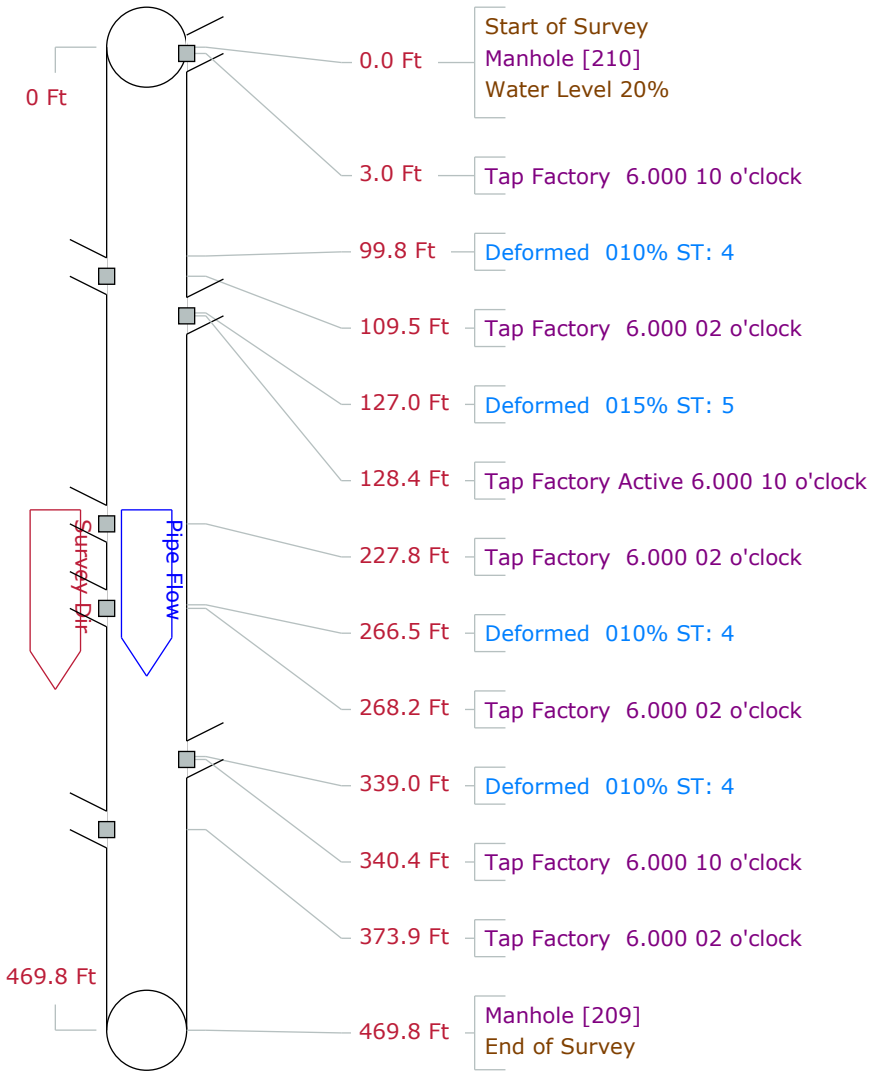
Pipe Graphic Report of PSR 113 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 6 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/16 | Time | 10:57 |
| Street | scully rd | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#210-SCU | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#209-SCU | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean J | Date Cleaned 2014/10/16 |
| Material | Polyvinyl Chloride | Joint length | | Total length | 469.8 Ft | | Length Surveyed 469.80 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Constructional | | | |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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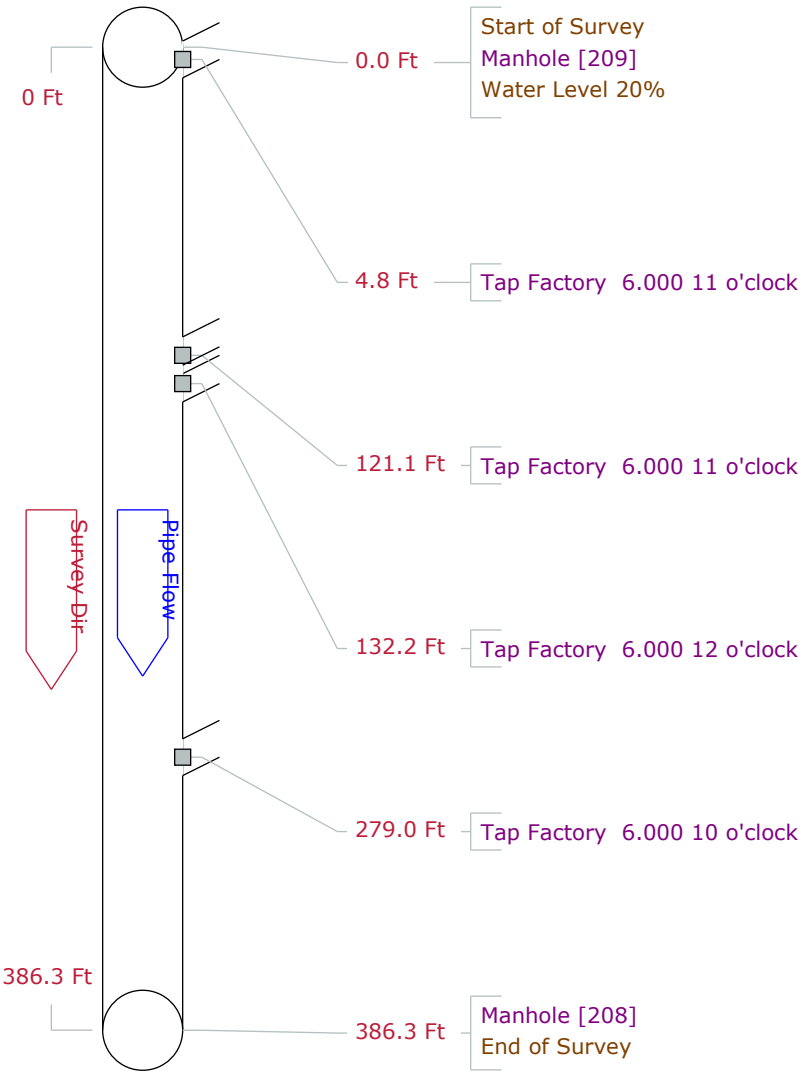
Pipe Graphic Report of PSR 112 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 11 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/16 | Time | 13:55 |
| Street | scully rd | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#209-SCU | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#208-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean J | Date Cleaned 2014/10/16 |
| Material | Polyvinyl Chloride | Joint length | | Total length | 386.3 Ft | Length Surveyed | 386.30 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Constructional | | | |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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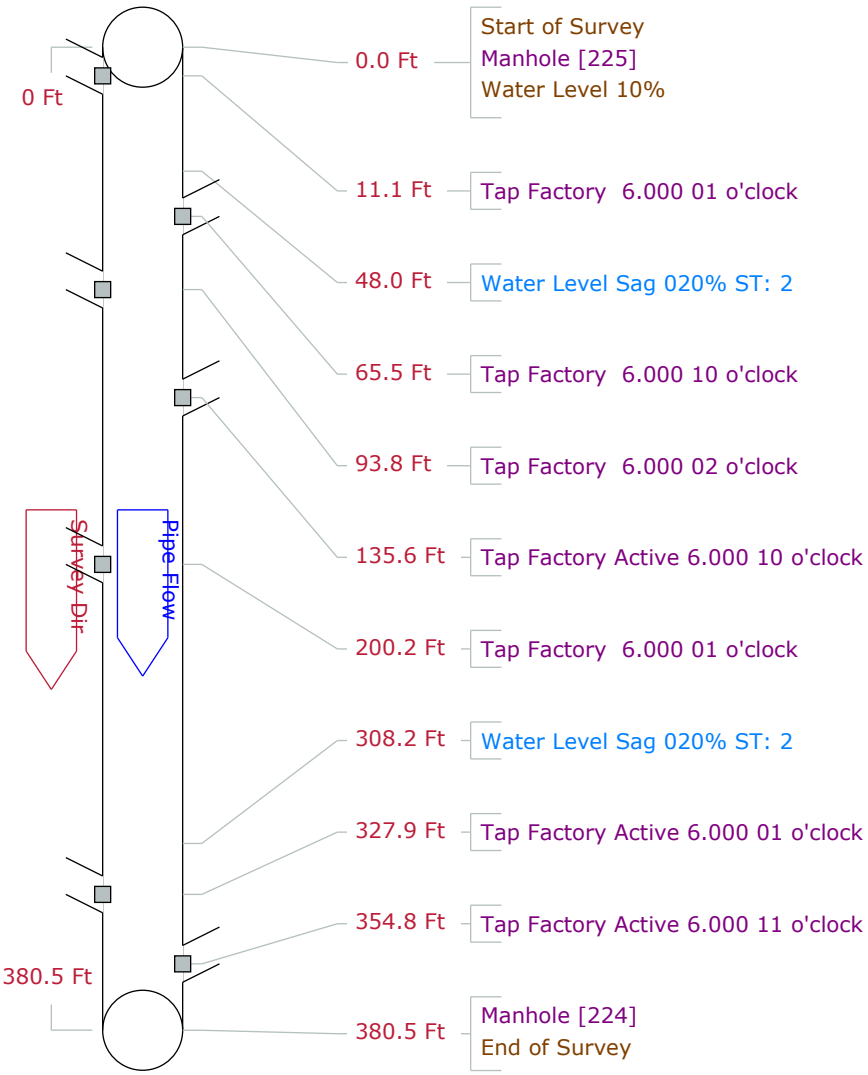
Pipe Graphic Report of PSR 093 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 21 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/17 | Time | 10:07 |
| Street | s lincoln rd | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#225-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#224-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Date Cleaned | 2014/10/16 | | | | | | |
| Material | Polyvinyl Chloride | Joint length | | Total length | 380.5 Ft | Length Surveyed | 380.50 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Constructional | | | |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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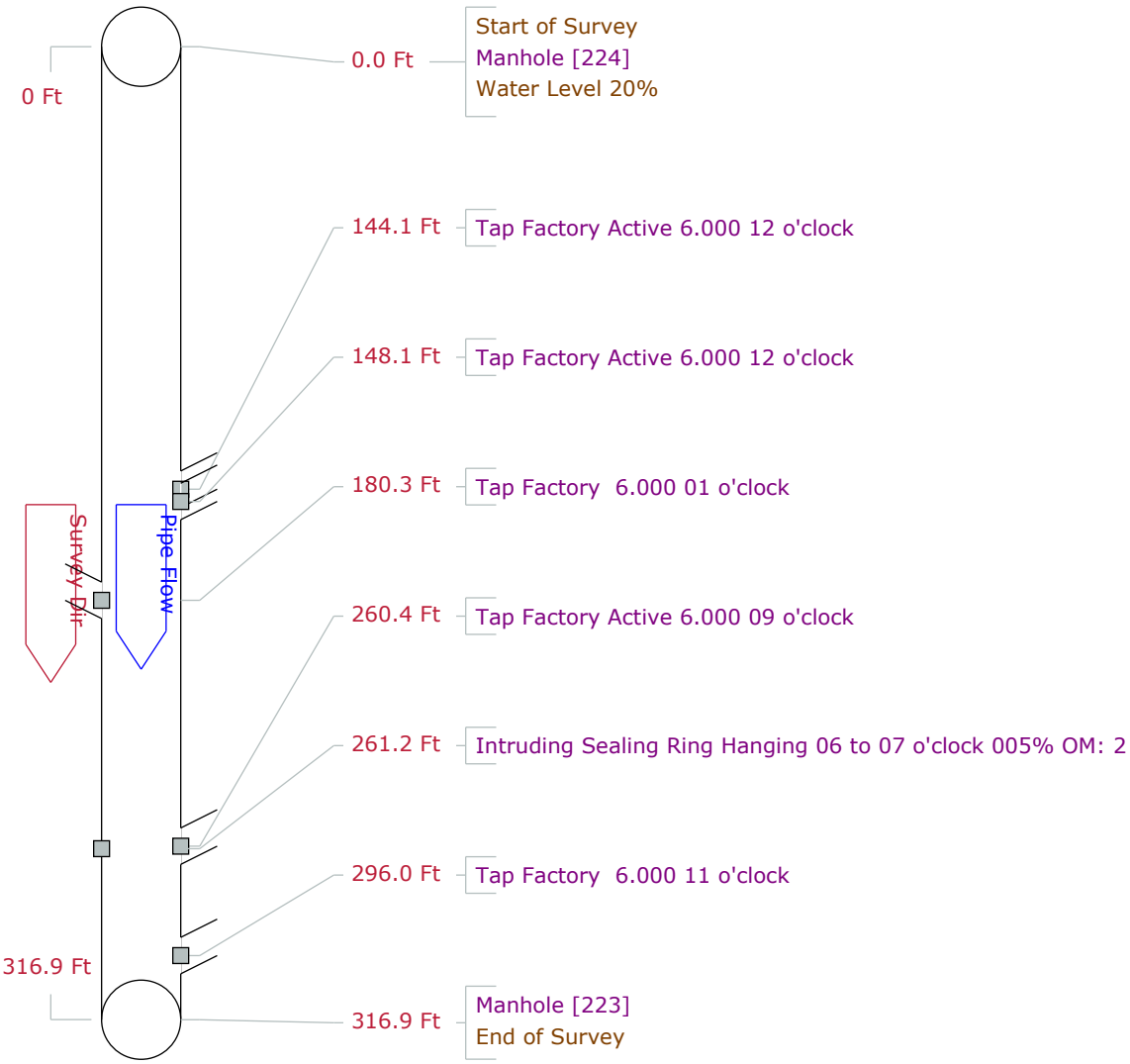
Pipe Graphic Report of PSR 092 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 22 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/17 | Time | 10:23 |
| Street | s lincoln rd | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#224-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#223-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media | No |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Date Cleaned | 2014/10/16 | | | | | | |
| Material | Polyvinyl Chloride | Joint length | | Total length | 316.9 Ft | Length Surveyed | 316.90 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Constructional | | | |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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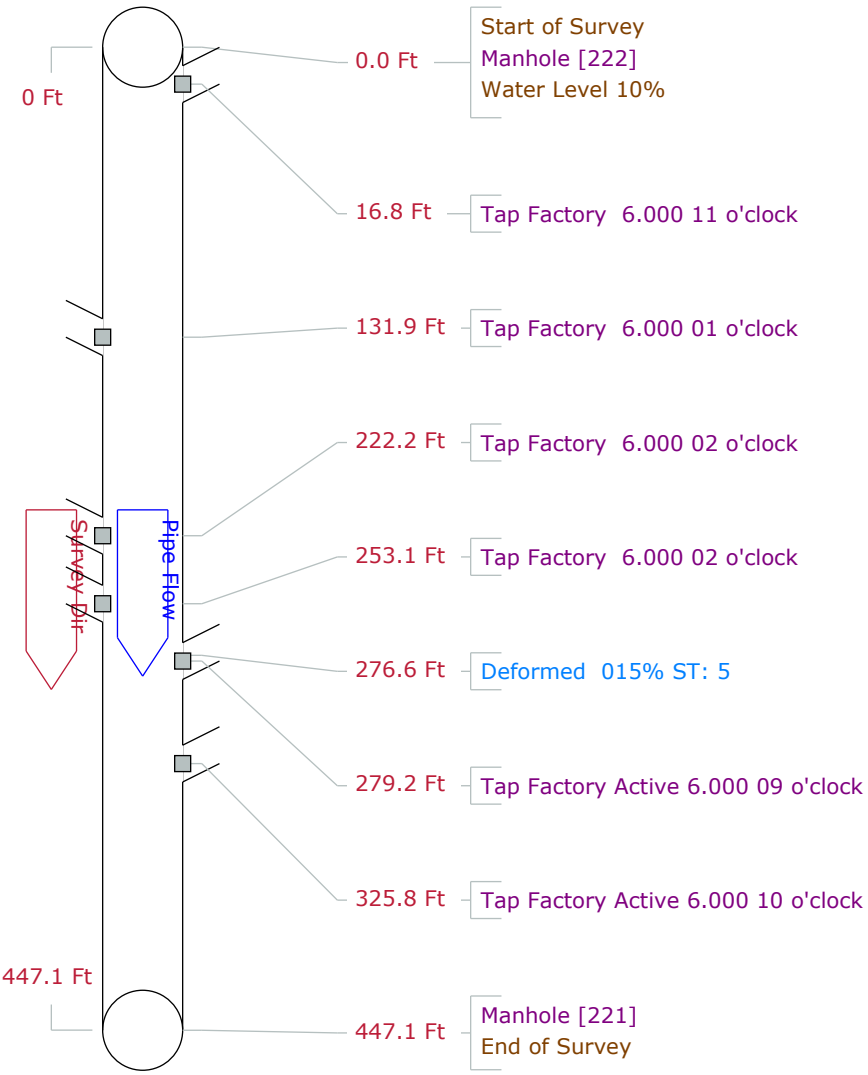
Pipe Graphic Report of PSR 090 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 24 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/17 | Time | 11:11 |
| Street | s lincoln rd | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#222-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#221-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean J | Date Cleaned 2014/10/16 |
| Material | Polyvinyl Chloride | Joint length | | Total length | 447.1 Ft | | Length Surveyed 447.10 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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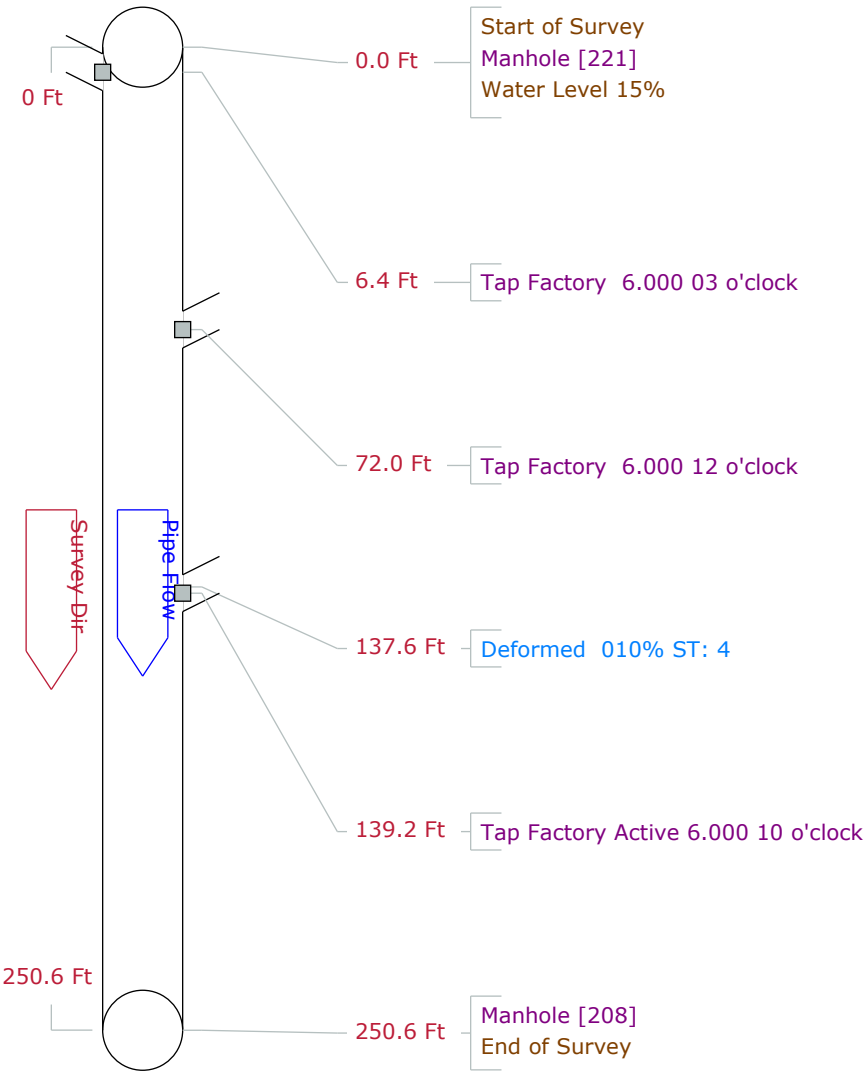
Pipe Graphic Report of PSR 089 for Union Twp

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Setup | 25 | Surveyor | Matt | Certificate # | U-1213-06019567 | System Owner | |
| Drainage | | Survey Customer | | | | | |
| P/O # | | Date | 2014/10/17 | Time | 11:33 | Street | s lincoln rd |
| City | mt pleasant | Further location details | | | | | |
| Up | MH#221-LIN | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Down | MH#208-LIN | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Material | Polyvinyl Chloride | Joint length | | Total length | 250.6 Ft | Length Surveyed | 250.60 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |
| Additional info | | | | | | | |
| Location | Main Highway - Urban | | | | | | |
| Project | CLEANING AND TELEVISING 2014 | | | | | Work Order | |
| Northing | | Easting | | | | Elevation | |
| Coordinate System | | | | | | GPS Accuracy | |

Structural O & M Constructional
Miscellaneous Hydralic





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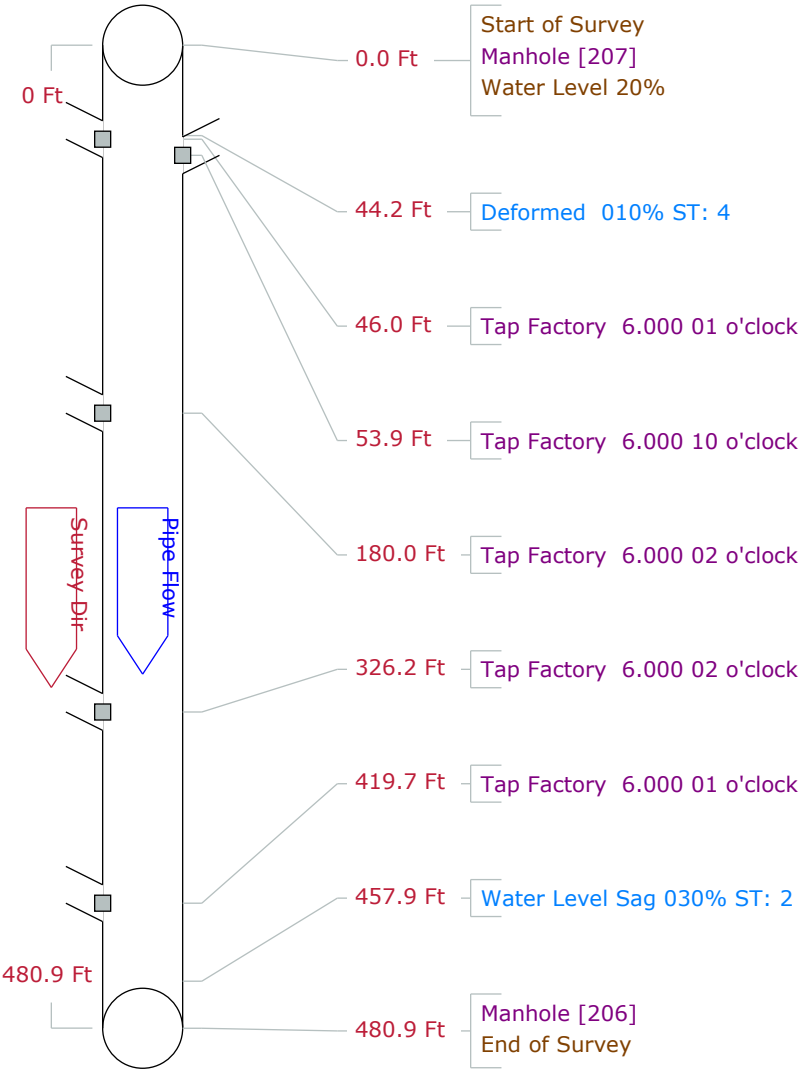
Pipe Graphic Report of PSR 087 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 27 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/17 | Time | 13:35 |
| Street | s lincoln rd | | | | |
| City | mt pleasant | Further location details | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Up | MH#207-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |
| Down | MH#206-LIN | Rim to invert | | Grade to invert | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Date Cleaned | 2014/10/16 | | | | | | |
| Material | Polyvinyl Chloride | Joint length | | Total length | 480.9 Ft | Length Surveyed | 480.90 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Constructional | | | |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | GPS Accuracy | | |





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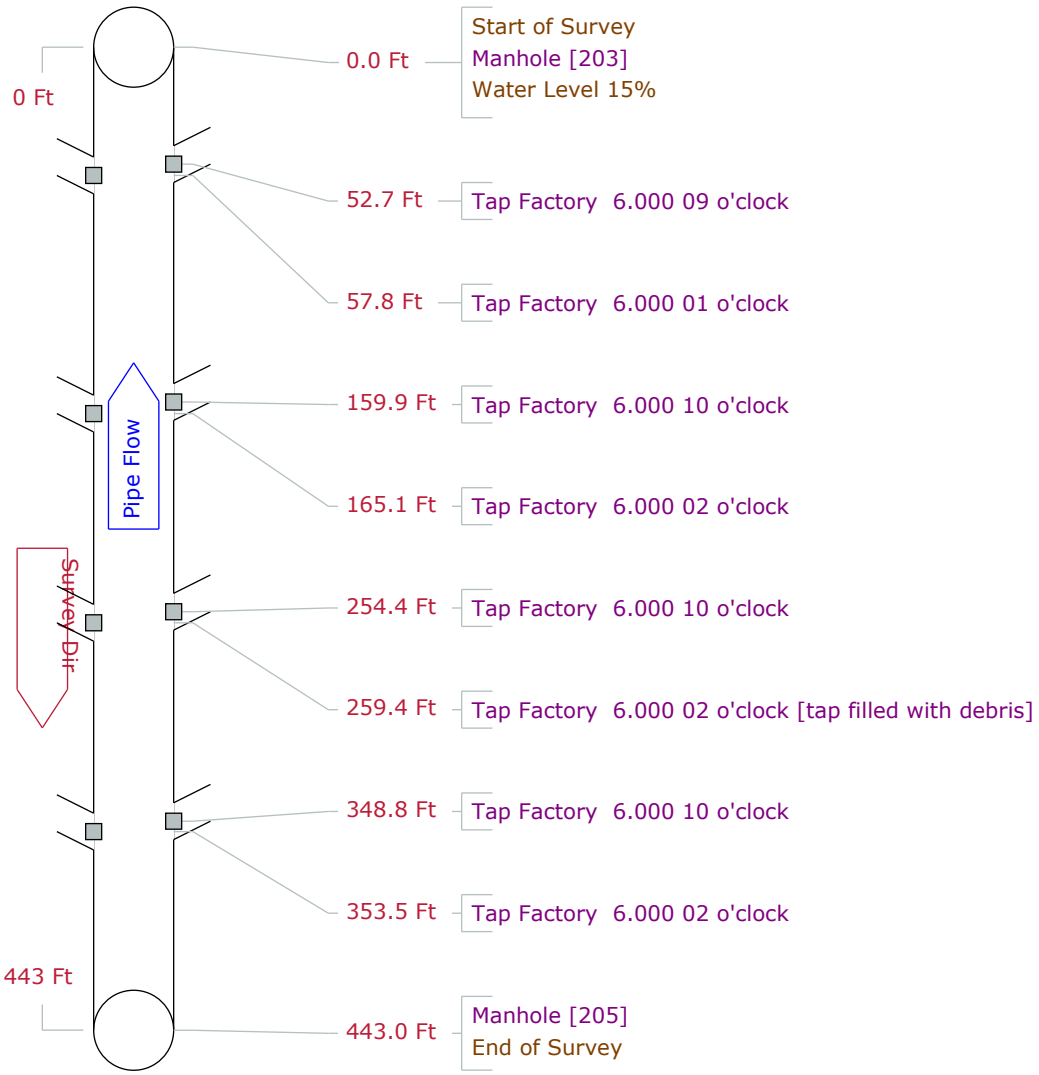
Pipe Graphic Report of PSR 085 for Union Twp

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Setup | 29 | Surveyor | Matt | Certificate # | U-1213-06019567 | System Owner | |
| Drainage | | Survey Customer | | | | | |
| P/O # | | Date | 2014/10/20 | Time | 9:05 | Street | mcdonald dr |
| City | mt pleasant | Further location details | | | | | |
| Up | MH#205-MCD | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Down | MH#203-MCD | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Use | Sanitary | Direction | Upstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Material | Polyvinyl Chloride | Joint length | | Total length | 443.0 Ft | Length Surveyed | 443.00 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |
| Additional info | | | | | | | |
| Location | Main Highway - Urban | | | | | | |
| Project | CLEANING AND TELEVISING 2014 | | | | | Work Order | |
| Northing | | Easting | | | | Elevation | |
| Coordinate System | | | | | | GPS Accuracy | |

Structural O & M Constructional
Miscellaneous Hydralic





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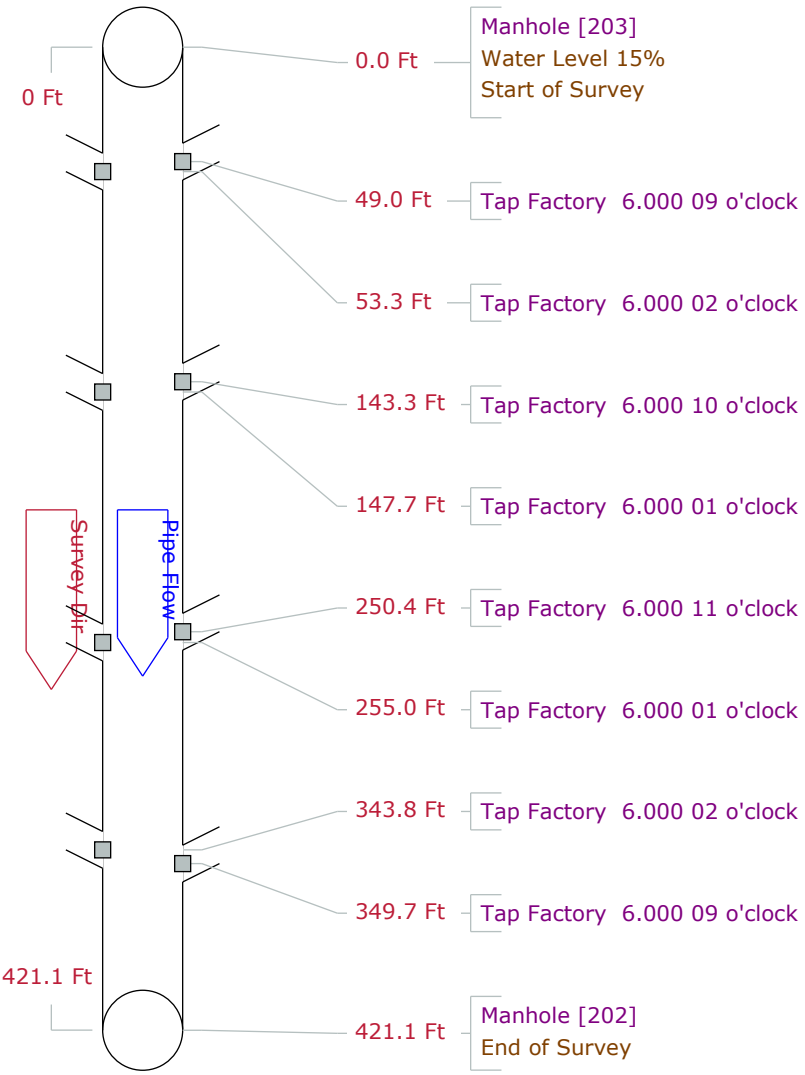
Pipe Graphic Report of PSR 084 for Union Twp

| | | | | | |
|---|---|---|---|---|---|
| Setup | 30 | Surveyor | Matt | Certificate # | U-1213-06019567 |
| System Owner | | | | | |
| Drainage | | Survey Customer | | | |
| P/O # | | Date | 2014/10/20 | Time | 9:42 |
| Street | mcdonald dr | | | | |
| City | mt pleasant | Further location details | | | |
| Up | MH#203-MCD | Rim to invert | | Grade to invert | Rim to grade Ft |
| Down | MH#202-MCD | Rim to invert | | Grade to invert | Rim to grade Ft |
| Use | Sanitary | Direction | Downstream | Flow control | Media No |
| Shape | Circular | Height | 8 | Width | ins |
| Preclean | J | Date Cleaned | 2014/10/20 | | |
| Material | Polyvinyl Chloride | Joint length | | Total length | 421.1 Ft |
| Length Surveyed | 421.10 | | | | |
| Lining | | Year laid | | Year rehabilitated | Weather Dry |
| Purpose | | Cat | | | |
| Additional info | | | | | |
| Location | Main Highway - Urban | | | | |
| Project | CLEANING AND TELEVISING 2014 | | | | |
| Northing | | Easting | | | |
| Coordinate System | | | | | |

Structural O & M Constructional
Miscellaneous Hydralic

Work Order
Elevation
GPS Accuracy





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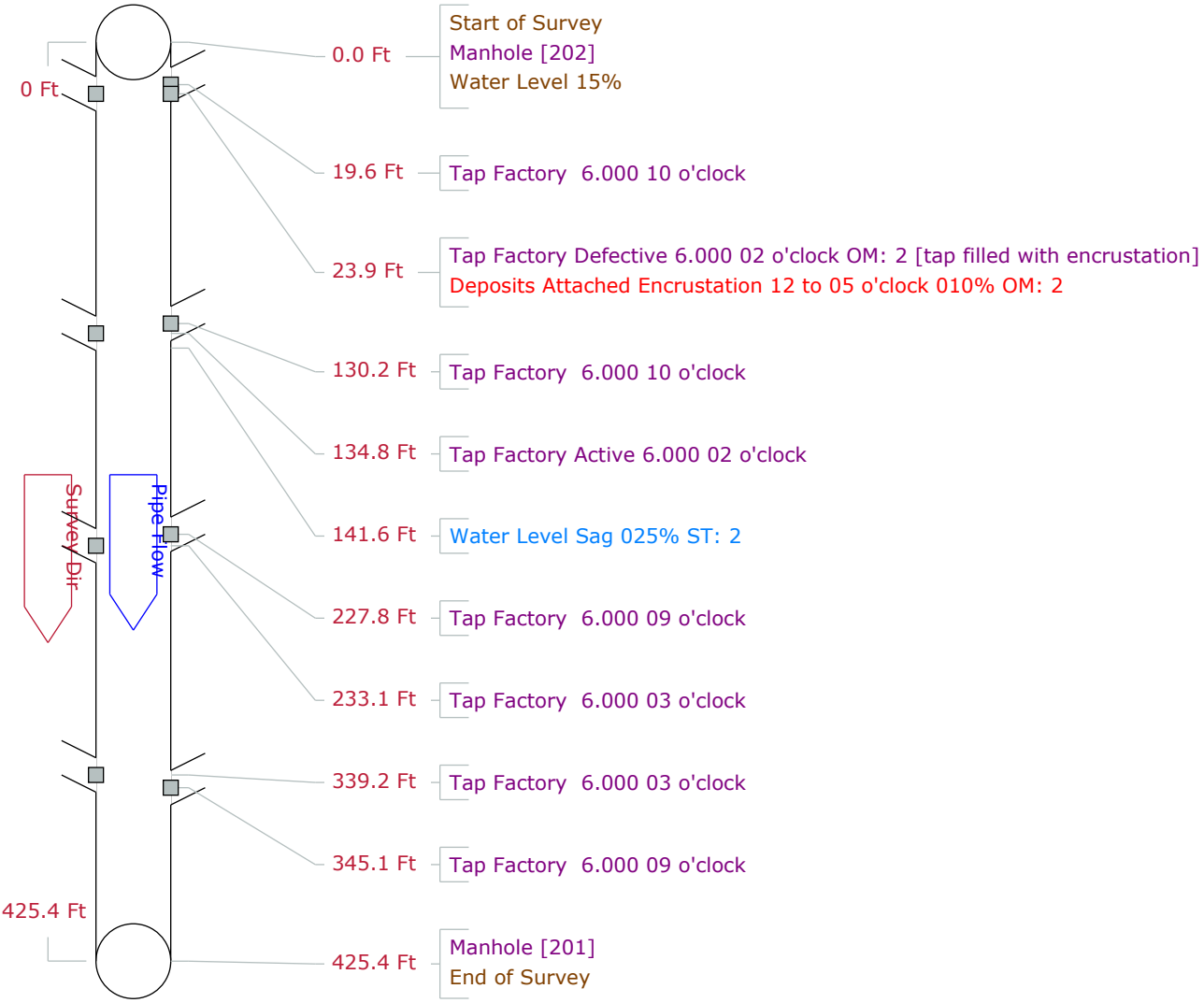
Pipe Graphic Report of PSR 083 for Union Twp

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Setup | 31 | Surveyor | Matt | Certificate # | U-1213-06019567 | System Owner | |
| Drainage | | Survey Customer | | | | | |
| P/O # | | Date | 2014/10/20 | Time | 10:01 | Street | mcdonald dr |
| City | mt pleasant | Further location details | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Up | MH#202-MCD | Rim to invert | | Grade to invert | | Rim to grade | Ft |
| Down | MH#201-MCD | Rim to invert | | Grade to invert | | Rim to grade | Ft |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Use | Sanitary | Direction | Downstream | Flow control | | Media No | |
| Shape | Circular | Height | 8 | Width | ins | Preclean | J |
| Material | Polyvinyl Chloride | Joint length | | Total length | 425.4 Ft | Length Surveyed | 425.40 |
| Lining | | Year laid | | Year rehabilitated | | Weather | Dry |
| Purpose | | Cat | | | | | |

| | | | |
|---|---|---|---|
| Additional info | | Structural | O & M |
| Location | Main Highway - Urban | Miscellaneous | Hydralic |
| Project | CLEANING AND TELEVISING 2014 | Work Order | |
| Northing | Easting | Elevation | |
| Coordinate System | | GPS Accuracy | |





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# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 112 | SWR-108 | MH#201.5-OCO | MH#201.4-OCO | 352.9 | 8 | PVC | 10 | 130 | 140 |
| 129 | SWR-064 | MH#276-RIV | MH#275-RIV | 354.0 | 8 | PVC | 24 | 20 | 44 |
| 71 | SWR-302 | MH#3-BIL | MH#2-WOOD | 474.3 | 8 | PVC | 38 | 0 | 38 |
| 69 | SWR-429 | MH#3B-WOOD | MH#3A-WOOD | 497.7 | 8 | PVC | 8 | 30 | 38 |
| 145 | SWR-901 | MH#2-SIL | MH#1-SIL | 258.8 | 8 | PVC | 29 | 2 | 31 |
| 26 | SWR-019 | MH#321-ROG | MH#305-ROG | 418.8 | 8 | PVC | 28 | 0 | 28 |
| 114 | SWR-061 | MH#272D-MIS | MH#272E-MIS | 262.6 | 8 | PVC | 25 | 1 | 26 |
| 4 | SWR-292 | MH#140A-CON | MH#140-CRAW | 262.4 | 8 | PVC | 20 | 5 | 25 |
| 104 | SWR-390 | MH#200D-PIC | MH#2-COR | 519.2 | 8 | PVC | 24 | 0 | 24 |
| 137 | SWR-079 | MH#200E-PIC | MH#200D-PIC | 646.7 | 8 | PVC | 24 | 0 | 24 |
| 130 | SWR-063 | MH#274-RIV | MH#275-RIV | 364.1 | 8 | PVC | 20 | 4 | 24 |
| 72 | SWR-301 | MH#2-WOOD | MH#140A-CON | 444.7 | 8 | PVC | 20 | 2 | 22 |
| 94 | SWR-080 | MH#200F-PIC | MH#200E-PIC | 450.6 | 8 | PVC | 22 | 0 | 22 |
| 128 | SWR-066 | MH#277-RIV | MH#278-RIV | 401.3 | 8 | PVC | 14 | 6 | 20 |
| 53 | SWR-690 | MH#1-JOS | MH#2-JOS | 415.3 | 8 | PVC | 15 | 4 | 19 |
| 55 | SWR-689 | MH#3-JOS | MH#201.2-JAC | 302.2 | 8 | PVC | 18 | 1 | 19 |
| 123 | SWR-053 | MH#270-CRA | MH#269-CRA | 316.2 | 8 | PVC | 14 | 4 | 18 |
| 126 | SWR-068 | MH#279A-RIV | MH#279-RIV | 215.1 | 8 | PVC | 18 | 0 | 18 |
| 39 | SWR-044 | MH#350-LIN | MH#349-REM | 397.9 | 8 | PVC | 18 | 0 | 18 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 115 | SWR-060 | MH#272D-MIS | MH#272CD-MIS | 171.4 | 8 | PVC | 17 | 0 | 17 |
| 65 | SWR-308 | MH#3-BILB | MH#2-BIL | 285.6 | 8 | PVC | 14 | 2 | 16 |
| 67 | SWR-307 | MH#3-BILB | MH#4-BIL | 256.4 | 8 | PVC | 12 | 3 | 15 |
| 80 | SWR-480 | MH#10-BAM | MH#9-BAM | 401.2 | 8 | PVC | 14 | 0 | 14 |
| 19 | SWR-026 | MH#340-IND | MH#6-SSCO | 300.8 | 8 | PVC | 12 | 2 | 14 |
| 111 | SWR-109 | MH#201.6-OCO | MH#201.5-OCO | 364.8 | 8 | PVC | 10 | 4 | 14 |
| 146 | SWR-900 | MH#2-SIL | MH#4-SIL | 499.2 | 8 | PVC | 14 | 0 | 14 |
| 41 | SWR-412 | MH#7-OAK | MH#6-OAK | 254.1 | 8 | PVC | 14 | 0 | 14 |
| 127 | SWR-070 | MH#280-RIV | MH#281-RIV | 459.3 | 8 | PVC | 14 | 0 | 14 |
| 38 | SWR-045 | MH#352-LIN | MH#350-LIN | 397.1 | 8 | PVC | 14 | 0 | 14 |
| 70 | SWR-303 | MH#3-BIL | MH#3A-WOOD | 467.4 | 8 | PVC | 12 | 2 | 14 |
| 91 | SWR-558 | MH#200FA-PIC | MH#2-TWP | 324.1 | 8 | PVC | 13 | 0 | 13 |
| 87 | SWR-557 | MH#1-TWP | MH#2-TWP | 553.1 | 8 | PVC | 13 | 0 | 13 |
| 81 | SWR-1128 | MH#9-BAM | MH#8-BAM | 366.0 | 8 | PVC | 12 | 0 | 12 |
| 135 | SWR-050 | MH#268-MIS | MH#267-MIS | 312.9 | 8 | PVC | 12 | 0 | 12 |
| 24 | SWR-021 | MH#336-ROG | MH#322-ROG | 318.6 | 8 | PVC | 10 | 2 | 12 |
| 9 | SWR-157 | MH#142-CON | MH#143-CON | 314.4 | 8 | PVC | 12 | 0 | 12 |
| 43 | SWR-410 | MH#5-OAK | MH#4-OAK | 279.8 | 8 | PVC | 12 | 0 | 12 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 120 | SWR-057 | MH#272A-CRA | MH#273-CRA | 172.9 | 8 | PVC | 8 | 2 | 10 |
| 54 | SWR-688 | MH#3-JOS | MH#2-JOS | 292.1 | 8 | PVC | 10 | 0 | 10 |
| 110 | SWR-077 | MH#200-PIC | MH#199-CITY | 386.2 | 8 | PVC | 10 | 0 | 10 |
| 101 | SWR-328 | MH#5-OAK2 | MH#8-OAK2 | 427.6 | 8 | PVC | 10 | 0 | 10 |
| 27 | SWR-041 | MH#306-REM | MH#305-ROG | 270.5 | 10 | PVC | 10 | 0 | 10 |
| 138 | SWR-341 | MH#3-OAK2 | MH#2-OAK2 | 263.0 | 8 | PVC | 10 | 0 | 10 |
| 21 | SWR-024 | MH#339-IND | MH#338-IND | 398.5 | 8 | PVC | 10 | 0 | 10 |
| 11 | SWR-155 | MH#144-CON | MH#145-CON | 179.2 | 8 | PVC | 10 | 0 | 10 |
| 97 | SWR-330 | MH#10-OAK2 | MH#9-OAK2 | 267.0 | 8 | PVC | 6 | 3 | 9 |
| 17 | SWR-752 | MH#6-SSCO | MH#02-LER | 421.4 | 8 | PVC | 9 | 0 | 9 |
| 88 | SWR-081 | MH#200G-PIC | MH#200F-PIC | 354.8 | 8 | PVC | 9 | 0 | 9 |
| 22 | SWR-023 | MH#337-IND | MH#338-IND | 397.2 | 8 | PVC | 6 | 2 | 8 |
| 25 | SWR-020 | MH#322-ROG | MH#321-ROG | 262.4 | 8 | PVC | 8 | 0 | 8 |
| 10 | SWR-156 | MH#143-CON | MH#144-CON | 306.3 | 8 | PVC | 8 | 0 | 8 |
| 49 | SWR-694 | MH#1-FRA | MH#2-FRA | 280.7 | 8 | PVC | 8 | 0 | 8 |
| 118 | SWR-058 | MH#272B-MIS | MH#272A-CRA | 397.1 | 8 | PVC | 8 | 0 | 8 |
| 119 | SWR-059 | MH#272B-MIS | MH#272C-MIS | 112.0 | 8 | PVC | 8 | 0 | 8 |
| 122 | SWR-054 | MH#270-CRA | MH#271-CRA | 408.5 | 8 | PVC | 6 | 2 | 8 |
| 44 | SWR-409 | MH#4-OAK | MH#3-OAK | 397.5 | 8 | PVC | 7 | 0 | 7 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 37 | SWR-435 | MH#1-OAKW | MH#352-LIN | 120.4 | 8 | PVC | 6 | 1 | 7 |
| 61 | SWR-482 | MH#10-BAM | MH#12-BAM | 429.0 | 8 | PVC | 6 | 0 | 6 |
| 52 | SWR-691 | MH#4-FRA | MH#3-JOS | 305.8 | 8 | PVC | 6 | 0 | 6 |
| 50 | SWR-693 | MH#2-FRA | MH#3-FRA | 318.3 | 8 | PVC | 6 | 0 | 6 |
| 45 | SWR-408 | MH#3-OAK | MH#2-OAK | 401.9 | 8 | PVC | 6 | 0 | 6 |
| 68 | SWR-304 | MH#4-BIL | MH#3-BIL | 330.2 | 8 | PVC | 6 | 0 | 6 |
| 42 | SWR-411 | MH#6-OAK | MH#5-OAK | 158.5 | 8 | PVC | 4 | 2 | 6 |
| 48 | SWR-107 | MH#201.2-JAC | MH#201.4-OCO | 232.0 | 8 | PVC | 6 | 0 | 6 |
| 124 | SWR-052 | MH#269-CRA | MH#266-MIS | 187.8 | 8 | PVC | 6 | 0 | 6 |
| 131 | SWR-062 | MH#274-RIV | MH#270-CRA | 418.7 | 8 | PVC | 6 | 0 | 6 |
| 8 | SWR-158 | MH#141-CON | MH#142-CON | 180.7 | 8 | PVC | 6 | 0 | 6 |
| 86 | SWR-555 | MH#1A-TWP | MH#1-TWP | 117.2 | 8 | PVC | 6 | 0 | 6 |
| 83 | SWR-1129 | MH#7-BAM | MH#8-BAM | 311.3 | 8 | PVC | 6 | 0 | 6 |
| 125 | SWR-069 | MH#280-RIV | MH#279A-RIV | 174.6 | 8 | PVC | 6 | 0 | 6 |
| 121 | SWR-056 | MH#272A-CRA | MH#272-CRA | 225.0 | 8 | PVC | 4 | 2 | 6 |
| 106 | SWR-937 | MH#3-COR | MH#2-COR | 84.3 | 8 | PVC | 6 | 0 | 6 |
| 23 | SWR-022 | MH#337-IND | MH#336-ROG | 280.9 | 8 | PVC | 4 | 2 | 6 |
| 73 | SWR-009 | MH#327-SEA | MH#328-SEA | 160.5 | 8 | PVC | 3 | 2 | 5 |
| 113 | SWR-111 | MH#201.6-OCO | MH#201.7-OCO | 26.8 | 8 | PVC | 0 | 4 | 4 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 103 | SWR-324 | MH#4-OAK2 | MH#3-OAK2 | 262.8 | 8 | PVC | 4 | 0 | 4 |
| 134 | SWR-067 | MH#278-RIV | MH#279-RIV | 53.0 | 8 | PVC | 0 | 4 | 4 |
| 140 | SWR-320 | MH#316-REM | MH#1-OAK2 | 114.4 | 8 | PVC | 4 | 0 | 4 |
| 139 | SWR-323 | MH#1-OAK2 | MH#2-OAK2 | 113.9 | 8 | PVC | 4 | 0 | 4 |
| 46 | SWR-407 | MH#2-OAK | MH#1-OAK | 120.9 | 8 | PVC | 4 | 0 | 4 |
| 47 | SWR-432 | MH#201.2-JAC | MH#201.3-JAC | 238.9 | 8 | PVC | 4 | 0 | 4 |
| 5 | SWR-159 | MH#140-CRAW | MH#141-CON | 309.5 | 8 | PVC | 4 | 0 | 4 |
| 18 | SWR-748 | MH#6-SSCO | MH#1-LIB | 351.0 | 8 | PVC | 4 | 0 | 4 |
| 2 | SWR-294 | MH#2-LARK | MH#1-WOOD | 163.5 | 8 | PVC | 4 | 0 | 4 |
| 16 | SWR-154 | MH#145-CON | MH#150-CON | 133.9 | 8 | PVC | 4 | 0 | 4 |
| 75 | SWR-011 | MH#329-SEA | MH#330-SEA | 167.9 | 8 | PVC | 4 | 0 | 4 |
| 76 | SWR-007 | MH#325-SEA | MH#326-SEA | 251.8 | 8 | PVC | 2 | 2 | 4 |
| 82 | SWR-1130 | MH#3-FRA | MH#7-BAM | 84.6 | 8 | PVC | 4 | 0 | 4 |
| 109 | SWR-391A | MH#200A-PIC | MH#200-PIC | 21.9 | 8 | PVC | 0 | 4 | 4 |
| 90 | SWR-1044 | MH#200G-PIC | STUB | 69.9 | 8 | PVC | 4 | 0 | 4 |
| 102 | SWR-325 | MH#5-OAK2 | MH#4-OAK2 | 218.6 | 8 | PVC | 4 | 0 | 4 |
| 60 | SWR-483 | MH#13-BAM | MH#12-BAM | 169.1 | 8 | PVC | 4 | 0 | 4 |
| 51 | SWR-692 | MH#3-FRA | MH#4-FRA | 100.4 | 8 | PVC | 4 | 0 | 4 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 58 | SWR-484 | MH#13-BAM | MH#14-BAM | 199.4 | 8 | PVC | 4 | 0 | 4 |
| 57 | SWR-431 | MH#201.1-MCD | MH#201-MCD | 164.8 | 8 | PVC | 4 | 0 | 4 |
| 56 | SWR-430 | MH#201.2-JAC | MH#201.1-MCD | 248.0 | 8 | PVC | 4 | 0 | 4 |
| 95 | SWR-413 | MH#10-OAK2 | MH#12-OAK2 | 283.0 | 8 | PVC | 4 | 0 | 4 |
| 14 | SWR-150 | MH#148-CON | MH#149-CON | 285.8 | 8 | PVC | 4 | 0 | 4 |
| 3 | SWR-654 | MH#1-WOOD | MH#140A-CON | 183.9 | 8 | PVC | 2 | 0 | 2 |
| 15 | SWR-149 | MH#149-CON | MH#150-CON | 256.2 | 8 | PVC | 2 | 0 | 2 |
| 108 | SWR-391A | MH#200-PIC | MH#200A-PIC | 94.6 | 8 | PVC | 0 | 2 | 2 |
| 20 | SWR-025 | MH#340-IND | MH#339-IND | 281.9 | 8 | PVC | 2 | 0 | 2 |
| 13 | SWR-151 | MH#147-CON | MH#148-CON | 286.2 | 8 | PVC | 2 | 0 | 2 |
| 66 | SWR-309 | MH#2-BIL | MH#1-BIL | 259.1 | 8 | PVC | 2 | 0 | 2 |
| 92 | SWR-558A | MH#200FA-PIC | MH#200F-PIC | 66.6 | 8 | PVC | 2 | 0 | 2 |
| 79 | SWR-004 | MH#321A-COMM | MH#323-SEA | 266.2 | 8 | PVC | 2 | 0 | 2 |
| 133 | SWR-078 | MH#200-PIC | MH#200B-PIC | 42.8 | 8 | PVC | 2 | 0 | 2 |
| 142 | SWR-029 | MH#347-BRA | MH#346-REM | 77.1 | 8 | PVC | 2 | 0 | 2 |
| 141 | SWR-030 | MH#347-BRA | UNKNOWN | 186.4 | 8 | PVC | 2 | 0 | 2 |
| 143 | SWR-028 | MH#346-REM | MH#345-REM | 79.8 | 8 | PVC | 2 | 0 | 2 |
| 96 | SWR-414 | MH#10-OAK2 | MH#11-OAK2 | 287.7 | 8 | PVC | 2 | 0 | 2 |
| 85 | SWR-553 | MH#1B-TWP | MH#1C-TWP | 379.7 | 8 | PVC | 2 | 0 | 2 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 77 | SWR-005 | MH#324-SEA | MH#323-SEA | 200.7 | 8 | PVC | 2 | 0 | 2 |
| 74 | SWR-010 | MH#328-SEA | MH#329-SEA | 25.8 | 8 | PVC | 2 | 0 | 2 |
| 63 | SWR-008 | MH#327-SEA | MH#326-SEA | 256.8 | 8 | PVC | 2 | 0 | 2 |
| 36 | SWR-436 | MH#2-OAKW | MH#1-OAKW | 212.0 | 8 | PVC | 2 | 0 | 2 |
| 33 | SWR-013 | MH#331-COMM | MH#321A-COMM | 183.7 | 8 | PVC | 0 | 0 | 0 |
| 28 | SWR-018 | MH#335-COMM | UNKNOWN | 80.5 | 8 | PVC | 0 | 0 | 0 |
| 31 | SWR-015 | MH#333-COMM | MH#332-COMM | 357.1 | 8 | PVC | 0 | 0 | 0 |
| 34 | SWR-012 | MH#321A-COMM | MH#321-ROG | 206.7 | 8 | PVC | 0 | 0 | 0 |
| 144 | SWR-1181 | UNKNOWN | MH#345-REM | 28.9 | 8 | PVC | 0 | 0 | 0 |
| 6 | SWR-300 | MH#3-LARK | MH#4-LARK | 228.6 | 8 | PVC | 0 | 0 | 0 |
| 7 | SWR-297 | MH#3-LARK | MH#1-WOOD | 194.3 | 8 | PVC | 0 | 0 | 0 |
| 32 | SWR-014 | MH#332-COMM | MH#331-COMM | 354.7 | 8 | PVC | 0 | 0 | 0 |
| 136 | SWR-049 | MH#267-MIS | MH#266-MIS | 82.2 | 8 | PVC | 0 | 0 | 0 |
| 105 | SWR-1150 | MH#3-COR | MH#002-PIC | 61.3 | 8 | PVC | 0 | 0 | 0 |
| 100 | SWR-326 | MH#6-OAK2 | MH#5-OAK2 | 203.7 | 8 | PVC | 0 | 0 | 0 |
| 12 | SWR-152 | MH#146-CON | MH#147-CON | 95.3 | 8 | PVC | 0 | 0 | 0 |
| 84 | SWR-554 | MH#1A-TWP | MH#1B-TWP | 143.5 | 8 | PVC | 0 | 0 | 0 |
| 98 | SWR-329 | MH#9-OAK2 | MH#8-OAK2 | 60.4 | 8 | PVC | 0 | 0 | 0 |
| 107 | SWR-391 | MH#200C-PIC | MH#200A-PIC | 194.9 | 8 | PVC | 0 | 0 | 0 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Township | Contract | Project # |
| Project | Clean & Tv 2017 | | Project Start 9/5/2017 |
| Location | | UOM Ft | Survey Count 143 |
| Database | T:\VIDEO INSPECTIONS\2017 TELEVISING\UNION TOWNSHIP 2017\DATA\UNION TOWNSHIP 2017.MDB | | Printed On Oct-13-2017 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 93 | SWR-1045 | MH#200F-PIC | STUB | 3.0 | 8 | PVC | 0 | 0 | 0 |
| 89 | SWR-1044 | MH#200G-PIC | STUB | 193.7 | 8 | PVC | 0 | 0 | 0 |
| 62 | SWR-477 | MH#10-BAM | MH#11-BAM | 241.4 | 8 | PVC | 0 | 0 | 0 |
| 30 | SWR-016 | MH#334-COMM | MH#333-COMM | 61.7 | 8 | PVC | 0 | 0 | 0 |
| 29 | SWR-017 | MH#335-COMM | MH#334-COMM | 301.3 | 8 | PVC | 0 | 0 | 0 |
| 78 | SWR-006 | MH#325-SEA | MH#324-SEA | 217.7 | 8 | PVC | 0 | 0 | 0 |
| 116 | SWR-060A | MH#272CD-MIS | MH#272C-MIS | 232.4 | 8 | PVC | 0 | 0 | 0 |
| 35 | SWR-437 | MH#3-OAKW | MH#2-OAKW | 100.4 | 8 | PVC | 0 | 0 | 0 |
| 1 | SWR-296 | MH#2-LARK | MH#1-LARK | 220.4 | 8 | PVC | 0 | 0 | 0 |
| 59 | SWR-487 | MH#14-BAM | STUB | 3.0 | 6 | PVC | 0 | 0 | 0 |
| 40 | SWR-476 | MH#352-LIN | STUB | 8.5 | 8 | PVC | 0 | 0 | 0 |
| 99 | SWR-327 | MH#6-OAK2 | MH#7-OAK2 | 102.7 | 8 | PVC | 0 | 0 | 0 |

# CCTV Grade Count report

Client Union Twp | Work Order

Project Union 2015 | Project Start 11/16/2015

Location | Start Tape | UOM Ft | Setups 153

Database F:\UNION TWP\DATA\UNION TWP.MDB | Printed on 12/18/2015

| Setup | Manhole | | Pipe | | | Grade count | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | From | To | Svy length | Diameter in | Material | 5 | 4 | 3 | 2 | 1 | 0 |
| 1 | MH#91-BEL | MH#92-BEL | 449.4 | 10 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 12 |
| 2 | MH#92-BEL | MH#93A-BEL | 279.2 | 10 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 8 |
| 3 | MH#90A-BEL | MH#90-BEL | 267.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 8 |
| 4 | MH#90-BEL | MH#89-BEL | 314.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 1 | 11 |
| 5 | MH#86-BEL | MH#85-BEL | 266.2 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 7 |
| 6 | MH#83-NAT | MH#82-NAT | 287.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 8 |
| 7 | MH#83-NAT | MH#84-NAT | 295.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 1 | 8 |
| 8 | MH#84-NAT | MH#87-BEL | 278.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 4 |
| 9 | MH#86-BEL | MH#87-BEL | 226.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 5 |
| 10 | MH#87-BEL | MH#88-BEL | 495.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 1 | 10 |
| 11 | MH#88-BEL | MH#89-BEL | 208.6 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 5 | 1 | 5 |
| 12 | MH#77-CAR | MH#78-CAR | 335.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 0 | 10 |
| 13 | MH#78-CAR | MH#79-CAR | 305.3 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 6 | 0 | 7 |
| 14 | MH#79-CAR | MH#80-PIC | 255.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 9 | 0 | 6 |
| 15 | MH#80-PIC | MH#75-PIC | 255.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 0 | 6 |
| 16 | MH#71-BET | MH#72-BET | 236.2 | 8 | Polyvinyl Chloride | 1 | 0 | 0 | 1 | 0 | 7 |
| 17 | MH#72-BET | MH#73-BET | 272.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 9 |
| 18 | MH#75-PIC | MH#73-BET | 405.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 13 | 0 | 9 |
| 19 | MH#45-1ST | MH#46-1ST | 262.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 10 | 0 | 3 |
| 20 | MH#46-1ST | MH#47-PAL | 221.1 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 5 | 0 | 4 |
| 21 | MH#47-PAL | MH#41-2ND | 249.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 0 | 5 |
| 22 | MH#11-PIC | MH#12-PIC | 334.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 4 |
| 23 | MH#11-PIC | MH#42-2ND | 186.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 3 |
| 24 | MH#42-2ND | MH#41-2ND | 221.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 2 |
| 25 | MH#11-PIC | MH#10-PIC | 99.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 3 |
| 26 | MH#41-2ND | MH#51-PAL | 194.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 5 | 0 | 5 |
| 27 | MH#51-PAL | MH#50-3RD | 2.5 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 0 | 0 | 1 |
| 28 | MH#50-3RD | MH#51-PAL | 228.2 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 0 | 0 | 7 |
| 29 | MH#50-3RD | MH#49-3RD | 130.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 3 |
| 30 | MH#49-3RD | MH#57A-ELIZ | 262.7 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 5 | 0 | 5 |
| 31 | MH#13-PIC | MH#12-PIC | 361.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 5 |
| 32 | MH#13-PIC | MH#58-ELIZ | 258.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 5 | 0 | 6 |
| 33 | MH#58-ELIZ | MH#57A-ELIZ | 285.1 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 9 | 0 | 8 |
| 34 | MH#57A-ELIZ | MH#57-ELIZ | 62.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 1 |
| 35 | MH#57-ELIZ | MH#60-WARD | 251.2 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 5 | 0 | 2 |
| 36 | MH#60-WARD | MH#59-WARD | 283.6 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 8 | 0 | 9 |

PLUMMER'S Environmental Services Inc.

Plummer's Environmental Services
Phone:616-877-3930
Fax:616-877-3937

| Setup | Manhole | | Pipe | | | Grade count | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | From | To | Svy length | Diameter in | Material | 5 | 4 | 3 | 2 | 1 | 0 |
| 37 | MH#59-WARD | MH#61-FLO | 139.9 | 8 | Polyvinyl Chloride | 1 | 1 | 0 | 5 | 0 | 5 |
| 38 | MH#15-PIC | MH#16-PIC | 412.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 5 |
| 40 | MH#15-PIC | MH#61A-FLO | 153.2 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 2 |
| 41 | MH#61A-FLO | MH#61-FLO | 309.2 | 8 | Polyvinyl Chloride | 0 | 1 | 0 | 4 | 0 | 9 |
| 42 | MH#15-PIC | MH#14-PIC | 382.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 6 |
| 43 | MH#24-PIC | MH#26-PIC | 373.3 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 4 |
| 44 | MH#24-PIC | MH#25-PIC | 180.3 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 3 |
| 45 | MH#24-PIC | MH#23-AIRW | 330.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 9 | 0 | 11 |
| 46 | MH#68-YAT | MH#69-YAT | 265.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 9 |
| 47 | MH#69-YAT | MH#70-YAT | 270.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 4 | 1 | 7 |
| 48 | MH#23-AIRW | MH#22-AIRW | 389.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 12 | 0 | 13 |
| 49 | MH#22-AIRW | MH#21-AIRW | 379.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 4 | 1 | 11 |
| 50 | MH#20-AIRW | MH#21-AIRW | 216.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 6 |
| 51 | MH#28-PIC | MH#27-PIC | 302.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 6 |
| 52 | MH#27-PIC | MH#26-PIC | 360.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 6 |
| 53 | MH#28-PIC | MH#35-BUD | 230.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 2 | 3 |
| 54 | MH#35-BUD | MH#34-BUD | 313.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 7 |
| 55 | MH#33-BUD | MH#34-BUD | 85.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 3 |
| 56 | MH#33-BUD | MH#32-BUD | 334.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 1 | 9 |
| 57 | MH#8-HYDE | MH#9-HYDE | 278.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 6 |
| 58 | MH#8-HYDE | MH#7-PIC | 342.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 0 | 9 |
| 59 | MH#7-PIC | MH#6-PIC | 247.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 4 | 1 | 2 |
| 60 | MH#6-PIC | MH#5-PIC | 352.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 0 | 5 |
| 61 | MH#2-SCIT | MH#1-SCIT | 284.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 1 |
| 62 | MH#2-SCIT | MH#3-SCIT | 78.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 1 |
| 63 | MH#4-SCIT | MH#5-SCIT | 282.3 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 1 | 0 | 1 |
| 64 | MH#5-SCIT | MH#6-PIC-SCIT | 264.3 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 10 | 1 | 4 |
| 65 | MH#4-SCIT | MH#3-SCIT | 393.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 1 |
| 66 | MH#5-PIC | MH#4-PIC | 333.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 10 | 1 | 3 |
| 67 | MH#4-PIC | MH#3-PIC | 384.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 0 | 5 |
| 68 | MH#2-PIC | MH#2A-PIC | 19.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 2 |
| 69 | MH#2-PIC | MH#2B-ENT | 188.6 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 5 | 0 | 4 |
| 70 | MH#3-PIC | MH#2-PIC | 277.5 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 7 | 2 | 5 |
| 71 | MH#6-PIC-SCIT | MH#2-PIC-MMCC | 303.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 16 | 0 | 2 |
| 72 | MH#1-PIC-MMCC | MH#2-PIC-MMCC | 188.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 2 |
| 73 | MH#1-PIC-MMCC | MH#1-PIC | 87.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 3 |
| 74 | MH#2A-PIC | MH#1-PIC | 262.2 | 10 | Polyvinyl Chloride | 0 | 0 | 1 | 4 | 0 | 3 |
| 75 | MH#97-PIC | MH#97A-PIC | 104.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 1 | 2 |
| 76 | MH#81A-PIC | MH#81-PIC | 106.1 | 15 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 2 |
| 77 | MH#227B-RIV | MH#227A-RIV | 302.2 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 14 | 1 | 7 |
| 78 | MH#227B-RIV | MH#227C-RIV | 325.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 12 | 0 | 8 |
| 79 | MH#227-RIV | MH#227A-RIV | 35.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 1 | 1 |

| Setup | Manhole | | Pipe | | | Grade count | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | From | To | Svy length | Diameter in | Material | 5 | 4 | 3 | 2 | 1 | 0 |
| 80 | MH#227-RIV | MH#226-RIV | 357.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 6 | 0 | 6 |
| 81 | MH#1-PIC-MMH | STUB | 297.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 3 |
| 82 | MH#1-PIC-MMH | STUB MMH BUILDING | 77.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 1 | 2 |
| 83 | MH#1-PIC-MMH | MH#2-PIC-MMH | 242.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 1 | 3 |
| 84 | MH#76B-PIC | MH#2-PIC-MMH | 106.2 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 2 | 4 |
| 85 | MH#76B-PIC | MH#76-PIC | 97.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 1 |
| 86 | MH#76A-PIC | MH#76-PIC | 385.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 9 |
| 87 | MH#76-PIC | MH#75-PIC | 179.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 1 | 3 |
| 88 | MH#73-BET | MH#70-YAT | 309.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 9 | 0 | 7 |
| 89 | MH#70-YAT | MH#70A-ISA | 188.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 6 | 0 | 6 |
| 90 | MH#20A-BUD | MH#21-AIRW | 336.2 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 3 |
| 91 | MH#20A-BUD | MH#20B-BUD | 146.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 1 |
| 92 | MH#28-PIC | MH#29-PIC | 317.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 2 |
| 93 | MH#32-BUD | MH#20C-BUD | 309.9 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 8 | 0 | 6 |
| 94 | MH#20C-BUD | MH#20B-BUD | 322.6 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 13 | 0 | 7 |
| 95 | MH#32-BUD | MH#31-BUD | 356.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 1 | 8 |
| 96 | MH#31-BUD | MH#30-ISA | 323.5 | 8 | Polyvinyl Chloride | 0 | 0 | 2 | 10 | 1 | 7 |
| 97 | MH#30A.1-ISA | MH#30-ISA | 441.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 14 | 1 | 4 |
| 98 | MH#96C-PIC | MH#96A-PIC | 333.8 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 4 | 0 | 5 |
| 99 | MH#96A-PIC | MH#96B-PIC | 152.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 5 |
| 100 | MH#96A-PIC | MH#96-PIC | 93.1 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 1 | 0 | 1 |
| 101 | MH#002-BLUE | MH#170-BLUE | 245.5 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 3 |
| 102 | MH#170-BLUE | MH#171-BLUE | 239.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 2 |
| 103 | MH#172-BLUE | MH#171-BLUE | 394.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 16 | 0 | 2 |
| 104 | MH#172-BLUE | MH#173-BLUE | 280.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 3 |
| 105 | MH#173-BLUE | MH#15-BLUE | 20.6 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 1 | 0 | 1 |
| 106 | MH#14-BLUE | MH#15-BLUE | 364.6 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 1 | 2 |
| 107 | MH#14-BLUE | MH#13-BLUE | 407.3 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 3 |
| 108 | MH#13-BLUE | MH#12-BLUE | 406.3 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 12 | 0 | 2 |
| 109 | MH#11-BLUE | MH#12-BLUE | 407.4 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 1 | 4 |
| 110 | MH#11-BLUE | MH#10-BLUE | 407.5 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 14 | 3 | 1 |
| 111 | MH#10-BLUE | MH#9-BLUE | 407.0 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 2 |
| 112 | MH#9-BLUE | MH#12-COP | 407.0 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 3 |
| 113 | MH#7-BLUE | MH#8-BLUE | 322.8 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 1 | 1 |
| 114 | MH#8-BLUE | MH#12-COP | 85.6 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 2 |
| 115 | MH#7-BLUE | MH#6-BLUE | 410.5 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 10 | 0 | 2 |
| 116 | MH#6-BLUE | MH#5-ISA | 382.4 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 11 | 0 | 1 |
| 117 | MH#61-FLO | MH#66B-ISA | 165.9 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 4 | 0 | 4 |
| 118 | MH#66B-ISA | MH#66A-ISA | 122.2 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 4 | 0 | 1 |
| 119 | MH#66A-ISA | MH#66-ISA | 253.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 6 | 0 | 3 |
| 120 | MH#70A-ISA | MH#70B-ISA | 200.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 4 | 0 | 3 |
| 121 | MH#70B-ISA | MH#67-ISA | 40.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 2 |

| Setup | Manhole | | Pipe | | | Grade count | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | From | To | Svy length | Diameter in | Material | 5 | 4 | 3 | 2 | 1 | 0 |
| 122 | MH#3-ISA | MH#4-ISA | 399.7 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 2 | 2 |
| 123 | MH#4-ISA | MH#5-ISA | 307.2 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 4 |
| 124 | MH#3-ISA | MH#2-ISA | 416.5 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 2 | 3 |
| 125 | MH#2-ISA | MH#1-ISA | 403.1 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 2 |
| 126 | MH#46-ISA | MH#1-ISA | 397.2 | 12 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 4 |
| 127 | MH#174-BLUE | MH#15-BLUE | 393.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 6 | 0 | 3 |
| 128 | MH#174-BLUE | MH#175-BLUE | 404.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 1 | 3 |
| 129 | MH#175-BLUE | MH#176A-BLUE | 404.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 16 | 0 | 4 |
| 130 | MH#176A-BLUE | MH#176-BLUE | 50.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 1 |
| 131 | MH#176-BLUE | MH#177-BLUE | 356.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 5 |
| 132 | MH#1-INDIAN | MH#2-INDIAN | 229.3 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 8 | 0 | 2 |
| 133 | MH#2-INDIAN | MH#176-BLUE | 399.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 1 |
| 134 | MH#178-BLUE | MH#177-BLUE | 173.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 7 | 0 | 2 |
| 135 | MH#17-BLUE | MH#13-BLUE | 66.8 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 4 |
| 136 | MH UNKOWN | MH#7-BLUE | 85.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 1 |
| 137 | MH#18-BLUE | MH#12-BLUE | 70.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 2 |
| 138 | MH#6A-BLUE | MH#6-BLUE | 77.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 3 | 0 | 1 |
| 139 | MH#178-BLUE | LIFT STATION | 109.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 6 | 0 | 1 |
| 140 | MH#30-ISA | MH#30A-ISA | 368.4 | 8 | Polyvinyl Chloride | 0 | 0 | 1 | 8 | 0 | 6 |
| 141 | MH#18A-PIC | MH#29-PIC | 275.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 3 |
| 142 | MH#14-BLUE | STUB | 11.2 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 1 |
| 143 | MH#13-BLUE | STUB | 3.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 1 |
| 144 | MH#12-BLUE | STUB | 3.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 2 |
| 145 | MH#11-BLUE | STUB | 73.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 2 |
| 146 | MH#9-BLUE | STUB | 22.6 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 5 |
| 147 | MH#9-BLUE | MH#16-BLUE | 65.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 2 |
| 148 | MH#5-ISA | STUB | 11.1 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 1 |
| 149 | MH#6-BLUE | STUB | 3.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 1 |
| 150 | MH#1-ISA | STUB | 3.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 0 | 0 | 1 |
| 151 | MH#2-ISA | STUB | 3.0 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 1 |
| 152 | MH#4-ISA | STUB | 101.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 1 |
| 153 | MH#30A-ISA | STUB | 57.4 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 2 | 0 | 1 |
| 154 | MH#30-ISA | STUB | 66.7 | 8 | Polyvinyl Chloride | 0 | 0 | 0 | 1 | 0 | 1 |
| | | Total surveyed length | 37,368.6 | | Grade count totals | 2 | 8 | 15 | 757 | 36 | 634 |

PLUMMER'S Environmental Services Inc.

Plummer's Environmental Services
Phone:616-877-3930
Fax:616-877-3937

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Twp | Contract | Project # |
| Project | 2014 Sewer Clean and CCTV | | Project Start 10/28/2014 |
| Location | | UOM Ft | Survey Count 92 |
| Database | D:\UNION TWP\UNION TWP GIS\DATA\UNION TWP.MDB | | Printed On Oct-28-2014 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 35 | 172 | MH#112L-HIGH | MH#112K-HIGH | 427.0 | 8 | PVC | 0 | 156 | 156 |
| 58 | 188 | MH#101-BRD | MH#100-BRD | 343.8 | 8 | PVC | 14 | 138 | 152 |
| 72 | 142 | MH#151-DEER | MH#151A-DEER | 379.9 | 8 | PVC | 0 | 78 | 78 |
| 80 | 126 | MH#158-DEER | MH#159-DEER | 352.4 | 8 | PVC | 40 | 2 | 42 |
| 55 | 191 | MH#103-RUBY | MH#101-BRD | 299.3 | 8 | PVC | 5 | 36 | 41 |
| 43 | 1068 | MH#112F2-ISA | MH#112E-ISA | 81.6 | 8 | PVC | 2 | 34 | 36 |
| 78 | 128 | MH#156-DEER | MH#157-DEER | 360.6 | 8 | PVC | 36 | 0 | 36 |
| 82 | 897 | MH#1-DEER | MH#160-DEER | 240.7 | 8 | PVC | 33 | 2 | 35 |
| 91 | 185 | MH#106-BRD | MH#107-ISA | 335.8 | 8 | PVC | 20 | 12 | 32 |
| 92 | 181 | MH#107-ISA | MH#126-BRD | 181.3 | 8 | PVC | 4 | 24 | 28 |
| 77 | 129 | MH#155-DEER | MH#156-DEER | 350.1 | 8 | PVC | 22 | 0 | 22 |
| 6 | 113 | MH#210-SCU | MH#209-SCU | 469.8 | 8 | PVC | 17 | 0 | 17 |
| 76 | 130 | MH#154-DEER | MH#155-DEER | 389.4 | 8 | PVC | 17 | 0 | 17 |
| 48 | 886 | MH#2-JON | MH#1-JON | 381.4 | 8 | PVC | 16 | 0 | 16 |
| 10 | 116 | MH#209-SCU | MH#217-WIL | 383.9 | 8 | PVC | 16 | 0 | 16 |
| 62 | 186 | MH#105-BRD | MH#106-BRD | 323.3 | 8 | PVC | 15 | 0 | 15 |
| 71 | 143 | MH#151B-DEER | MH#151A-DEER | 515.6 | 8 | PVC | 9 | 5 | 14 |
| 46 | 889 | MH#5-HON | MH#3-HON | 437.9 | 8 | PVC | 12 | 1 | 13 |
| 40 | 167 | MH#112G-HIGH | MH#112F-ISA | 229.8 | 8 | PVC | 10 | 3 | 13 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Twp | Contract | Project # |
| Project | 2014 Sewer Clean and CCTV | | Project Start 10/28/2014 |
| Location | | UOM Ft | Survey Count 92 |
| Database | D:\UNION TWP\UNION TWP GIS\DATA\UNION TWP.MDB | | Printed On Oct-28-2014 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 90 | 181 | MH#126-BRD | MH#107-ISA | 210.7 | 8 | PVC | 13 | 0 | 13 |
| 1 | 122 | MH#216-SCU | MH#215-SCU | 291.8 | 8 | PVC | 10 | 0 | 10 |
| 53 | 192 | MH#103-RUBY | MH#102-RUBY | 340.7 | 8 | PVC | 10 | 0 | 10 |
| 61 | 187 | MH#101-BRD | MH#105-BRD | 309.8 | 8 | PVC | 10 | 0 | 10 |
| 50 | 883 | MH#2-BER | MH#1-BER | 314.9 | 8 | PVC | 10 | 0 | 10 |
| 45 | 895 | MH#5-HON | UNKNOWN | 200.9 | 8 | PVC | 7 | 2 | 9 |
| 57 | 188 | MH#100-BRD | MH#101-BRD | 47.6 | 8 | PVC | 9 | 0 | 9 |
| 84 | 1009 | MH#161-DEER | MH#161A-DEER | 237.9 | 8 | PVC | 9 | 0 | 9 |
| 83 | 125 | MH#160-DEER | MH#161-DEER | 249.7 | 8 | PVC | 9 | 0 | 9 |
| 79 | 127 | MH#157-DEER | MH#158-DEER | 350.7 | 8 | PVC | 9 | 0 | 9 |
| 66 | 182 | MH#127-BRD | MH#126-BRD | 417.2 | 8 | PVC | 8 | 0 | 8 |
| 67 | 147 | MH#151F-CRAW | MH#151E-DEER | 416.8 | 8 | PVC | 2 | 6 | 8 |
| 39 | 168 | MH#112H-HIGH | MH#112G-HIGH | 330.4 | 8 | PVC | 8 | 0 | 8 |
| 9 | 117 | MH#218-WIL | MH#217-WIL | 396.1 | 8 | PVC | 8 | 0 | 8 |
| 5 | 114 | MH#211-SCU | MH#210-SCU | 470.0 | 8 | PVC | 8 | 0 | 8 |
| 42 | 1069 | MH#112F-ISA | MH#112F2-ISA | 59.8 | 8 | PVC | 3 | 4 | 7 |
| 27 | 087 | MH#207-LIN | MH#206-LIN | 480.9 | 8 | PVC | 6 | 0 | 6 |
| 31 | 083 | MH#202-MCD | MH#201-MCD | 425.4 | 8 | PVC | 2 | 4 | 6 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Twp | Contract | Project # |
| Project | 2014 Sewer Clean and CCTV | | Project Start 10/28/2014 |
| Location | | UOM Ft | Survey Count 92 |
| Database | D:\UNION TWP\UNION TWP GIS\DATA\UNION TWP.MDB | | Printed On Oct-28-2014 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 41 | 385 | MH#112F-ISA | MH#112G-HIGH | 199.6 | 8 | PVC | 4 | 2 | 6 |
| 93 | 894 | MH#1-JON | MH#48-3RD | 177.0 | 8 | PVC | 6 | 0 | 6 |
| 75 | 131 | MH#153-DEER | MH#154-DEER | 308.4 | 8 | PVC | 6 | 0 | 6 |
| 64 | 184 | MH#129-BRD | MH#125-BRD | 129.7 | 8 | PVC | 4 | 2 | 6 |
| 24 | 090 | MH#222-LIN | MH#221-LIN | 447.1 | 8 | PVC | 5 | 0 | 5 |
| 49 | 893 | MH#4-BER | MH#3-BER | 361.7 | 8 | PVC | 5 | 0 | 5 |
| 38 | 169 | MH#112I-HIGH | MH#112H-HIGH | 406.2 | 8 | PVC | 5 | 0 | 5 |
| 36 | 171 | MH#112I.1-HIGH | MH#112J-HIGH | 114.9 | 8 | PVC | 0 | 4 | 4 |
| 21 | 093 | MH#225-LIN | MH#224-LIN | 380.5 | 8 | PVC | 4 | 0 | 4 |
| 25 | 089 | MH#221-LIN | MH#208-LIN | 250.6 | 8 | PVC | 4 | 0 | 4 |
| 13 | 105 | MH#236-RIV | MH#235-RIV | 353.0 | 8 | PVC | 4 | 0 | 4 |
| 47 | 887 | MH#3-HON | MH#2-JON | 83.3 | 8 | PVC | 0 | 4 | 4 |
| 63 | 186 | MH#106-BRD | MH#105-BRD | 51.9 | 8 | PVC | 4 | 0 | 4 |
| 54 | 884 | MH#102-RUBY | MH#3-BER | 166.0 | 8 | PVC | 4 | 0 | 4 |
| 4 | 115 | MH#212-SCU | MH#211-SCU | 413.2 | 8 | PVC | 4 | 0 | 4 |
| 44 | 890 | MH#5-HON | MH#6-MOR | 188.5 | 8 | PVC | 4 | 0 | 4 |
| 59 | 885 | MH#1A.1-JON | MH#1A-JON | 374.6 | 8 | PVC | 2 | 1 | 3 |
| 81 | 896 | MH#159-DEER | MH#1-DEER | 104.9 | 8 | PVC | 3 | 0 | 3 |
| 60 | 885a | MH#1-JON | MH#1A.1-JON | 350.6 | 8 | PVC | 2 | 0 | 2 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Twp | Contract | Project # |
| Project | 2014 Sewer Clean and CCTV | | Project Start 10/28/2014 |
| Location | | UOM Ft | Survey Count 92 |
| Database | D:\UNION TWP\UNION TWP GIS\DATA\UNION TWP.MDB | | Printed On Oct-28-2014 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 37 | 170 | MH#112I.1-HIGH | MH#112I-HIGH | 425.4 | 8 | PVC | 2 | 0 | 2 |
| 33 | 174 | MH#112M-HIGH | MH#112N-HIGH | 439.9 | 8 | PVC | 0 | 2 | 2 |
| 70 | 144 | MH#151C-DEER | MH#151B-DEER | 92.5 | 8 | PVC | 2 | 0 | 2 |
| 22 | 092 | MH#224-LIN | MH#223-LIN | 316.9 | 8 | PVC | 0 | 2 | 2 |
| 74 | 132 | MH#152-DEER | MH#153-DEER | 325.3 | 8 | PVC | 2 | 0 | 2 |
| 3 | 120 | MH#214-SCU | PS#8 | 42.5 | 8 | PVC | 0 | 1 | 1 |
| 12 | 106 | MH#236-RIV | MH#237-RIV | 355.8 | 8 | PVC | 0 | 0 | 0 |
| 17 | 101 | MH#232-RIV | MH#231-RIV | 421.8 | 8 | PVC | 0 | 0 | 0 |
| 7 | 119 | MH#219-WIL | MH#220-CYP | 167.7 | 8 | PVC | 0 | 0 | 0 |
| 16 | 102 | MH#233-RIV | MH#232-RIV | 411.4 | 8 | PVC | 0 | 0 | 0 |
| 15 | 103 | MH#233-RIV | MH#234-RIV | 381.3 | 8 | PVC | 0 | 0 | 0 |
| 2 | 121 | MH#215-SCU | MH#214-SCU | 201.4 | 8 | PVC | 0 | 0 | 0 |
| 88 | 137 | MH#166-MIS | MH#165-MIS | 354.5 | 8 | PVC | 0 | 0 | 0 |
| 89 | 136 | MH#166-MIS | MH#166A-MIS | 76.8 | 8 | PVC | 0 | 0 | 0 |
| 18 | 100 | MH#231-RIV | MH#230-RIV | 422.3 | 8 | PVC | 0 | 0 | 0 |
| 11 | 112 | MH#209-SCU | MH#208-LIN | 386.3 | 8 | PVC | 0 | 0 | 0 |
| 8 | 118 | MH#219-WIL | MH#218-WIL | 358.3 | 8 | PVC | 0 | 0 | 0 |
| 14 | 104 | MH#235-RIV | MH#234-RIV | 445.8 | 8 | PVC | 0 | 0 | 0 |
| 87 | 140 | MH#164-MIS | MH#165A-MIS | 72.5 | 8 | PVC | 0 | 0 | 0 |

# Overall Rating

| | | | |
|---|---|---|---|
| Client | Union Twp | Contract | Project # |
| Project | 2014 Sewer Clean and CCTV | | Project Start 10/28/2014 |
| Location | | UOM Ft | Survey Count 92 |
| Database | D:\UNION TWP\UNION TWP GIS\DATA\UNION TWP.MDB | | Printed On Oct-28-2014 |

| Setup | PSR | From MH | To MH | Length | Size | Mat | Struct | O & M | Overall |
|---|---|---|---|---|---|---|---|---|---|
| 65 | 183 | MH#129-BRD | MH#127-BRD | 405.5 | 8 | PVC | 0 | 0 | 0 |
| 68 | 146 | MH#151E-DEER | MH#151D-DEER | 292.8 | 8 | PVC | 0 | 0 | 0 |
| 69 | 145 | MH#151C-DEER | MH#151D-DEER | 16.6 | 8 | PVC | 0 | 0 | 0 |
| 73 | 133 | MH#152-DEER | MH#151-DEER | 341.9 | 8 | PVC | 0 | 0 | 0 |
| 56 | 189 | MH#100-BRD | MH#99-BRD | 322.7 | 8 | PVC | 0 | 0 | 0 |
| 51 | 882 | MH#2-BER | MH#3-BER | 332.9 | 8 | PVC | 0 | 0 | 0 |
| 32 | 082 | MH#201-MCD | PS#7 | 19.5 | 8 | PVC | 0 | 0 | 0 |
| 86 | 138 | MH#164-MIS | MH#165-MIS | 354.8 | 8 | PVC | 0 | 0 | 0 |
| 19 | 099 | MH#230-RIV | MH#226-RIV | 424.7 | 8 | PVC | 0 | 0 | 0 |
| 34 | 173 | MH#112L-HIGH | MH#112M-HIGH | 447.4 | 8 | PVC | 0 | 0 | 0 |
| 30 | 084 | MH#203-MCD | MH#202-MCD | 421.1 | 8 | PVC | 0 | 0 | 0 |
| 29 | 085 | MH#203-MCD | MH#205-MCD | 443.0 | 8 | PVC | 0 | 0 | 0 |
| 28 | 086 | MH#206-LIN | MH#205-MCD | 228.6 | 8 | PVC | 0 | 0 | 0 |
| 26 | 088 | MH#207-LIN | MH#208-LIN | 230.5 | 8 | PVC | 0 | 0 | 0 |
| 23 | 091 | MH#222-LIN | MH#223-LIN | 333.7 | 8 | PVC | 0 | 0 | 0 |
| 20 | 094 | MH#225-LIN | MH#226-RIV | 338.8 | 8 | PVC | 0 | 0 | 0 |
| 85 | 139 | MH#163-MIS | MH#164-MIS | 123.2 | 8 | PVC | 0 | 0 | 0 |

# Sewer CAD Hydraulic Model
# Charter Township Of Union, Isabella County

Gourdie-Fraser

RIVER ROAD

PICKARD ROAD

LINCOLN ROAD

BAMBER ROAD

CRAWFORD ROAD

MISSION ROAD

U.S. 127

CITY OF
MT. PLEASANT

NOT TO SCALE

LEGEND

- UNION TOWNSHIP LIMITS
- MANHOLE
- FORCE MAIN
- GRAVITY SEWER

T:\PROJECTS\18159 UNION TOWNSHIP\DWG\SEWER CAD HYDRAULIC MODEL.DWG (09-07-18 8:25 AM) TGRAHAM

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Executive Summary

| Scenario | |
|---|---|
| Label | Existing Sewer Flows |
| Computation Results | |
| Subnetwork Results | Number of Gravity Subnetworks: 4<br>Number of Pressure Subnetworks: 2<br><br>>>>> Info: Gravity subnetwork draining to: WW-8<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Pressure subnetwork flowing to: MH-212<br>>>>> Info: Pressure analysis iterations: 4<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Gravity subnetwork draining to: WW-14<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Gravity subnetwork draining to: WW-7a<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Pressure subnetwork flowing to: 2<br>>>>> Info: Pressure analysis iterations: 5<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Gravity subnetwork draining to: MH-1 (WWTF)<br>>>>> Info: Convergence was achieved. |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Calculation Options

| <General> | | | |
|---|---|---|---|
| Label | Base-Scenario Options | | |
| **Calculation Options** | | | |
| Time Analysis Type | Steady State | Calculation Type | Analysis |
| **Calculation Options (GVF-Convex)** | | | |
| Peak Flow Ratio | 75.0 % | Pattern Setup | Base Pattern Setup |
| Extreme Flow Setup | Base Extreme Flow Setup | Steady State Hydrograph Equivalent | Minimum |
| **Calculation Options (SWMM Hydrology)** | | | |
| Default Infiltration Method | Horton | SWMM Hydrologic Increment | 0.250 hours |
| **Gravity Hydraulics** | | | |
| Maximum Network Traversals | 5 | Governing Upstream Pipe Selection Method | Pipe with Maximum QV |
| Flow Convergence Test | 0.001 | Structure Loss Mode | Hydraulic Grade |
| Shear Stress (Global Minimum) | 0.000 lbs/ft² | Report Hydrologic Time Step? | True |
| Flow Profile Method | Backwater Analysis | Save Detailed Headloss Data? | False |
| Number of Flow Profile Steps | 5 | Gravity Friction Method | Manning's |
| Hydraulic Grade Convergence Test | 0.00 ft | Liquid Label | Water at 20C (68F) |
| Average Velocity Method | Actual Uniform Flow Velocity | Use Explicit Depth and Slope Equations? | False |
| Minimum Structure Headloss | 0.00 ft | | |
| **Pressure Hydraulics** | | | |
| Use Controls During Steady State? | True | Use Linear Interpolation For Multipoint Pumps? | False |
| Wet Well Convergence Increment | 0.5 ft | Use Controls During Steady State? | True |
| Use Pumped Flows? | False | Liquid Specific Gravity | 0.998 |
| Pressure Subnetwork Accuracy | 0.001 | Pressure Friction Method | Hazen-Williams |
| Pressure Subnetwork Trials | 40 | | |
| **Headloss (AASHTO)** | | | |
| Expansion, Ke | 0.350 | Shaping Adjustment, Cs | 0.500 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

| Headloss (AASHTO) | | | |
|---|---|---|---|
| Contraction, Kc | 0.250 | Non-Piped Flow Adjustment, Cn | 1.300 |

## Bend Angle vs. Bend Loss Curve

| Bend Angle (degrees) | Bend Loss Coefficient, Kb |
|---|---|
| 0.00 | 0.000 |
| 15.00 | 0.190 |
| 30.00 | 0.350 |
| 45.00 | 0.470 |
| 60.00 | 0.560 |
| 75.00 | 0.640 |
| 90.00 | 0.700 |

| HEC-22 Energy Losses | | | |
|---|---|---|---|
| Elevations Considered Equal Within | 0.50 ft | Consider Non-Piped Plunging Flow? | False |

| HEC-22 Energy Losses (Second Edition) | | | |
|---|---|---|---|
| Flat Unsubmerged Factor | 1.000 | Half Bench Submerged Factor | 0.950 |
| Flat Submerged Factor | 1.000 | Full Bench Unsubmerged Factor | 0.070 |
| Depressed Unsubmerged Factor | 1.000 | Full Bench Submerged Factor | 0.750 |
| Depressed Submerged Factor | 1.000 | Improved Bench Unsubmerged Factor | 0.035 |
| Half Bench Unsubmerged Factor | 0.150 | Improved Bench Submerged Factor | 0.375 |

| HEC-22 Energy Losses (Third Edition) | | | |
|---|---|---|---|
| Flat Submerged Coefficient | -0.050 | Half Bench Unsubmerged Coefficient | -0.850 |
| Flat Unsubmerged Coefficient | -0.050 | Full Bench Submerged Coefficient | -0.250 |
| Depressed Submerged Coefficient | 0.000 | Full Bench Unsubmerged Coefficient | -0.930 |
| Depressed Unsubmerged Coefficient | 0.000 | Improved Submerged Coefficient | -0.600 |
| Half Bench Submerged Coefficient | -0.050 | Improved Unsubmerged Coefficient | -0.980 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Calculation Summary (1107: Existing Sewer Flows )

| Time (hours) | Balanced? | Trials | Relative Flow Change |
|---|---|---|---|
| All Time Steps (1) | True | 4 | 0.0000113 |
| 0.00 | True | 4 | 0.0000113 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Pipe Report

Subnetwork Summary

| Subnetwork | Gravity Subnetwork |
|---|---|

### Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| P-277 | 0.000 | 2.60 | 0.66 | 7.4 |
| P-278 | 0.000 | 5.21 | 0.78 | 9.2 |
| P-279 | 0.000 | 7.81 | 1.00 | 9.3 |
| P-329 | 0.000 | 0.00 | 0.00 | 0.0 |
| P-286 | 0.000 | 2.08 | 0.57 | 11.1 |
| P-293 | 0.000 | 2.08 | 0.59 | 6.8 |
| P-294 | 0.000 | 4.17 | 0.71 | 8.7 |
| P-292 | 0.000 | 6.25 | 0.83 | 10.8 |
| P-289 | 0.000 | 8.33 | 0.77 | 11.7 |
| P-290 | 0.000 | 10.42 | 1.07 | 12.3 |
| P-291 | 0.000 | 12.50 | 1.01 | 13.6 |
| P-288 | 0.000 | 14.58 | 1.12 | 13.0 |
| P-287 | 0.000 | 16.67 | 1.05 | 16.1 |
| P-285 | 0.000 | 20.83 | 1.24 | 17.3 |
| P-281 | 0.000 | 22.92 | 1.19 | 17.8 |
| P-282 | 0.000 | 25.00 | 1.36 | 18.2 |
| P-283 | 0.000 | 27.08 | 1.32 | 18.9 |
| P-284 | 0.000 | 29.17 | 1.41 | 18.2 |
| P-266 | 0.000 | 31.25 | 1.76 | 14.4 |
| P-280 | 0.000 | 10.42 | 0.93 | 12.8 |
| P-270 | 0.000 | 13.02 | 1.07 | 14.0 |
| P-271 | 0.000 | 16.67 | 1.16 | 13.9 |
| P-273 | 0.000 | 1.56 | 0.55 | 5.7 |
| P-274 | 0.000 | 2.60 | 0.61 | 7.9 |
| P-275 | 0.000 | 6.25 | 0.84 | 10.3 |
| P-276 | 0.000 | 9.90 | 1.04 | 15.0 |
| P-272 | 0.000 | 27.60 | 1.35 | 22.9 |
| P-267 | 0.000 | 59.90 | 1.75 | 28.0 |
| P-268 | 0.000 | 61.98 | 1.64 | 29.8 |
| P-269 | 0.000 | 64.06 | 1.58 | 30.0 |
| P-263 | 0.000 | 66.15 | 1.73 | 29.9 |
| P-264 | 0.000 | 68.23 | 1.69 | 30.1 |
| P-265 | 0.000 | 70.31 | 1.81 | 32.3 |
| P-350 | 0.000 | 2.60 | 0.82 | 6.8 |
| P-347 | 0.000 | 5.73 | 0.93 | 9.8 |
| P-348 | 0.000 | 8.33 | 0.86 | 11.7 |
| P-349 | 0.000 | 10.94 | 1.01 | 15.0 |
| CO-9 | 0.000 | 2.60 | 0.64 | 7.4 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| CO-8 | 0.000 | 5.21 | 0.80 | 10.9 |
| CO-4 | 0.000 | 2.60 | 0.76 | 6.5 |
| CO-7 | 0.000 | 5.21 | 0.99 | 8.0 |
| CO-6 | 0.000 | 7.29 | 1.19 | 9.2 |
| CO-2 | 0.000 | 9.38 | 1.52 | 11.5 |
| CO-1 | 0.000 | 17.19 | 1.65 | 15.5 |
| P-391 | 0.000 | 30.73 | 1.71 | 19.2 |
| P-392 | 0.000 | 31.77 | 1.36 | 27.7 |
| P-390 | 0.000 | 103.13 | 2.12 | 34.0 |
| P-380 | 0.000 | 103.13 | 1.25 | 17.7 |
| P-381 | 0.000 | 103.13 | 2.41 | 14.0 |
| P-382 | 0.000 | 103.13 | 2.97 | 15.2 |
| P-383 | 0.000 | 103.13 | 1.04 | 19.3 |
| P-384 | 0.000 | 103.13 | 1.08 | 18.9 |
| P-378 | 0.000 | 103.13 | 1.26 | 17.7 |
| P-377 | 0.000 | 103.13 | 1.28 | 17.6 |
| P-376 | 0.000 | 103.13 | 1.60 | 16.1 |
| P-375 | 0.000 | 103.13 | 1.28 | 17.6 |
| P-374 | 0.000 | 103.13 | 1.15 | 18.4 |
| P-373 | 0.000 | 103.13 | 1.21 | 18.0 |
| P-372 | 0.000 | 103.13 | 1.11 | 18.6 |
| P-371 | 0.000 | 103.13 | 2.23 | 19.3 |
| P-370 | 0.000 | 103.13 | 2.18 | 14.4 |
| P-369 | 0.000 | 103.13 | 1.68 | 18.8 |
| P-385 | 0.000 | 103.13 | 1.23 | 20.1 |
| P-386 | 0.000 | 103.13 | 1.38 | 17.1 |
| P-89 | 0.000 | 103.13 | 1.03 | 12.0 |
| P-90 | 0.000 | 103.13 | 1.13 | 11.6 |
| P-91 | 0.000 | 103.13 | 1.14 | 9.9 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Node Report

Subnetwork Summary

| Subnetwork | Gravity Subnetwork |
|---|---|

### Node Report

| Label | Time to Maximum Hydraulic Grade (hours) | Hydraulic Grade (Maximum) (ft) | Depth (Maximum) (ft) | Pressure (Maximum) (psi) |
|---|---|---|---|---|
| MH-216 | 0.000 | 783.33 | 0.04 | (N/A) |
| MH-215 | 0.000 | 782.08 | 0.06 | (N/A) |
| MH-214 | 0.000 | 781.33 | 0.06 | (N/A) |
| MH-301 | 0.000 | 754.64 | 0.00 | (N/A) |
| MH-227 | 0.000 | 785.43 | 0.04 | (N/A) |
| MH-237 | 0.000 | 796.39 | 0.04 | (N/A) |
| MH-236 | 0.000 | 795.04 | 0.05 | (N/A) |
| MH-235 | 0.000 | 793.86 | 0.06 | (N/A) |
| MH-234 | 0.000 | 792.20 | 0.08 | (N/A) |
| MH-233 | 0.000 | 791.28 | 0.08 | (N/A) |
| MH-232 | 0.000 | 789.23 | 0.09 | (N/A) |
| MH-231 | 0.000 | 787.71 | 0.09 | (N/A) |
| MH-230 | 0.000 | 785.62 | 0.11 | (N/A) |
| MH-226 | 0.000 | 784.26 | 0.11 | (N/A) |
| MH-225 | 0.000 | 782.83 | 0.12 | (N/A) |
| MH-224 | 0.000 | 781.51 | 0.12 | (N/A) |
| MH-223 | 0.000 | 780.04 | 0.13 | (N/A) |
| MH-222 | 0.000 | 778.66 | 0.13 | (N/A) |
| MH-221 | 0.000 | 776.59 | 0.11 | (N/A) |
| MH-211 | 0.000 | 781.22 | 0.09 | (N/A) |
| MH-210 | 0.000 | 779.32 | 0.10 | (N/A) |
| MH-220 | 0.000 | 781.26 | 0.03 | (N/A) |
| MH-219 | 0.000 | 780.62 | 0.04 | (N/A) |
| MH-218 | 0.000 | 779.44 | 0.06 | (N/A) |
| MH-217 | 0.000 | 777.89 | 0.07 | (N/A) |
| MH-209 | 0.000 | 776.11 | 0.13 | (N/A) |
| MH-208 | 0.000 | 774.52 | 0.18 | (N/A) |
| MH-207 | 0.000 | 773.44 | 0.19 | (N/A) |
| MH-206 | 0.000 | 771.60 | 0.20 | (N/A) |
| MH-205 | 0.000 | 770.83 | 0.20 | (N/A) |
| MH-203 | 0.000 | 768.97 | 0.20 | (N/A) |
| MH-202 | 0.000 | 767.36 | 0.20 | (N/A) |
| MH-4 #940103 | 0.000 | 774.08 | 0.04 | (N/A) |
| MH-3 #940103 | 0.000 | 771.91 | 0.06 | (N/A) |
| MH-2 #940103 | 0.000 | 769.89 | 0.07 | (N/A) |
| MH-1 #940103 | 0.000 | 768.72 | 0.08 | (N/A) |
| MH-5 | 0.000 | 773.04 | 773.04 | (N/A) |
| MH-7 | 0.000 | 771.46 | 771.46 | (N/A) |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Node Report

| Label | Time to Maximum Hydraulic Grade (hours) | Hydraulic Grade (Maximum) (ft) | Depth (Maximum) (ft) | Pressure (Maximum) (psi) |
|---|---|---|---|---|
| MH-4 | 0.000 | 780.04 | 780.04 | (N/A) |
| MH-3 | 0.000 | 778.24 | 778.24 | (N/A) |
| MH-6 | 0.000 | 775.85 | 775.85 | (N/A) |
| MH-2 | 0.000 | 774.86 | 774.86 | (N/A) |
| MH-1 | 0.000 | 770.29 | 770.29 | (N/A) |
| MH-201.2 | 0.000 | 767.79 | 0.12 | (N/A) |
| MH-201.1 | 0.000 | 766.14 | 0.14 | (N/A) |
| MH-201_MS | 0.000 | 765.47 | 0.23 | (N/A) |
| 3 | 0.000 | 755.68 | 0.19 | (N/A) |
| 4 | 0.000 | 753.61 | 0.19 | (N/A) |
| 5 | 0.000 | 752.28 | 0.30 | (N/A) |
| 6 | 0.000 | 751.87 | 0.29 | (N/A) |
| 7 | 0.000 | 751.36 | 0.26 | (N/A) |
| 8 | 0.000 | 750.66 | 0.26 | (N/A) |
| 9 | 0.000 | 749.94 | 0.22 | (N/A) |
| 10 | 0.000 | 748.10 | 0.25 | (N/A) |
| 11 | 0.000 | 747.33 | 0.27 | (N/A) |
| 12 | 0.000 | 746.78 | 0.27 | (N/A) |
| 13 | 0.000 | 746.31 | 0.50 | (N/A) |
| 13A | 0.000 | 746.01 | 0.20 | (N/A) |
| 14 | 0.000 | 745.08 | 0.19 | (N/A) |
| 15 | 0.000 | 742.38 | 0.21 | (N/A) |
| 16 | 0.000 | 741.73 | 0.26 | (N/A) |
| 17 | 0.000 | 741.61 | 0.24 | (N/A) |
| MH-4 | 0.000 | 740.13 | 0.25 | (N/A) |
| MH-3 | 0.000 | 739.73 | 0.23 | (N/A) |
| MH-2 | 0.000 | 739.44 | 0.23 | (N/A) |
| MH-1 (WWTF) | 0.000 | 739.16 | 0.16 | (N/A) |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Pipe Report

| Subnetwork Summary | |
|---|---|
| Subnetwork | Gravity Subnetwork |

### Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| FM-79 | 0.000 | 122.49 | 1.39 | (N/A) |
| FM-80 | 0.000 | 122.49 | 1.39 | (N/A) |
| PS#8 Discharge FM - Pump 2 | 0.000 | 122.49 | 1.39 | (N/A) |
| PS#8 Forcemain - 4" | 0.000 | 244.97 | 2.78 | (N/A) |
| PS #8 Pump 1 Discharge FM | 0.000 | 122.49 | 1.39 | (N/A) |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Sewer Flows )

## Pipe Report

Subnetwork Summary

| Subnetwork | Gravity Subnetwork |
|---|---|

### Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| FM-44 | 0.000 | 331.94 | 2.12 | (N/A) |
| FM-45 | 0.000 | 329.29 | 2.10 | (N/A) |
| FM-46 | 0.000 | 329.29 | 3.74 | (N/A) |
| FM-47 | 0.000 | 331.94 | 3.77 | (N/A) |
| PS #14 Forcemain - 10" | 0.000 | 661.22 | 2.70 | (N/A) |
| PS#14 Forcemain - 10" (2) | 0.000 | 661.22 | 2.70 | (N/A) |
| FM-38 | 0.000 | 156.30 | 1.77 | (N/A) |
| FM-37 | 0.000 | 156.30 | 1.77 | (N/A) |
| FM-36 | 0.000 | 159.37 | 1.81 | (N/A) |
| FM-39 | 0.000 | 159.37 | 1.81 | (N/A) |
| PS#7 Forcemain - 6" | 0.000 | 315.67 | 3.58 | (N/A) |
| Common Forcemain 10" | 0.000 | 976.89 | 3.99 | (N/A) |
| Common Forcemain 10" (2) | 0.000 | 976.89 | 3.99 | (N/A) |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Executive Summary

| Scenario | |
|---|---|
| Label | Existing Plus 5 Year Storm Event |
| **Computation Results** | |
| Subnetwork Results | Number of Gravity Subnetworks: 4<br>Number of Pressure Subnetworks: 2<br><br>>>>> Info: Gravity subnetwork draining to: WW-8<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Pressure subnetwork flowing to: MH-212<br>>>>> Info: Pressure analysis iterations: 4<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Gravity subnetwork draining to: WW-14<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Gravity subnetwork draining to: WW-7a<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Pressure subnetwork flowing to: 2<br>>>>> Info: Pressure analysis iterations: 5<br>>>>> Info: Convergence was achieved.<br><br>>>>> Info: Gravity subnetwork draining to: MH-1 (WWTF)<br>>>>> Info: Convergence was achieved. |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Calculation Options

| <General> | | | |
|---|---|---|---|
| Label | Base-Scenario Options | | |
| **Calculation Options** | | | |
| Time Analysis Type | Steady State | Calculation Type | Analysis |
| **Calculation Options (GVF-Convex)** | | | |
| Peak Flow Ratio | 75.0 % | Pattern Setup | Base Pattern Setup |
| Extreme Flow Setup | Base Extreme Flow Setup | Steady State Hydrograph Equivalent | Minimum |
| **Calculation Options (SWMM Hydrology)** | | | |
| Default Infiltration Method | Horton | SWMM Hydrologic Increment | 0.250 hours |
| **Gravity Hydraulics** | | | |
| Maximum Network Traversals | 5 | Governing Upstream Pipe Selection Method | Pipe with Maximum QV |
| Flow Convergence Test | 0.001 | Structure Loss Mode | Hydraulic Grade |
| Shear Stress (Global Minimum) | 0.000 lbs/ft² | Report Hydrologic Time Step? | True |
| Flow Profile Method | Backwater Analysis | Save Detailed Headloss Data? | False |
| Number of Flow Profile Steps | 5 | Gravity Friction Method | Manning's |
| Hydraulic Grade Convergence Test | 0.00 ft | Liquid Label | Water at 20C (68F) |
| Average Velocity Method | Actual Uniform Flow Velocity | Use Explicit Depth and Slope Equations? | False |
| Minimum Structure Headloss | 0.00 ft | | |
| **Pressure Hydraulics** | | | |
| Use Controls During Steady State? | True | Use Linear Interpolation For Multipoint Pumps? | False |
| Wet Well Convergence Increment | 0.5 ft | Use Controls During Steady State? | True |
| Use Pumped Flows? | False | Liquid Specific Gravity | 0.998 |
| Pressure Subnetwork Accuracy | 0.001 | Pressure Friction Method | Hazen-Williams |
| Pressure Subnetwork Trials | 40 | | |
| **Headloss (AASHTO)** | | | |
| Expansion, Ke | 0.350 | Shaping Adjustment, Cs | 0.500 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

| Headloss (AASHTO) | | | |
|---|---|---|---|
| Contraction, Kc | 0.250 | Non-Piped Flow Adjustment, Cn | 1.300 |

### Bend Angle vs. Bend Loss Curve

| Bend Angle (degrees) | Bend Loss Coefficient, Kb |
|---|---|
| 0.00 | 0.000 |
| 15.00 | 0.190 |
| 30.00 | 0.350 |
| 45.00 | 0.470 |
| 60.00 | 0.560 |
| 75.00 | 0.640 |
| 90.00 | 0.700 |

| HEC-22 Energy Losses | | | |
|---|---|---|---|
| Elevations Considered Equal Within | 0.50 ft | Consider Non-Piped Plunging Flow? | False |

| HEC-22 Energy Losses (Second Edition) | | | |
|---|---|---|---|
| Flat Unsubmerged Factor | 1.000 | Half Bench Submerged Factor | 0.950 |
| Flat Submerged Factor | 1.000 | Full Bench Unsubmerged Factor | 0.070 |
| Depressed Unsubmerged Factor | 1.000 | Full Bench Submerged Factor | 0.750 |
| Depressed Submerged Factor | 1.000 | Improved Bench Unsubmerged Factor | 0.035 |
| Half Bench Unsubmerged Factor | 0.150 | Improved Bench Submerged Factor | 0.375 |

| HEC-22 Energy Losses (Third Edition) | | | |
|---|---|---|---|
| Flat Submerged Coefficient | -0.050 | Half Bench Unsubmerged Coefficient | -0.850 |
| Flat Unsubmerged Coefficient | -0.050 | Full Bench Submerged Coefficient | -0.250 |
| Depressed Submerged Coefficient | 0.000 | Full Bench Unsubmerged Coefficient | -0.930 |
| Depressed Unsubmerged Coefficient | 0.000 | Improved Submerged Coefficient | -0.600 |
| Half Bench Submerged Coefficient | -0.050 | Improved Unsubmerged Coefficient | -0.980 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Calculation Summary (1155: Existing Plus 5 Year Storm Event)

| Time (hours) | Balanced? | Trials | Relative Flow Change |
|---|---|---|---|
| All Time Steps (1) | True | 4 | 0.0000113 |
| 0.00 | True | 4 | 0.0000113 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Pipe Report

Subnetwork Summary

| Subnetwork | Gravity Subnetwork |
|---|---|

### Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| P-277 | 0.000 | 5.21 | 0.83 | 10.2 |
| P-278 | 0.000 | 10.42 | 0.96 | 12.8 |
| P-279 | 0.000 | 15.62 | 1.23 | 13.1 |
| P-329 | 0.000 | 0.00 | 0.00 | 0.0 |
| P-286 | 0.000 | 4.17 | 0.71 | 15.5 |
| P-293 | 0.000 | 4.17 | 0.73 | 9.5 |
| P-294 | 0.000 | 8.33 | 0.87 | 12.2 |
| P-292 | 0.000 | 12.50 | 1.02 | 15.0 |
| P-289 | 0.000 | 16.67 | 0.95 | 16.4 |
| P-290 | 0.000 | 20.83 | 1.31 | 17.2 |
| P-291 | 0.000 | 25.00 | 1.24 | 19.0 |
| P-288 | 0.000 | 29.17 | 1.37 | 18.3 |
| P-287 | 0.000 | 33.33 | 1.29 | 22.6 |
| P-285 | 0.000 | 41.67 | 1.52 | 24.3 |
| P-281 | 0.000 | 45.83 | 1.45 | 25.1 |
| P-282 | 0.000 | 50.00 | 1.66 | 25.6 |
| P-283 | 0.000 | 54.17 | 1.62 | 26.7 |
| P-284 | 0.000 | 58.33 | 1.72 | 25.8 |
| P-266 | 0.000 | 62.50 | 2.17 | 20.6 |
| P-280 | 0.000 | 20.83 | 1.14 | 17.9 |
| P-270 | 0.000 | 26.04 | 1.30 | 19.6 |
| P-271 | 0.000 | 33.33 | 1.42 | 19.6 |
| P-273 | 0.000 | 3.12 | 0.67 | 7.9 |
| P-274 | 0.000 | 5.21 | 0.75 | 11.0 |
| P-275 | 0.000 | 12.50 | 1.04 | 14.3 |
| P-276 | 0.000 | 19.79 | 1.27 | 21.1 |
| P-272 | 0.000 | 55.21 | 1.65 | 32.7 |
| P-267 | 0.000 | 119.79 | 2.13 | 40.4 |
| P-268 | 0.000 | 123.96 | 1.99 | 43.1 |
| P-269 | 0.000 | 128.12 | 1.91 | 43.4 |
| P-263 | 0.000 | 132.29 | 2.09 | 43.3 |
| P-264 | 0.000 | 136.46 | 2.04 | 43.6 |
| P-265 | 0.000 | 140.63 | 2.19 | 47.1 |
| P-350 | 0.000 | 5.21 | 1.00 | 9.5 |
| P-347 | 0.000 | 11.46 | 1.14 | 13.6 |
| P-348 | 0.000 | 16.67 | 1.06 | 16.3 |
| P-349 | 0.000 | 21.88 | 1.24 | 21.2 |
| CO-9 | 0.000 | 5.21 | 0.80 | 10.3 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| CO-8 | 0.000 | 10.42 | 0.98 | 15.4 |
| CO-4 | 0.000 | 5.21 | 0.94 | 9.0 |
| CO-7 | 0.000 | 10.42 | 1.22 | 11.2 |
| CO-6 | 0.000 | 14.58 | 1.46 | 13.0 |
| CO-2 | 0.000 | 18.75 | 1.86 | 16.4 |
| CO-1 | 0.000 | 34.37 | 2.03 | 22.1 |
| P-391 | 0.000 | 61.46 | 2.09 | 27.3 |
| P-392 | 0.000 | 63.54 | 1.66 | 40.2 |
| P-390 | 0.000 | 206.25 | 2.55 | 49.4 |
| P-380 | 0.000 | 206.25 | 1.53 | 25.2 |
| P-381 | 0.000 | 206.25 | 2.96 | 19.8 |
| P-382 | 0.000 | 206.25 | 3.65 | 23.4 |
| P-383 | 0.000 | 206.25 | 1.26 | 29.3 |
| P-384 | 0.000 | 206.25 | 1.31 | 27.0 |
| P-378 | 0.000 | 206.25 | 1.54 | 25.1 |
| P-377 | 0.000 | 206.25 | 1.56 | 25.0 |
| P-376 | 0.000 | 206.25 | 1.96 | 22.8 |
| P-375 | 0.000 | 206.25 | 1.56 | 25.0 |
| P-374 | 0.000 | 206.25 | 1.40 | 26.7 |
| P-373 | 0.000 | 206.25 | 1.47 | 26.7 |
| P-372 | 0.000 | 206.25 | 1.35 | 26.2 |
| P-371 | 0.000 | 206.25 | 2.72 | 27.4 |
| P-370 | 0.000 | 206.25 | 2.68 | 20.4 |
| P-369 | 0.000 | 206.25 | 2.05 | 26.6 |
| P-385 | 0.000 | 206.25 | 1.50 | 28.3 |
| P-386 | 0.000 | 206.25 | 1.69 | 24.2 |
| P-89 | 0.000 | 206.25 | 1.27 | 16.7 |
| P-90 | 0.000 | 206.25 | 1.39 | 16.2 |
| P-91 | 0.000 | 206.25 | 1.40 | 13.9 |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Node Report

Subnetwork Summary

| Subnetwork | Gravity Subnetwork |
|---|---|

### Node Report

| Label | Time to Maximum Hydraulic Grade (hours) | Hydraulic Grade (Maximum) (ft) | Depth (Maximum) (ft) | Pressure (Maximum) (psi) |
|---|---|---|---|---|
| MH-216 | 0.000 | 783.35 | 0.06 | (N/A) |
| MH-215 | 0.000 | 782.10 | 0.08 | (N/A) |
| MH-214 | 0.000 | 781.36 | 0.09 | (N/A) |
| MH-301 | 0.000 | 754.64 | 0.00 | (N/A) |
| MH-227 | 0.000 | 785.44 | 0.05 | (N/A) |
| MH-237 | 0.000 | 796.40 | 0.05 | (N/A) |
| MH-236 | 0.000 | 795.06 | 0.07 | (N/A) |
| MH-235 | 0.000 | 793.89 | 0.09 | (N/A) |
| MH-234 | 0.000 | 792.23 | 0.11 | (N/A) |
| MH-233 | 0.000 | 791.31 | 0.11 | (N/A) |
| MH-232 | 0.000 | 789.26 | 0.12 | (N/A) |
| MH-231 | 0.000 | 787.75 | 0.13 | (N/A) |
| MH-230 | 0.000 | 785.66 | 0.15 | (N/A) |
| MH-226 | 0.000 | 784.30 | 0.15 | (N/A) |
| MH-225 | 0.000 | 782.88 | 0.17 | (N/A) |
| MH-224 | 0.000 | 781.55 | 0.16 | (N/A) |
| MH-223 | 0.000 | 780.09 | 0.18 | (N/A) |
| MH-222 | 0.000 | 778.71 | 0.18 | (N/A) |
| MH-221 | 0.000 | 776.63 | 0.15 | (N/A) |
| MH-211 | 0.000 | 781.25 | 0.12 | (N/A) |
| MH-210 | 0.000 | 779.36 | 0.14 | (N/A) |
| MH-220 | 0.000 | 781.28 | 0.05 | (N/A) |
| MH-219 | 0.000 | 780.64 | 0.06 | (N/A) |
| MH-218 | 0.000 | 779.47 | 0.09 | (N/A) |
| MH-217 | 0.000 | 777.92 | 0.10 | (N/A) |
| MH-209 | 0.000 | 776.16 | 0.18 | (N/A) |
| MH-208 | 0.000 | 774.60 | 0.26 | (N/A) |
| MH-207 | 0.000 | 773.53 | 0.28 | (N/A) |
| MH-206 | 0.000 | 771.70 | 0.30 | (N/A) |
| MH-205 | 0.000 | 770.91 | 0.28 | (N/A) |
| MH-203 | 0.000 | 769.06 | 0.29 | (N/A) |
| MH-202 | 0.000 | 767.45 | 0.29 | (N/A) |
| MH-4 #940103 | 0.000 | 774.09 | 0.05 | (N/A) |
| MH-3 #940103 | 0.000 | 771.93 | 0.08 | (N/A) |
| MH-2 #940103 | 0.000 | 769.92 | 0.10 | (N/A) |
| MH-1 #940103 | 0.000 | 768.75 | 0.11 | (N/A) |
| MH-5 | 0.000 | 773.06 | 773.06 | (N/A) |
| MH-7 | 0.000 | 771.48 | 771.48 | (N/A) |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Node Report

| Label | Time to Maximum Hydraulic Grade (hours) | Hydraulic Grade (Maximum) (ft) | Depth (Maximum) (ft) | Pressure (Maximum) (psi) |
|---|---|---|---|---|
| MH-4 | 0.000 | 780.05 | 780.05 | (N/A) |
| MH-3 | 0.000 | 778.26 | 778.26 | (N/A) |
| MH-6 | 0.000 | 775.87 | 775.87 | (N/A) |
| MH-2 | 0.000 | 774.89 | 774.89 | (N/A) |
| MH-1 | 0.000 | 770.33 | 770.33 | (N/A) |
| MH-201.2 | 0.000 | 767.84 | 0.17 | (N/A) |
| MH-201.1 | 0.000 | 766.20 | 0.20 | (N/A) |
| MH-201_MS | 0.000 | 765.58 | 0.34 | (N/A) |
| 3 | 0.000 | 755.75 | 0.26 | (N/A) |
| 4 | 0.000 | 753.68 | 0.26 | (N/A) |
| 5 | 0.000 | 752.40 | 0.42 | (N/A) |
| 6 | 0.000 | 751.99 | 0.41 | (N/A) |
| 7 | 0.000 | 751.46 | 0.36 | (N/A) |
| 8 | 0.000 | 750.76 | 0.36 | (N/A) |
| 9 | 0.000 | 750.03 | 0.31 | (N/A) |
| 10 | 0.000 | 748.21 | 0.36 | (N/A) |
| 11 | 0.000 | 747.45 | 0.39 | (N/A) |
| 12 | 0.000 | 746.89 | 0.38 | (N/A) |
| 13 | 0.000 | 746.42 | 0.61 | (N/A) |
| 13A | 0.000 | 746.09 | 0.28 | (N/A) |
| 14 | 0.000 | 745.15 | 0.26 | (N/A) |
| 15 | 0.000 | 742.47 | 0.30 | (N/A) |
| 16 | 0.000 | 741.84 | 0.37 | (N/A) |
| 17 | 0.000 | 741.71 | 0.34 | (N/A) |
| MH-4 | 0.000 | 740.23 | 0.35 | (N/A) |
| MH-3 | 0.000 | 739.82 | 0.32 | (N/A) |
| MH-2 | 0.000 | 739.53 | 0.32 | (N/A) |
| MH-1 (WWTF) | 0.000 | 739.23 | 0.23 | (N/A) |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Pipe Report

Subnetwork Summary

| Subnetwork | Gravity Subnetwork |
|---|---|

### Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| FM-79 | 0.000 | 122.49 | 1.39 | (N/A) |
| FM-80 | 0.000 | 122.49 | 1.39 | (N/A) |
| PS#8 Discharge FM - Pump 2 | 0.000 | 122.49 | 1.39 | (N/A) |
| PS#8 Forcemain - 4" | 0.000 | 244.97 | 2.78 | (N/A) |
| PS #8 Pump 1 Discharge FM | 0.000 | 122.49 | 1.39 | (N/A) |

# Detailed Calculation Summary (sewercad model_updated.stsw, Existing Plus 5 Year Storm Event)

## Pipe Report

Subnetwork Summary

| Subnetwork | Gravity Subnetwork |
|---|---|

### Pipe Report

| Label | Time (Maximum Flow) (hours) | Flow (Maximum) (gal/min) | Velocity (Maximum Calculated) (ft/s) | Depth (Average End) / Rise (Maximum) (%) |
|---|---|---|---|---|
| FM-44 | 0.000 | 331.94 | 2.12 | (N/A) |
| FM-45 | 0.000 | 329.29 | 2.10 | (N/A) |
| FM-46 | 0.000 | 329.29 | 3.74 | (N/A) |
| FM-47 | 0.000 | 331.94 | 3.77 | (N/A) |
| PS #14 Forcemain - 10" | 0.000 | 661.22 | 2.70 | (N/A) |
| PS#14 Forcemain - 10" (2) | 0.000 | 661.22 | 2.70 | (N/A) |
| FM-38 | 0.000 | 156.30 | 1.77 | (N/A) |
| FM-37 | 0.000 | 156.30 | 1.77 | (N/A) |
| FM-36 | 0.000 | 159.37 | 1.81 | (N/A) |
| FM-39 | 0.000 | 159.37 | 1.81 | (N/A) |
| PS#7 Forcemain - 6" | 0.000 | 315.67 | 3.58 | (N/A) |
| Common Forcemain 10" | 0.000 | 976.89 | 3.99 | (N/A) |
| Common Forcemain 10" (2) | 0.000 | 976.89 | 3.99 | (N/A) |

Engineering
Surveying
Testing &
Operations

123 West Front Street
Traverse City, Michigan 49684
231.946.5874 (p)
231.946.3703 (f)

# OPINION OF PROBABLE CONSTRUCTION COST

CHARTER TOWNSHIP OF UNION
SANITARY SEWER REHABILITATION - REPAIR CRACKS / DEFORMATIONS
GFA PROJECT NO. 18159
September 4, 2018

| No. | Item | Estimated Quantity | Unit | Unit Price | Item Cost |
|---|---|---|---|---|---|
| 1 | Sanitary Sewer, 8" / 12" Cured in Place Pipe (6mm) | LF | 1,300 | $ 48.75 | $ 63,375.00 |
| | | | | **ENGINEERING, ADMINISTRATIONS, CONSTRUCTION SERVICES** | **$63,375.00** |
| | | | | **10% CONTINGENCY** | **$6,337.50** |
| | | | | **TOTAL ESTIMATED CONSTRUCTION COST** | **$69,712.50** |

- These costs are based on preliminary information. The actual site conditions may result in variations of unit prices or items.
- Costs for financing, land, right-of-way, easement acquisition, and permit fees are not included in this cost estimate.
- Construction easement will be required to perform work. Costs not included with this cost estimate.

Engineering
Surveying
Testing &
Operations

123 West Front Street
Traverse City, Michigan 49684
231.946.5874
231.946.3703

# OPINION OF PROBABLE CONSTRUCTION COST

CHARTER TOWNSHIP OF UNION
SANITARY SEWER REHABILITATION - WATERPROOFING
GFA PROJECT NO. 18159
September 4, 2018

| No. | Item | Estimated Quantity | Unit | Unit Price | Item Cost |
|---|---|---|---|---|---|
| 1 | Waterproof Manholes, install grades / adjust grade | EA | 36 | $ 1,850.00 | $66,600.00 |
| 2 | Manhole Spray Liner | EA | 36 | $ 3,800.00 | $136,800.00 |
| | | | | **ENGINEERING, ADMINISTRATIONS, CONSTRUCTION SERVICES** | **$203,400.00** |
| | | | | **10% CONTINGENCY** | **$20,340.00** |
| | | | | **TOTAL ESTIMATED CONSTRUCTION COST** | **$223,740.00** |

- These costs are based on preliminary information. The actual site conditions may result in variations of unit prices or items.
- Costs for financing, land, right-of-way, easement acquisition, and permit fees are not included in this cost estimate.
- This cost estimate is approximate. Pricing for each item is based upon quotes obtained from equipment manufacturers with 6% sales tax and 35% installation fee added. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of Gourdie-Fraser.
- Construction Easement will be required to perform work. Costs not included with this cost estimate

Engineering
Surveying
Testing &
Operations

123 West Front Street
Traverse City, Michigan 49684
231.946.5874
231.946.3703

# OPINION OF PROBABLE CONSTRUCTION COST

CHARTER TOWNSHIP OF UNION
SANITARY SEWER PUMP STATION UPGRADES
GFA PROJECT NO. 17029U
September 4, 2018

| No. | Item | Estimated Quantity | Unit | Unit Price | Item Cost |
|---|---|---|---|---|---|
| **Pump Station #7** | | | | | |
| 1 | Instrumentation - Flowmeter & Transducer | 1 | LS | $35,000.00 | $35,000.00 |
| 2 | SCADA Panel Upgrades / Programming (by Perceptive Controls) | 1 | LS | $15,000.00 | $15,000.00 |
| **Pump Station #8** | | | | | |
| 1 | Instrumentation - Flowmeter & Transducer | 1 | LS | $35,000.00 | $35,000.00 |
| 2 | Generator Set Receptacle | 1 | LS | $5,000.00 | $5,000.00 |
| 3 | SCADA Panel Upgrades / Programming (by Perceptive Controls) | 1 | LS | $15,000.00 | $15,000.00 |
| | | | | **ESTIMATED CONSTRUCTION COST** | **$50,000.00** |
| | | | | **10% CONTINGENCY** | **$5,000.00** |
| | | | | **ENGINEERING, ADMINISTRATIONS, CONSTRUCTION SERVICES** | **$11,000.00** |
| | | | | **TOTAL ESTIMATED CONSTRUCTION COST** | **$66,000.00** |

- These costs are based on preliminary information. The actual site conditions may result in variations of unit prices or items.
- Costs for financing, land, right-of-way, easement acquisition, and permit fees are not included in this cost estimate.
- This cost estimate is approximate. Pricing for each item is based upon quotes obtained from equipment manufacturers with 6% sales tax and 40% installation fee added. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of Gourdie-Fraser.

Charter Township Of Union

# Board Expiration Dates

| Planning Commission Board Members (9 Members) 3 year term | | | |
|---|---|---|---|
| # | F Name | L Name | Expiration Date |
| 1-BOT Representative | Lisa | Cody | 11/20/2020 |
| 2-Chair | Phil | Squattrito | 2/15/2020 |
| 3- Vice Chair | Bryan | Mielke | 2/15/2021 |
| 4-Secretary | Alex | Fuller | 2/15/2020 |
| 5 - Vice Secretary | Mike | Darin | 2/15/2019 |
| 6 | Stan | Shingles | 2/15/2021 |
| 7 | Ryan | Buckley | 2/15/2019 |
| 8 | Denise | Webster | 2/15/2020 |
| 9 | Doug | LaBelle II | 2/15/2019 |
| Zoning Board of Appeals Members (5 Members, 2 Alternates) 3 year term | | | |
| # | F Name | L Name | Expiration Date |
| 1-Chair | Tim | Warner | 12/31/2019 |
| 2-PC Rep / Vice Chair | Bryan | Mielke | 2/18/2021 |
| 3-Secretary | Jake | Hunter | 12/31/2019 |
| 4 | Andy | Theisen | 12/31/2019 |
| 5 - Vice Secretary | Paul | Gross | 12/31/2018 |
| Alt. #1 | John | Zerbe | 12/31/2019 |
| Alt. #2 | Taylor | Sheahan-Stahl | 2/15/2021 |
| Board of Review (3 Members) 2 year term | | | |
| # | F Name | L Name | Expiration Date |
| 1 | Doug | LaBelle II | 12/31/2018 |
| 2 | James | Thering | 12/31/2018 |
| 3 | Bryan | Neyer | 12/31/2018 |
| Alt #1 | Mary Beth | Orr | 1/25/2019 |
| Citizens Task Force on Sustainability (4 Members) 2 year term | | | |
| # | F Name | L Name | Expiration Date |
| 1 | Laura | Coffee | 12/31/2018 |
| 2 | Mike | Lyon | 12/31/2018 |
| 3 | Jay | Kahn | 12/31/2018 |
| 4 | Phil | Mikus | 11/20/2020 |
| Construction Board of Appeals (3 Members) 2 year term | | | |
| # | F Name | L Name | Expiration Date |
| 1 | Colin | Herron | 12/31/2019 |
| 2 | Richard | Jakubiec | 12/31/2019 |
| 3 | Andy | Theisen | 12/31/2019 |
| Hannah's Bark Park Advisory Board (2 Members from Township) 2 year term | | | |
| 1 | Mark | Stuhldreher | 12/31/2018 |
| 2 | John | Dinse | 12/31/2019 |
| Chippewa River District Library Board 4 year term | | | |
| 1 | Ruth | Helwig | 12/31/2019 |
| 2 | Lynn | Laskowsky | 12/31/2021 |

# Board Expiration Dates

| EDA Board Members (11 Members) 4 year term | | | |
|---|---|---|---|
| # | F Name | L Name | Expiration Date |
| 1 | Thomas | Kequom | 4/14/2019 |
| 2 | James | Zalud | 4/14/2019 |
| 3 | Richard | Barz | 2/13/2021 |
| 4 | Robert | Bacon | 1/13/2019 |
| 5 | Ben | Gunning | 11/20/2020 |
| 6 | Marty | Figg | 6/22/2022 |
| 7 | Sarvijit | Chowdhary | 1/20/2022 |
| 8 | Cheryl | Hunter | 6/22/2019 |
| 9 | Vance | Johnson | 2/13/2021 |
| 10 | Michael | Smith | 2/13/2021 |
| 11 | David | Coyne | 3/26/2022 |
| Mid Michigan Area Cable Consortium (2 Members) | | | |
| # | F Name | L Name | Expiration Date |
| 1 | Kim | Smith | 12/31/2020 |
| 2 | Vacant | | |
| Cultural and Recreational Commission (1 seat from Township) 3 year term | | | |
| # | F Name | L Name | Expiration Date |
| 1 | Brian | Smith | 12/31/2019 |
| Sidewalks and Pathways Prioritization Committee (2 year term) | | | |
| # | F Name | L Name | Expiration Date |
| 1 BOT Representative | Phil | Mikus | 7/26/2019 |
| 2 PC Representative | Denise | Webster | 8/15/2020 |
| 3 Township Resident | Sherrie | Teall | 8/15/2019 |
| 4 Township Resident | Jeremy | MacDonald | 10/17/2018 |
| 5 Member at large | Connie | Bills | 8/15/2019 |

# 2018 CHARTER TOWNSHIP OF UNION
## Board of Trustees
## Regular Meeting

A regular meeting of the Charter Township of Union Board of Trustees was held on September 26, 2018 at 7:00 p.m. at Union Township Hall.

**Meeting was called to order at 7:00 p.m.**

**Roll Call**
Present: Supervisor Gunning, Treasurer Rice, Clerk Cody, Trustees B. Hauck, Lannen, and Woerle
Excused: Trustee Mikus

**Approval of Agenda**
**Cody** moved **Rice** supported to approve the agenda as presented. **Vote: Ayes: 6 Nays: 0. Motion carried.**

**Presentations**

**Public Hearings**
Consider Adoption of Rezoning Ordinance 2018-05 (997 E. Remus Rd.)
Open 7:02 p.m.
No comments were offered.
Closed 7:03 p.m.

**Public Comment** - open 7:03 p.m.
No comments were offered.

**Reports/Board Comments**
Cody- City of Mt. Pleasant updates
Gunning – EDA updates
Hauck- Isabella County Road Commission project updates
Lannen- Isabella County Board of Commissioners and Isabella County MTA updates
Woerle – Commented on due date for submission of 2% Grant Applications to the Saginaw Chippewa Indian Tribe.

Planning Commission and ZBA updates by Township Planner.

**Consent Agenda**
A. Communications
B. Minutes September 12, 2018 – Regular Meeting
C. Accounts Payable
D. Payroll
E. Meeting Pay
F. Fire Reports

DRAFT

**Cody** moved **Hauck** supported to approve the consent agenda as presented. **Vote: Ayes: 6 Nays: 0. Motion carried**.

## BOARD AGENDA

A. **Discussion/Action: (Gallinat) Consider Adoption of Rezoning Ordinance 2018-05 and to publish notice of adoption of Rezoning Ordinance 2018-05 (Roll Call Vote)**

**Cody** moved **Lannen** supported to approve the adoption of Ordinance 2018-05 and to publish notice of adoption in the Morning Sun with the effective date of adoption being October 6, 2018, seven days after publication. **Roll Call Vote: Ayes: Gunning, Rice, Cody, Hauck, Lannen, and Woerle Nays: 0. Motion carried.**

B. **Discussion/Action: (DePriest) Approval of Land Division #37-14-026-10-005-08, located at 4445 E. Bluegrass Rd., Owner MP Note, LLC**

**Woerle** moved **Cody** supported to approve the land division for parcel #37-14-026-005-08 located at 4445 E. Bluegrass Rd, owner MP Note, LLC. **Vote: Ayes: 6 Nays: 0. Motion carried.**

C. **Discussion/Action: (DePriest) Approval of Land Division #37-14-018-040-002-00, located at 997 E. Remus Rd.**

**Cody** moved **Woerle** supported to approve the land division for parcel #37-14-040-002-00 located at 997 E. Remus Rd., owner Richard Beltinck 811 E. Remus Rd, Mt. Pleasant, Teresa A. Clark 6785 Michael Dr., Troy, MI 48098, and Martha A. Clare 10106 Herbison Rd., Eagle, MI 48822. **Vote: Ayes: 6 Nays: 0. Motion carried.**

D. **Discussion/Action: (Stuhldreher) Policy Governance 4.1 Unity of Control**

Discussion by the Board.

**Woerle** moved **Hauck** supported to set up a work session to review the Policy Governance Manual, to provide additional training and review for possible updates, with Sue Radwan sometime after the November 6th election. **Vote: Ayes: 6 Nays: 0. Motion carried.**

**EXTENDED PUBLIC COMMENT** - Open 8:04 p.m.

No comments were offered.

## MANAGER COMMENTS

- Isabella remodeling update meeting with architect, requested post bid addendum, reviewed responses and adjusting scope – Recommendation to the Board at the October 10th Board meeting.
- Presentation and report out on Pump Station #7 (O'Connor Dr.) by Gordie-Fraser – Will be on the October 10th Board meeting.
- Mentioned fire millage renewal will be on the November 6th ballot
- 2019 Recommended Budget will be delivered to the Board both electronically and hard copy in Township mail boxes later this week with an overview at the October 10th Board meeting.

DRAFT

- Mentioned that the Township has been approached by both St. Andrews subdivision (paving) and Cornerstone subdivision (lighting) regarding future possible special assessment districts.
- Mentioned the Manager Review that was held at the 8/22/18 and asked the Board to discuss his annual contract at a future meeting
- Confirmed to the Board that the 2% applications will be submitted by 9/30/18 and that three applications will be presented, which are: on behalf of the City/Township field/parking improvements in relationship to hosting the 2019 Little League World Series, Jameson Park Master Plan in conjunction with the EDA, and CMU/Deerfield Connector Pathway

**FINAL BOARD MEMBER COMMENTS**

Cody – October 9th is the last day to register to vote to be eligible to vote at the November 6th election.
Hauck – Mentioned that he would still like to see a hired Building Official.
Lannen – Commented on the Monthly Report provided by the Township Manager/Township Staff being a greatly appreciated. Asked about the fire contract with the City of Mt. Pleasant coming before the Board, Township Manager followed with a possible October 24th date to bring the item before the Board, asked about the Joint Operations Board at the Mt. Pleasant Airport.

**Closed Session**

**ADJOURNMENT**

**Rice** moved **Cody** supported to adjourn the meeting at 8:19 p.m. **Vote: Ayes: 6 Nays: 0. Motion carried.**

**APPROVED BY:** _____

**Lisa Cody, Clerk**

_____

**Ben Gunning, Supervisor**

*(Recorded by Jennifer Loveberry)*

DRAFT

| Check Date | Bank | Check | Vendor | Vendor Name | Description | Amount |
|---|---|---|---|---|---|---|
| Bank 101 POOLED CHECKING | | | | | | |
| 09/27/2018 | 101 | 211(E) | 01105 | MASTERCARD | MASTERCARD DEPRIEST | 261.43 |
| | | | | | MASTERCARD TEALL | 650.07 |
| | | | | | MASTERCARD CRAWFORD | 69.08 |
| | | | | | MASTERCARD WALDRON | 322.19 |
| | | | | | MASTERCARD DEARING | 340.31 |
| | | | | | MASTERCARD RADAR | 152.20 |
| | | | | | MASTERCARD MCBRIDE | 625.95 |
| | | | | | MASTERCARD GALLINAT | 692.94 |
| | | | | | MASTERCARD ROCKAFELLOW | 514.06 |
| | | | | | MASTERCARD RICE | 1.00 |
| | | | | | MASTERCARD FUSSMAN | 76.95 |
| | | | | | MASTERCARD STUHLDREHER | 433.00 |
| | | | | | MASTERCARD HOHLBEIN | 187.04 |
| | | | | | MASTERCARD OCKERT | 266.97 |
| | | | | | MASTERCARD COFFELL | 216.91 |
| | | | | | MASTERCARD DEPRIEST | 1,354.69 |
| | | | | | | 6,164.79 |
| 09/27/2018 | 101 | 212(E) | 01105 | VOID | | V |
| | | | | Void Reason: Created From Check Run Process | | |
| 09/28/2018 | 101 | 213(E) | 00146 | CONSUMERS ENERGY PAYMENT CENTER | 2279 S MERIDIAN PUMP HOUSE | 27.60 |
| | | | | | 2279 S MERIDIAN | 1,649.22 |
| | | | | | 4511 E RIVER | 12,271.45 |
| | | | | | 2010 S LINCOLN | 795.27 |
| | | | | | | 14,743.54 |
| 09/28/2018 | 101 | 20496 | 01564 | AMERICAN EXCAVATING | BULK WATER PERMIT REFUND | 322.00 |
| 10/10/2018 | 101 | 20497 | 00020 | JAMES ALWOOD | WELL SITE LEASE - SEPT 2018 | 528.40 |
| 10/10/2018 | 101 | 20498 | 00066 | BILL'S CUSTOM FAB, INC. | WELDING ON MANHOLE COVER LINCOLN ROAD | 155.00 |
| 10/10/2018 | 101 | 20499 | 00072 | BLOCK ELECTRIC | LINCOLN WATER TOWER CODE UPDATE | 666.84 |
| | | | | | REPLACE VFD ON MERIDIAN WELL | 700.00 |
| | | | | | | 1,366.84 |
| 10/10/2018 | 101 | 20500 | 00095 | C & C ENTERPRISES, INC. | BEE BLAST - WASP & HORNET KILLER | 29.70 |
| | | | | | JANITORIAL SUPPLIES - PARKS | 214.85 |
| | | | | | | 244.55 |
| 10/10/2018 | 101 | 20501 | 01171 | DBI BUSINESS INTERIORS | BATTERIES FOR TOWNSHIP | 54.41 |
| | | | | | FOLDER/LABELS/TAPE - TWP HALL/BLDG & TON | 193.31 |
| | | | | | SHARPIE PENS - ELECTIONS | 31.50 |
| | | | | | | 279.22 |
| 10/10/2018 | 101 | 20502 | 00176 | PATRICIA DEPRIEST | FLEX REIMBURSEMENT-9-27-18 | 324.00 |
| 10/10/2018 | 101 | 20503 | 00188 | DOUG'S SMALL ENGINE | BELT - PARKS | 104.99 |
| | | | | | BELT - PARKS | 108.90 |
| | | | | | BELT - PARKS | 124.70 |
| | | | | | BELT RETURN - PARKS | (104.99) |
| | | | | | BELT RETURN - PARKS | (108.90) |
| | | | | | | 124.70 |

| Check Date | Bank | Check | Vendor | Vendor Name | Description | Amount |
|---|---|---|---|---|---|---|
| 10/10/2018 | 101 | 20504 | 00201 | ELHORN ENGINEERING COMPANY | BULK CHLORINE | 4,333.50 |
| 10/10/2018 | 101 | 20505 | 00209 | ETNA SUPPLY COMPANY | SENSUS TOUCHPAD METERS | 400.00 |
| | | | | | NEW SEWER LEAD FOR NEW OFFICES | 205.92 |
| | | | | | | 605.92 |
| 10/10/2018 | 101 | 20506 | 01593 | FISHBECK, THOMPSON, CARR & HUBER | SERVICES RENDERED THRU 8/10/18-WATER STU | 4,261.15 |
| | | | | | SERVICES RENDERED THRU 9/7/18-WATER STUD | 6,097.62 |
| | | | | | | 10,358.77 |
| 10/10/2018 | 101 | 20507 | 01601 | FISHER CONTRACTING | BULK WATER PERMIT #2018-02 | 50.00 |
| 10/10/2018 | 101 | 20508 | 00249 | GILL-ROY'S HARDWARE | SINCLE CUT KEY | 1.99 |
| 10/10/2018 | 101 | 20509 | 00324 | ISABELLA CORPORATION | 8" LIVE TAP & DRILL FOR MESSENGER OFFICE | 37,500.00 |
| 10/10/2018 | 101 | 20510 | 00333 | ISABELLA COUNTY ROAD COMMISSION | MERIDIAN BRIDGE-PROG PMT #1 | 25,690.10 |
| 10/10/2018 | 101 | 20511 | 00351 | JONES & HENRY LABORATORIES, INC. | MERCURY LAB SAMPLES | 210.00 |
| 10/10/2018 | 101 | 20512 | 00360 | KIMBALL MIDWEST | GLASSES/MARKER/DRILL BIT | 169.61 |
| 10/10/2018 | 101 | 20513 | 01506 | MCKENNA ASSOCIATES | ZONING ORDINANCE REVISION-AUGUST CHARGES | 1,659.00 |
| 10/10/2018 | 101 | 20514 | 01268 | MICH LABOR LAW POSTER SERVICE | 2019-2021 3 YEAR PLAN | 1,002.50 |
| 10/10/2018 | 101 | 20515 | 00142 | MICHIGAN OFFICE SOLUTIONS | COLOR COPY OVERAGE CHARGE 6/18 - 9/17 | 188.21 |
| 10/10/2018 | 101 | 20516 | 00422 | MICHIGAN PIPE & VALVE | VALVE/BOLT AND GASKET/PVC STAR GRIP | 953.00 |
| | | | | | ISABELLA WELL SITE 2: METER FLANGE | 365.00 |
| | | | | | | 1,318.00 |
| 10/10/2018 | 101 | 20517 | 01102 | STATE OF MICHIGAN - DEQ | DRINKING WATER LAB CERTIFICATION | 2,639.28 |
| 10/10/2018 | 101 | 20518 | 00494 | NORTH CENTRAL LABORATORIES | MILLIPORE PETRI DISH/WHIRL-PAK BAGS | 768.16 |
| 10/10/2018 | 101 | 20519 | 00506 | MEEKHOF TIRE SALES & SERVICE INC | CLAMP/ MOUNT & DISMOUNT | 113.23 |
| 10/10/2018 | 101 | 20520 | 00525 | PICKARD STREET CAR WASH | CAR WASHES - AUGUST 2018 | 52.00 |
| 10/10/2018 | 101 | 20521 | 00788 | POLLARDWATER.COM | 2T HDL PENT END WRCH | 128.50 |
| 10/10/2018 | 101 | 20522 | 00965 | JOY SMITH | MICAMP GIS CONFERENCE EXPENSE REIMBURSEM | 134.07 |
| 10/10/2018 | 101 | 20523 | 01364 | SHERRIE TEALL | MGFOA FALL CONFERENCE EXPENSE REIMBURSME | 163.38 |
| 10/10/2018 | 101 | 20524 | 00668 | UNITED PARCEL SERVICE | SEND WATER SAMPLES TO LAB | 12.40 |
| 10/10/2018 | 101 | 20525 | 01013 | USA BLUE BOOK | SDS BINDER 3.5" RINGS | 88.31 |
| | | | | | CONFINED SPACE PERMIT/MANHOLE GREASE SCR | 109.94 |
| | | | | | POISE MID BACK CHAIR | 203.95 |
| | | | | | | 402.20 |
| 10/10/2018 | 101 | 20526 | 01314 | VERIZON WIRELESS | CELL PHONES 8-16-18 TO 9-15-18 | 516.16 |
| 10/10/2018 | 101 | 20527 | 01483 | XEROX FINANCIAL SERVICES | LEASE PAYMENT - SEPTEMBER 2018 | 1,500.76 |

101 TOTALS:

| | |
|---|---|
| Total of 35 Checks: | 113,770.78 |
| Less 1 Void Checks: | 0.00 |
| Total of 34 Disbursements: | 113,770.78 |

# Charter Township of Union
# Payroll

## CHECK DATE: October 4, 2018
## PPE: September 29, 2018

## NOTE: CHECK TOTAL FOR TRANSFER

| | | |
|---|---|---|
| Gross Payroll | $ | 61,198.88 |
| Employer Share Med | | 853.68 |
| Employer Share SS | | 3,650.24 |
| SUI | | 47.53 |
| Pension-Employer Portion | | 3,837.37 |
| Workers' Comp | | 609.07 |
| Life/LTD | | 548.69 |
| Dental | | 981.21 |
| Health Care | | 15,674.00 |
| Vision | | 311.12 |
| Vision Contribution | | (155.56) |
| Health Care Contribution | | (1,964.37) |
| Cobra/Flex Administration | | - |
| PCORI Fee | | - |
| **Total Transfer to Payroll Checking** | $ | 85,591.86 |

## NOTE: PAYROLL TRANSFER NEEDED

| | | |
|---|---|---|
| General Fund | $ | 35,113.83 |
| EDDA | | - |
| WDDA | | - |
| Sewer Fund | | 27,401.00 |
| Water Fund | | 23,077.03 |
| **Total To Transfer from Pooled Savings** | $ | 85,591.86 |

# Charter Township of Union
# Payroll

## CHECK DATE: September 20, 2018
## PPE: September 15, 2018

## NOTE: CHECK TOTAL FOR TRANSFER

| | | |
|---|---|---|
| Gross Payroll | $ | 52,854.00 |
| Employer Share Med | | 763.42 |
| Employer Share SS | | 3,264.26 |
| SUI | | 68.68 |
| Pension-Employer Portion | | 3,436.90 |
| Workers' Comp | | 569.16 |
| Life/LTD | | - |
| Dental | | 989.23 |
| Health Care | | 15,674.00 |
| Vision | | - |
| Vision Contribution | | - |
| Health Care Contribution | | - |
| Cobra/Flex Administration | | 184.40 |
| PCORI Fee | | - |
| **Total Transfer to Payroll Checking** | $ | 77,804.05 |

## NOTE: PAYROLL TRANSFER NEEDED

| | | |
|---|---|---|
| General Fund | $ | 28,672.63 |
| EDDA | | - |
| WDDA | | - |
| Sewer Fund | | 26,664.95 |
| Water Fund | | 22,466.47 |
| **Total To Transfer from Pooled Savings** | $ | 77,804.05 |

**CHARTER TOWNSHIP OF UNION**
**MEETING PAY REQUEST FORM**
**2018**

**BOARD MEMBER:** Tim Lanner

**MONTH:** September

| Date | Meeting | Time Attended | | Total |
|---|---|---|---|---|
| | | 1hr or less | More than Hr | |
| 9.18.18 | Isabella County BOC | ✓ | | |
| 9.19.18 | MTA Council of Governments | ✓ | | |
| | | | | |
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**SIGNATURE:** Tim Lanner **Date:** 9.26.18

1. **This form is filled out by the board member monthly and turned into the Finance Director. Completed requests will be added to the consent agenda for approval at the next regular board meeting. After board approval, payment will be added to the next regular payroll process.**

2. **Only list those meetings that you have attended. You are required to list the amount of meeting time you were in attendance. The amount paid is subject to the time you spent during the actual meeting. 1 to 60 minutes is reimbursed at $50. Anything greater than 60 minutes is reimbursed at $75.**

3. **Attendances at all day conferences/sessions are reimbursed as one meeting at $75.**

# Mount Pleasant Fire Department

**Fire Experience Report For Union Township/City of Mt. Pleasant**
**Period - September 10, 2018 through September 16, 2018**

| Category | Code | Description | Twp | Resp | City |
|---|---|---|---|---|---|
| Fire | 100 | Fire, Other | | | |
| | 111 | Building Fire | | | |
| | 112 | Fires in Structures other than a Building | | | |
| | 113 | Cooking Fire | | | |
| | 114 | Chimney or Flue Fire | | | |
| | 116 | Fuel Burner/Boiler Malfunction | | | |
| | 130 | Mobile Property Fire, Other | | | |
| | 131 | Passenger Vehicle Fire | | | |
| | 132 | Road freight or transport vehicle fire | 1 | 18 | |
| | 136 | Self-propelled Motor Home/Recreational | | | |
| | 137 | Camper or Recreational Vehicle (RV) Fire | | | |
| | 138 | Off-road vehicle of heavy equipment fire | | | |
| | 140 | Natural Vegetation Fire | | | |
| | 143 | Grass/Brush fire | | | |
| | 150 | Outside Rubbish Fire, other | | | |
| | 151 | Outside Rubbish Fire, trash or waste fire | | | |
| | 154 | Dumpster Fire | | | |
| | 160 | Special Outside Fire, Other | | | |
| | | | | | |
| Overpressure Rupture, (No Fire) | 200 | Overpressure rupture, explosion, overheat | | | |
| | 251 | Excessive heat, scorch burns with no fire | | | |
| | 231 | Chemical reaction rupture of process vessel | | | |
| | | | | | |
| Rescue & EMS Incident | | | | | |
| | 300 | Rescue, EMS incident, other | | | 1 |
| | 311 | Medical Assist to EMS Crew | 1 | 3 | 1 |
| | 321 | EMS Call excluding Veh. Accident | | | 1 |
| | 322 | Motor Vehicle Acc. W/ Injuries | 1 | 3 | |
| | 323 | Motor Vehicle Acc/Pedestrian | | | |
| | 324 | Motor Vehicle Acc. W/no Injuries | | | |
| | 331 | Lock-In (If lock out use 551) | | | |
| | 342 | Search for Person in Water | 1 | 8 | |
| | 352 | Extrication of Victim (s) from vehicle | | | |
| | 353 | Remove Victim from Stalled Elevator | | | |
| | 360 | Water & Ice-related Rescue, Other | | | |
| | 361 | Swimming /recreational water area rescue | | | |
| | 363 | Swift Water Rescue | | | |
| | 3811 | Technical rescue standby | | | |
| Hazardous Condition (No Fire) | | | | | |
| | 400 | Hazard condition other | | | |
| | 410 | Combustible/Flammable Gas Condition | | | |
| | 411 | Gasoline or Other Flammable Spill | | | |
| | 412 | Gas Leak (natural gas or LPG) | | | |
| | 413 | Oil of Combustible Liquid Spill | | | |
| | 420 | Toxic Condition, Other | | | |
| | 421 | Chemical Hazard (No Spill or Leak) | | | |
| | 422 | Chemical Spill or Leak | | | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | 423 | Refrigeration Leak | | | |
| | 424 | Carbon Monoxide Incident | | | |
| | 440 | Electric Wiring/Equipment Problem | | | |
| | 441 | Heat from Short Circuit | | | |
| | 442 | Overheated Motor | 1 | 2 | |
| | 443 | Breakdown of Light Ballast | | | |
| | 444 | Power Line Down | | | |
| | 445 | Arcing, shorted electrical equipment | | | |
| | 451 | Biological hazard, confirmed or suspected | | | |
| | 461 | Building or Structure Weakened or Collapsed | | | |
| | 462 | Aircraft Standby | | | |
| | 463 | Vehicle Accident, general cleanup | | | |
| | 480 | Attempted burning, illegal action, other | | | |
| | 4441 | Utility Line Down | | | 1 |
| Service Call | | | | | |
| | 500 | Service Call - Other | | | 1 |
| | 510 | Person in Distress | | | |
| | 511 | Lock-out | | | |
| | 512 | Ring or Jewelry removal | | | |
| | 520 | Water Problem, Other | | | |
| | 521 | Water Evacuation | | | |
| | 522 | Water of Steam Leak | | | |
| | 531 | Smoke or Odor Removal | | | |
| | 542 | Animal Rescue | | | 1 |
| | 552 | Police Matter | | | |
| | 553 | Public Service | | | |
| | 555 | Defective Elevator, No Occupants | | | |
| | 561 | Unauthorized Burning | 1 | 2 | |
| | 571 | Cover assignment, standby, moveup | | | |
| Good Intent Call | | | | | |
| | 600 | Good Intent Call, Other | | | |
| | 611 | Dispatched and Cancelled en route | | | |
| | 622 | No Incident Found on Arrival | | | |
| | 631 | Authorized controlled burning | | | |
| | 650 | Steam, gas mistaken for smoke, | | | |
| | 651 | Smoke Scare, Odor of Smoke | | | |
| | 653 | Smoke from Barbecue, Tar Kettle | | | |
| | 661 | EMS call, party already transported | | | |
| | 671 | HazMat Investigation, no HazMat | | | |
| False Alarm & False Call | | | | | |
| | 700 | False Alarm, Other | 1 | 2 | |
| | 710 | Malicious, mischievous false call, other | | | |
| | 715 | Local Alarm System, Malicious False Alarm | | | |
| | 721 | Bomb Scare - No Bomb | | | |
| | 730 | System Malfunction | | | 1 |
| | 731 | Sprinkler activation due to malfunction | | | |
| | 732 | Extinguishing System Activation - Malfunction | | | |
| | 733 | Smoke Det. Activation - Malfunction | 2 | 5 | |
| | 734 | Heat Detector Activation - Malfunction | | | |
| | 735 | Alarm system sounded due to malfunction | | | |
| | 736 | CO detector activation due to malfunction | | | |
| | 740 | Unintentional transmission of alarm, other | | | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | 741 | Sprinkler activation, no fire | | | |
| | 743 | Smoke Det. Activation - Unintentional | | | |
| | 744 | Detector activation, no fire | | | |
| | 745 | Alarm System Act. - Unintentional | 1 | 2 | |
| | 746 | Carbon Monoxide Activation, NO CO | | | |
| Severe Weather | | | | | |
| | 812 | Flood Assessment | | | |
| Special Incident Type | 813 | Wind Storm,Tornado/Hurricane Assessment | | | |
| | | | | | |
| | 911 | Citizen Complaint | | | |
| | 9002 | Civil Infraction Issued | | | |
| | 9003 | Affidavit Issued | | | |
| | | | | | |
| | | Total Response for Union Twp/City | 10 | 45 | 9 |

| | |
|---|---|
| | Emergency - MPFD |
| | Emergency - MPFD Secondary to MMR |
| | Non - Emergency |

# Mount Pleasant Fire Department

**Fire Experience Report For Union Township/City of Mt. Pleasant**
**Period - September 17, 2018 through September 23, 2018**

| Category | Code | Description | Twp | Resp | City |
|---|---|---|---|---|---|
| Fire | 100 | Fire, Other | | | |
| | 111 | Building Fire | | | |
| | 112 | Fires in Structures other than a Building | | | |
| | 113 | Cooking Fire | | | |
| | 114 | Chimney or Flue Fire | | | |
| | 116 | Fuel Burner/Boiler Malfunction | | | |
| | 130 | Mobile Property Fire, Other | | | |
| | 131 | Passenger Vehicle Fire | | | |
| | 132 | Road freight or transport vehicle fire | | | |
| | 136 | Self-propelled Motor Home/Recreational | | | |
| | 137 | Camper or Recreational Vehicle (RV) Fire | | | |
| | 138 | Off-road vehicle of heavy equipment fire | | | |
| | 140 | Natural Vegetation Fire | | | |
| | 143 | Grass/Brush fire | | | |
| | 150 | Outside Rubbish Fire, other | | | |
| | 151 | Outside Rubbish Fire, trash or waste fire | | | |
| | 154 | Dumpster Fire | | | |
| | 160 | Special Outside Fire, Other | | | |
| | | | | | |
| Overpressure Rupture, (No Fire) | 200 | Overpressure rupture, explosion, overheat | | | |
| | 251 | Excessive heat, scorch burns with no fire | | | |
| | 231 | Chemical reaction rupture of process vessel | | | |
| | | | | | |
| Rescue & EMS Incident | | | | | |
| | 300 | Rescue, EMS incident, other | | | |
| | 311 | Medical Assist to EMS Crew | 3 | 6 | |
| | 321 | EMS Call excluding Veh. Accident | 1 | 3 | 2 |
| | 322 | Motor Vehicle Acc. W/ Injuries | | | 1 |
| | 323 | Motor Vehicle Acc/Pedestrian | | | |
| | 324 | Motor Vehicle Acc. W/no Injuries | 2 | 6 | |
| | 331 | Lock-In (If lock out use 551) | | | |
| | 342 | Search for Person in Water | | | |
| | 352 | Extrication of Victim (s) from vehicle | | | |
| | 353 | Remove Victim from Stalled Elevator | | | |
| | 360 | Water & Ice-related Rescue, Other | | | |
| | 361 | Swimming /recreational water area rescue | | | |
| | 363 | Swift Water Rescue | | | |
| | 3811 | Technical rescue standby | | | |
| Hazardous Condition (No Fire) | | | | | |
| | 400 | Hazard condition other | | | 1 |
| | 410 | Combustible/Flammable Gas Condition | | | |
| | 411 | Gasoline or Other Flammable Spill | | | |
| | 412 | Gas Leak (natural gas or LPG) | | | |
| | 413 | Oil of Combustible Liquid Spill | | | |
| | 420 | Toxic Condition, Other | | | |
| | 421 | Chemical Hazard (No Spill or Leak) | | | |
| | 422 | Chemical Spill or Leak | | | |

| | | | | | |
|---|---|---|---|---|---|
| | 423 | Refrigeration Leak | | | |
| | 424 | Carbon Monoxide Incident | | | |
| | 440 | Electric Wiring/Equipment Problem | | | |
| | 441 | Heat from Short Circuit | | | |
| | 442 | Overheated Motor | | | |
| | 443 | Breakdown of Light Ballast | | | |
| | 444 | Power Line Down | 1 | 2 | 2 |
| | 445 | Arcing, shorted electrical equipment | | | |
| | 451 | Biological hazard, confirmed or suspected | | | |
| | 461 | Building or Structure Weakened or Collapsed | | | |
| | 462 | Aircraft Standby | | | |
| | 463 | Vehicle Accident, general cleanup | | | |
| | 480 | Attempted burning, illegal action, other | | | |
| | 4441 | Utility Line Down | | | 1 |
| Service Call | | | | | |
| | 500 | Service Call - Other | | | |
| | 510 | Person in Distress | | | |
| | 511 | Lock-out | | | |
| | 512 | Ring or Jewelry removal | | | |
| | 520 | Water Problem, Other | | | 1 |
| | 521 | Water Evacuation | | | |
| | 522 | Water of Steam Leak | | | |
| | 531 | Smoke or Odor Removal | | | |
| | 542 | Animal Rescue | | | |
| | 552 | Police Matter | | | |
| | 553 | Public Service | | | |
| | 555 | Defective Elevator, No Occupants | | | |
| | 561 | Unauthorized Burning | | | |
| | 571 | Cover assignment, standby, moveup | | | |
| Good Intent Call | | | | | |
| | 600 | Good Intent Call, Other | | | |
| | 611 | Dispatched and Cancelled en route | | | |
| | 622 | No Incident Found on Arrival | | | |
| | 631 | Authorized controlled burning | | | |
| | 650 | Steam, gas mistaken for smoke, | | | |
| | 651 | Smoke Scare, Odor of Smoke | | | |
| | 653 | Smoke from Barbecue, Tar Kettle | | | |
| | 661 | EMS call, party already transported | | | |
| | 671 | HazMat Investigation, no HazMat | | | |
| False Alarm & False Call | | | | | |
| | 700 | False Alarm, Other | | | |
| | 710 | Malicious, mischievous false call, other | | | |
| | 715 | Local Alarm System, Malicious False Alarm | | | |
| | 721 | Bomb Scare - No Bomb | | | |
| | 730 | System Malfunction | | | |
| | 731 | Sprinkler activation due to malfunction | | | |
| | 732 | Extinguishing System Activation - Malfunction | | | |
| | 733 | Smoke Det. Activation - Malfunction | | | |
| | 734 | Heat Detector Activation - Malfunction | | | |
| | 735 | Alarm system sounded due to malfunction | | | 1 |
| | 736 | CO detector activation due to malfunction | | | |
| | 740 | Unintentional transmission of alarm, other | | | |

| | | | | | |
|---|---|---|---|---|---|
| | 741 | Sprinkler activation, no fire | 1 | 3 | |
| | 743 | Smoke Det. Activation - Unintentional | 2 | 5 | |
| | 744 | Detector activation, no fire | | | |
| | 745 | Alarm System Act. - Unintentional | | | |
| | 746 | Carbon Monoxide Activation, NO CO | | | |
| Severe Weather | | | | | |
| | 812 | Flood Assessment | | | |
| Special Incident Type | 813 | Wind Storm,Tornado/Hurricane Assessment | | | |
| | | | | | |
| | 911 | Citizen Complaint | | | |
| | 9002 | Civil Infraction Issued | | | |
| | 9003 | Affidavit Issued | | | |
| | | | | | |
| | | Total Response for Union Twp/City | 10 | 25 | 9 |

| | |
|---|---|
| | Emergency - MPFD |
| | Emergency - MPFD Secondary to MMR |
| | Non - Emergency |

# REQUEST FOR TOWNSHIP BOARD ACTION

| | | | |
|---|---|---|---|
| **TO:** | Board of Trustees | **DATE:** | 09/19/2018 |
| **FROM:** | Sidewalks and Pathways Prioritization Committee | **DATE FOR BOARD CONSIDERATION:** | 09/26/2018 |

**ACTION REQUESTED:** Accept existing sidewalk waiver revocation recommendation from the Township Sidewalk and Pathways Prioritization Committee. Instruct staff to contact owners of selected parcels to develop a plan for sidewalk construction in accordance with the Township Sidewalk Policy.

Current Action Emergency _____

Funds Budgeted: If Yes _____ Account #_____ No _____ N/A ___X____

Finance Approval _____

## BACKGROUND INFORMATION

The Charter Township of Union has had in effect a Sidewalks and Pathways Ordinance since 2010. Since 2010 sidewalks have been required to be shown on site plans. The Township Planning Commission at times has granted temporary waivers from this requirement. This has delayed or temporarily waived sidewalk construction with the projects approved on these site plans.

On August 13, 2018 the Sidewalks and Pathways Prioritization Committee reviewed parcels which had been granted temporary waivers from sidewalk construction during site plan approval by the Planning Commission. Of the twenty three (23) existing sidewalk waivers the committee prioritized seven (7) parcels where waivers should be revoked due to being located on designated priority streets.

The Sidewalks and Pathways Prioritization Committee is recommending that existing waivers not located on designated priority stress not be prioritized at this time.

The Committee forwarded their recommendation to the Planning Commission for comment. The Planning Commission reviewed the recommendation at the August 21st Planning Commission meeting. On August 27th, 2018 the Committee formally recommended the following parcels, previously granted temporary sidewalk waiver be revoked. The seven (7) parcels are listed below:

- 2865 S. Lincoln Rd. Mt. Pleasant Optics
- 2467 E. Remus Rd. Merchandise Outlet
- 2812 S. Lincoln Rd. Oak Meadows Condominiums
- 2260 E. Remus Rd. Woodland Investments LLC
- 2420 E. Broomfield Rd. Broomfield Plaza (The Jump Station)
- PID 14-017-40-008-03 Oak Meadows Condominiums
- 4445 E. Bluegrass Rd. Union Shoppes (MP Note LLC)

## SCOPE OF SERVICES

N/A

## JUSTIFICATION

According to the Sidewalks and Pathways ordinance the Sidewalks and Pathways Prioritization Committee will meet as needed to review the plan and make recommendations to the Township Board. These parcels were chosen by the committee because they are located on designated priority streets per the Sidewalk Implementation and & Prioritization map.

## PROJECT IMPROVEMENTS

The following Board of Trustees goal is addressed with this request.

1. Community well-being and common good.
2. Safety
3. Health
4. Natural Environment

## COSTS

N/A

## PROJECT TIME TABLE

Township staff will contact property owners to inform them that the Township Board of Trustees has deemed the sidewalk waiver, granted at the time of site plan review approval, has been revoked. Staff will work with the property owner to develop a plan for the construction of the sidewalk within the next two years as called for in the Sidewalk Policy which was adopted by the Board of Trustees on April 25, 2018. The policy allows for sidewalks to be constructed within 2 years.

## RESOLUTION

Authorization is hereby given to instruct staff to contact owners of property at:
2865 S. Lincoln Rd.
2476 E. Remus Rd.
2812 S. Lincoln Rd.
2260 E. Remus Rd.
2420 E. Broomfield Rd.
PID 14-017-40-008-03
4445 E. Bluegrass Rd.

and to inform the owners that the temporary waiver for sidewalk construction has been revoked.

Resolved by _____ Seconded by _____

Yes:
No:
Absent:

Sidewalk and Pathways Prioritization Committee recommends all site plans, within the boundaries of Union Township, will require sidewalks to be shown on the site plan. The Sidewalk and Pathways Prioritization Committee recommends to the Township Board and Planning Commission the following as it relates to the construction of sidewalks on parcels requiring a site plan.

I. Identification of Designated Streets for Sidewalk Construction

The Planning Commission will NOT grant a developer/owner of a parcel, with frontage along the designated streets, relief from the construction of a sidewalk as shown on the site plan. The goal is to develop sidewalks on both sides of the designated street.

- The designated streets were identified to complete sidewalks, to fill gaps with existing sidewalks to connect with city, and CMU property; to connect schools, parks, bus stops, activity centers, employment centers, retail, business, health care facilities, senior living centers, religious institutions, civic buildings, community services within the township.

Designated Streets (Identified on the Sidewalk map as developed by the Sidewalk and Pathways Prioritization Committee, March 2018.)

- North
  - **Pickard Road** from Lincoln to Township Boundary
    - Township parcels: Along **Crawford Road** North from Pickard to Mission Creek Park
- East
  - **Isabella Road** South from Pickard Road to Blue Grass
    - **Remus Road** (from Isabella Road east to 127)
    - **Remus Road** (from Isabella Road west to city limits)
- South
  - Township parcels:
    - **Broomfield Road** (east) - Gover Parkway to city line
    - **Broomfield Road** (west) - city line to Lincoln
      - Townships parcels: Crawford Road Broomfield to Deerfield
    - **Blue Grass** Isabella to Mission
- West
  - **Lincoln Road** north from Broomfield to Pickard
    - **Remus Road** (from Lincoln Road east to city limits)

II. Criteria for Granting Relief of Sidewalk Construction

Parcels not identified on a designated street may be granted provisional relief of sidewalk construction if any of the following conditions apply:

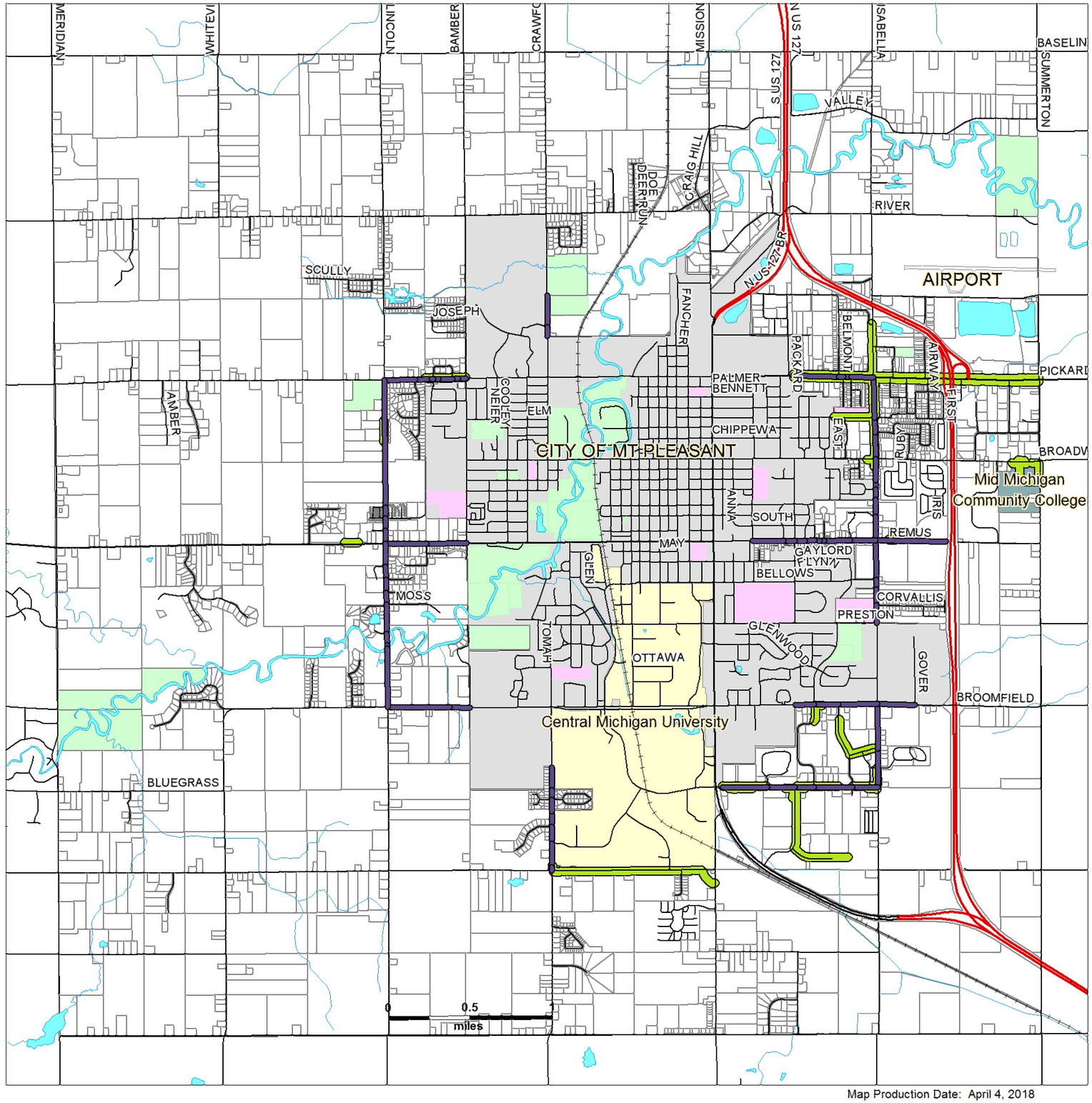
1. The development is located on a property zoned industrial.
2. The development is located on an unimproved road.
3. The development is located on property with road frontage where no car-pedestrian injury or fatality, due to the need of the pedestrian to walk in the roadway, has occurred for a distance of 1 mile in either direction of the development. A car-pedestrian accident within 1 mile of area provided relief from building the sidewalk will required sidewalk construction within 1 year.
4. Less than 50% of the surveyed sections of the township along the road fronting the proposed development has sidewalks. If on a corner lot, the mile will extend in both directions along the frontage roads. Once the threshold has been meet all parcels will be required to construct sidewalks within 1 year.
5. If the cost of the sidewalk construction exceeds more than 50% of the total cost of the project.

March 12, 2018

III. The Sidewalk and Pathways Prioritization Committee recommends to the Township Board
    1. Property owners previously granted relief (waivers) to construct sidewalks that have road frontage along the designated streets, as identified by the committee on March 12, 2018, need to be contacted and a plan be developed for the sidewalk to be constructed with 2 years.
    2. The designated streets, accompanying map, and the Criteria for Granting Relief should be reviewed yearly by the Sidewalk and Pathways Prioritization Committee and adjusted as conditions and growth occur with the township.

IV. Definitions
    a. Designated Street: A public way or road within The Charter Township of Union, Isabella County Michigan.
    b. Provisional: Provided for the time being; grant of relief is subject to later alteration.
    c. Relief: To eliminate the required construction of a sidewalk as shown on the site plan.
    d. Sidewalk: A paved path, usually concrete, located in a road right-a-way but away from the actual road surface and designed, constructed and designated for pedestrian travel. While Michigan law (MCL 257.660c and 257.660d) allows for travel on sidewalks or pathways by bicycle, provided they yield to pedestrians and do not impede traffic by pedestrians, adult cyclists are encouraged to use roadways or pathways as safer options.

# Union Township: Sidewalk Implementation & Prioritization




Legend

- Existing Sidewalks
- Street Priorities
- River, Creek, or Drain
- Lake or Pond
- Township Parcels
- Parks
- Schools
- Mid Michigan Community College
- Central Michigan University
- City of Mt. Pleasant

Map Production Date: April 4, 2018

# REQUEST FOR TOWNSHIP BOARD ACTION

**TO:** Mark Stuhldreher – Township Manager **DATE:** October 1, 2018

**FROM:** Kim Smith – Public Services Director **DATE FOR BOARD CONSIDERATION:** October 10, 2018

**ACTION REQUESTED:** Award Bid for construction services for office remodel at the Isabella Treatment Facility to JBS Contracting in the amount of $110,548.00.

Current Action ___X___ Emergency _____

Funds Budgeted: If Yes __X___ Account #_____591-536-975.000 & 590-536-975.000___ No _____ N/A _____

Finance Approval _____

## BACKGROUND INFORMATION

The 2018, Water Budget includes funds to remodel a portion of the Isabella Water Treatment Facility. Township wide, additional office space is needed to facilitate increased staffing levels across the entire organization. Current Public Services Department personnel from the Township Hall will be relocated to the remodeled facility. The remodel and relocation is necessary to alleviate some of the Township's need for additional office space for current and new employees.

The Township received two construction bids they are as follows:

| Bidder | Amount |
|---|---|
| JBS Contracting | $148,800.00 |
| Griffith Builders, Inc. | $170,245.00 |

The construction bids were higher than projected. Initial construction costs were estimated at $92,000 or $60.00 per square foot. The lowest bid received was from JBS Contracting in the amount of $148,800.00, at $81.00 per square foot.

In an effort to reduce the overall project cost, a post-bid addendum was issued. Upon receipt of the post-bid addendum from JBS Contracting, the project scope was reduced, therefore reducing the overall construction cost.

Project items removed are as follows:

| Item/Area | Cost |
|---|---|
| Eliminate all work in front area (payment center, additional office, copy/fax) | ($26,182.00) |
| Eliminate relocation of existing casework to new conference room area in back | ($8,558.00) |
| Acceptance of voluntary alternate of proposed RTU/McGuire Heating | (4,.000.00) |
| Add four additional data outlets and duplex receptacles in back office area (duplex receptacles/electrical work addition) | $488.00 |
| Total Post-Bid Addendum Items Adjustment/project reduction | ($38,252.00) |

Listed below for your review is a project summary including changes in scope and cost.

| Item | Original Estimated Cost | Changes in scope/cost | Revised Estimated Cost | Item Progress |
|---|---|---|---|---|
| General Filter Demolition and Removal<br>Change in scope – removal of cement slab | $10,160.00 | $2,300.00 | $12,460.00 | 100 % |
| Partial Roof Replacement (Otter Skin Flat Roof) | $4,800.00 | | $4,800.00 | 100% |
| Electrical upgrade and relocation (relocate well drives, new transformer installed, new main breaker installed, new panel installed) | $10,250.00 | | $10,250.00 | 100% |
| Architectural Design/Bidding/Construction Observation Services<br>Change in scope – structural engineer | $17,387.00 | $3,850.00 | $21,237.00 | 60% |
| Estimated Office Furniture/Supplies Purchase | $10,000.00 | | $10,000.00 | |
| Estimated Construction Cost | $92,000.00 | $18,548.00 | $110,548.00 | |
| Estimated IT Cost (install IT equipment/work station drops/camera installation) | $5,000.00 | ($523.00) | $4,477.00 | |
| 10% Contingency | $9,200.00 | | $9,200.00 | |
| **Estimated Total Project Cost** | **$158,797.00** | **$24,175.00** | **$182,972.00** | |

## SCOPE OF SERVICES

Construction Services for Isabella Treatment Facility office addition

## JUSTIFICATION

It is recommended that the Township award the construction services for the remodel of the Isabella Water Treatment Facility to JBS Contracting in the amount of $110,548.00. This recommendation is based on the following factors:

- Proposed work meet specifications
- Contractor's past performance and ability to complete the project as specified
- Cost

## PROJECT IMPROVEMENTS

Board of Trustees goals addressed by this award (From Policy 1.0: Global End)

1. Community well-being and common good

## COSTS

$110,548.00

The amount of this project will be paid from the Water & Sewer Funds as follows:

| | |
|---|---|
| 591-536-975.000 | $80,000.00 |
| 590-536-975.000 | $80,000.00 |

A budget adjustment to the water and sewer funds in the amount of $22,972.00, will be needed in November to fund the remaining portion of this project. At this time it is anticipated that funding is available from the water repairs budget, and the sewer pump station maintenance budget to fund the additional cost.

## PROJECT TIME TABLE

Ten (10) Weeks after Notice to Proceed is issued

## RESOLUTION

Approval of the bid for construction services for office remodel at the Isabella Treatment Facility to JBS Contracting in the amount of $110,548.00.

Resolved by _____ Seconded by _____

Yes:
No:
Absent:

GOUDREAU | ASSOCIATES
ARCHITECTS+BUILDERS
131 S. MAIN | MT. PLEASANT, MI | 48858 | P: 989.773.0146 | F: 989.400.4989

# AWARD RECOMMENDATION

**DATE:** September 28, 2018

**TO:** Kim Smith
Charter Township of Union
2010 S. Lincoln Road
Mt. Pleasant, MI 48858

**FROM:** Al Goudreau, AIA, LEED-AP
Shayna Bahlke, Associate AIA, Project Architect/Manager
Goudreau & Associates, Inc.

**RE:** Charter Township of Union
Water Treatment Building Renovations & Reconfigurations
Award Recommendation of Construction Contract

Dear Kim Smith,

This letter is in follow up to the referenced bid opening on 09-06-2018. The following outlines the changes in the project budget and scope to help clarify the difference in the initial estimate and the bids from the Contractors. Our original estimated project construction budget in February 2018 was derived from a blended cost per square foot; based on a higher cost per square foot for renovations in the 1987 portion of the project, and a lower cost per square foot in the 2010/2011 portion of the project. When combined, the overall cost per square foot was averaged at $60 per square foot. This brought the estimated project construction budget to $92,000.00.

During the planning and design process, there were items added to the scope which consequently increased the price of the project. Per the Owner's request, the following was added to the scope: painting the existing corridor, painting two existing offices, and new carpet in two existing offices. Per our recommendation and the Owner's approval, removal of the existing plywood ceiling and replacing it with lightweight gypsum drywall was added to the project as well. During the selection of interior finishes, efforts were taken to make cost-effective decisions.

At the bid opening, a total of two bidders submitted sealed bids that were opened as follows: **Griffith Builders, Inc.** and **JBS Contracting, Inc.** The Owner and Design Team collected "Appendix "A" – Bid Breakdowns from both bidders for evaluation and award recommendation. A complete Bid Breakdown was received from **JBS Contracting, Inc.**, and a partial Bid Breakdown from **Griffith Builders, Inc.** After contacting **Griffith Builders, Inc.** for further information and clarification, they indicated that because they were the high bidder, they did not wish to expend any more time and resources to further define their bid.

Our evaluation of the cost per square foot, based on the bids received, showed an average cost of $81 per square foot which we believe is in the appropriate range for a project of this type and size. In an effort to reduce to the overall cost of the project, our team sat down with the Owner to evaluate the project and identify items that could be removed or substituted for a more economical product. Based on this meeting, a Post-Bid Addendum was issued to both Contractors requesting breakout prices for fifteen (15) items. **Griffith Builders, Inc.** replied once again that they would not be providing any breakdowns for this project. After receiving a response from **JBS Contracting, Inc.** the Owner selected three (3) items/areas to reduce the cost of the project and are as follows:

| **Item/Area** | **Cost (Deduct)** |
|---|---|
| Eliminate all work in front area (Payment Center, Office, Copy/Fax) | $26,182.00 |
| Eliminate relocation of existing casework to new Conference Room | $ 8,558.00 |
| Accepting Voluntary Alternate of proposed RTU/McGuire Heating* | $ 4,000.00* |
| | **$38,740.00** |

* *Acceptance of Voluntary Alternate is contingent upon Engineer evaluation and approval of proposed RTU.*

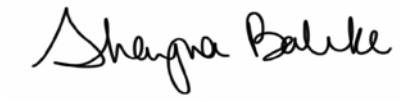
Also included in the Post-Bid Addendum was an item for pricing on Owner requested Electrical/IT additions. The following item was selected to be added to the project:

| **Item/Area** | **Cost (Add)** |
|---|---|
| Additional data outlets and duplex receptacles | $ 488.00 |
| | **$488.00** |

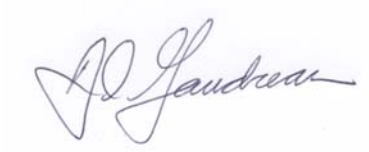
By accepting these four items, **JBS Contracting Inc.'s** price would be reduced from **$148,800.00** to **$110,548.00**. Together we have thoroughly evaluated the bid and Post-Bid addendum response by the apparent low bidder, **JBS Contracting, Inc.**, and have determined them to be responsive and responsible, and that the negotiated contract price is considered fair and responsible. It is our recommendation to award a construction contract for referenced project to **JBS Contracting, Inc**, as it would be in the best interest of the Owner, Charter Township of Union.

If you have any questions, please contact us at 989-773-0146.

Sincerely,



Shayna Bahlke, Project Architect/Manager
Goudreau & Associates, Inc.



Al Goudreau, Principal, AIA, NCARB, LEED-AP
Goudreau & Associates, Inc.

# REQUEST FOR TOWNSHIP BOARD ACTION

| | | | |
|---|---|---|---|
| **TO:** | Mark Stuhldreher - Township Manager | **DATE:** | October 1, 2018 |
| **FROM:** | Kim Smith – Public Services Director | **DATE FOR BOARD CONSIDERATION:** | October 10, 2018 |

**ACTION REQUESTED:** Deny the request to waive quarterly water and sewer bill penalties for The Crossings on Broadway in the amount of $3,038.89 – (Account Number #02342).

Current Action X Emergency _____

Funds Budgeted: If Yes _____ Account #_____No _____ N/A ____x___

Finance Approval _____

## BACKGROUND INFORMATION

The Township received a written request to waive the late fees for The Crossings on Broadway account number 02342 in the amount of $3,038.89.

Township Ordinance 1987-9, Article 10, Section 2 stipulates that quarterly water bills are payable without penalty within 35 days of the mailing date. Payments received after such period shall bear a penalty of 15% of the amount of the bill. Payment for the April 1, 2018 – June 30, 2018 quarterly water bills were due without penalties on August 5, 2018. Penalties were applied to all water and sewer quarterly billing customers' accounts with an outstanding balance on August 6, 2018. Payment for the quarterly billing was received on August 13, 2018. Payment for the penalties was received on August 31, 2018.

## SCOPE OF SERVICES

## JUSTIFICATION

Support to waive the penalties would result in unfair treatment of those customers that pay on time and those customers that pay late and also pay the penalties. Denial of the request to waive the penalties will maintain fair treatment among all water and sewer customers and support fair and non-discriminatory code enforcement.

## PROJECT IMPROVEMENTS

Board of Trustees goals addressed by this agreement (From Policy 1.0: Global End).

***1.*** **Community well-being and common good**

## COSTS

| | |
|---|---|
| $3,038.89 | Late Fee |
| $ 49.30 | Administrative Cost |
| $3,088.19 | Total |

This amount would be deducted from the Water Fund Revenue account number 591-000-655.000.

## PROJECT TIME TABLE

NA

## RESOLUTION

Deny the request to waive the penalties for The Crossings on Broadway account number 02342 in the amount of $3,038.89.

Resolved by _____ Seconded by _____

Yes:
No:
Absent:

M. SHAPIRO
Real Estate Group

RECEIVED
SEP 26 2018
BY: JL

September 25, 2018

Charter Township of Union
2010 South Lincoln Road
Mt. Pleasant, MI 48858

**Subject: Crossings on Broadway MHC – Late Fee**

To Whom It May Concern:

We manage the Crossings on Broadway MHC, and we recently incurred a late fee on Account # 02342, related to the water service for the period of April 1, 2018 – June 30, 2018. The payment, which was due on August 5th, was unfortunately paid late due to personnel issues within our accounting department (which have since been rectified). We have a very good payment history, and have put measures in place to ensure that future payments will be made on a timely basis.

We have paid the late fee, but would like to request that you consider waiving the fee as a one-time courtesy.

Your consideration of this matter is truly appreciated, and we look forward to hearing back from you. In the meantime, if you have any questions or would like to discuss this matter, please do not hesitate to contact me at (248) 865-0066.

Gratefully,

Julie Barnett

Julie Barnett

cc: Mark Kassab

$3,038.89 Late charge
Payment due 8-5-18
Payment Rcvd. 8-13-18

31550 Northwestern Hwy., Suite 220 | Farmington Hills, Michigan 48334
248.865.0066 (p) | 248.865.1166 (f) | www.mshapirorealestate.com

# History Detail Report

Thursday, September 27, 2018



Location ID: BROE-005402-0000-01
Account #: 02342
Service Address: 5402 E BROADWAY
Customer Name: CROSSINGS ON BROADWAY

| Posted | Created | Action<br>Read | Item - or - User<br>Usage | Amount<br>Other Info | Balance |
|---|---|---|---|---|---|
| 08/06/18 | 08/06/18 8:52 | Penalty | | $3038.89 | $23298.14 |
| 06/29/18 | 06/29/18 15:26 | Bill Calculated | 04/01/18-06/30/18 | $20259.25 | $20259.25 |
| 04/02/18 | 04/02/18 13:13 | Bill Calculated | 01/01/18-03/31/18 | $18936.25 | $18936.25 |
| 12/29/17 | 12/29/17 16:06 | Bill Calculated | 10/01/17-12/31/17 | $18936.25 | $18936.25 |
| 09/29/17 | 09/29/17 16:22 | Bill Calculated | 07/01/17-09/30/17 | $19092.25 | $19092.25 |
| 06/28/17 | 06/28/17 18:20 | Bill Calculated | 04/01/17-06/30/17 | $19092.25 | $19092.25 |
| 03/31/17 | 03/31/17 10:40 | Bill Calculated | 01/01/17-03/31/17 | $19206.35 | $19206.35 |
| 02/06/17 | 02/06/17 9:03 | Penalty | | $2900.08 | $22233.89 |
| 12/31/16 | 12/31/16 16:00 | Bill Calculated | 10/01/16-12/31/16 | $19333.81 | $19333.81 |
| 09/30/16 | 09/30/16 12:24 | Bill Calculated | 07/01/16-09/30/16 | $17992.11 | $17992.11 |
| 06/30/16 | 06/30/16 13:02 | Bill Calculated | 04/01/16-06/30/16 | $18214.41 | $18214.41 |
| 03/31/16 | 03/31/16 11:55 | Bill Calculated | 01/01/16-03/31/16 | $17048.31 | $17048.31 |
| 12/23/15 | 12/23/15 16:21 | Bill Calculated | 10/01/15-12/31/15 | $18341.16 | $18341.16 |
| 11/06/15 | 11/06/15 8:49 | Penalty | | $2358.85 | $18084.46 |
| 09/30/15 | 09/30/15 9:09 | Bill Calculated | 07/01/15-09/30/15 | $15725.61 | $15725.61 |
| 08/06/15 | 08/06/15 8:56 | Penalty | | $2173.99 | $16667.20 |
| 06/29/15 | 06/29/15 11:25 | Bill Calculated | 04/01/15-06/30/15 | $14493.21 | $14493.21 |
| 05/06/15 | 05/06/15 8:51 | Penalty | | $1957.54 | $15007.75 |
| 03/31/15 | 03/31/15 9:03 | Bill Calculated | 01/01/15-03/31/15 | $13050.21 | $13050.21 |
| 02/06/15 | 02/06/15 9:01 | Penalty | | $2704.75 | $20736.40 |
| 12/29/14 | 12/29/14 15:48 | Bill Calculated | 10/01/14-12/31/14 | $18031.65 | $18031.65 |
| 09/30/14 | 09/30/14 15:03 | Bill Calculated | 07/01/14-09/30/14 | $14811.85 | $14811.85 |
| 06/30/14 | 06/30/14 16:28 | Bill Calculated | 04/01/14-06/30/14 | $14811.85 | $14811.85 |
| 03/31/14 | 03/31/14 12:01 | Bill Calculated | 01/01/14-03/31/14 | $14811.85 | $14811.85 |
| 12/30/13 | 12/30/13 15:36 | Bill Calculated | 10/01/13-12/31/13 | $14660.61 | $14660.61 |
| 11/06/13 | 11/06/13 13:19 | Penalty | | $2528.64 | $19386.15 |
| 09/27/13 | 09/27/13 14:36 | Bill Calculated | 07/01/13-09/30/13 | $16857.51 | $16857.51 |

| | | | | | |
|---|---|---|---|---|---|
| 06/27/13 | 06/27/13 15:06 | Bill Calculated | 04/01/13-06/30/13 | $16857.51 | $16857.51 |
| 03/28/13 | 03/28/13 16:12 | Bill Calculated | 03/28/13-03/31/13 | $752.84 | $17625.35 |
| 03/27/13 | 03/27/13 10:54 | Bill Calculated | 01/01/13-03/27/13 | $16857.51 | $16872.51 |
| 03/27/13 | 03/27/13 10:36 | Bill Adjustment | Final Billing Fees | $15.00 | $15.00 |
| 12/21/12 | 12/21/12 15:40 | Bill Calculated | 10/01/12-12/31/12 | $16404.17 | $16404.17 |
| 09/27/12 | 09/27/12 15:23 | Bill Calculated | 07/01/12-09/30/12 | $18821.42 | $18821.42 |
| 06/28/12 | 06/28/12 16:57 | Bill Calculated | 04/01/12-06/30/12 | $16884.17 | $16884.17 |
| 03/30/12 | 03/30/12 13:43 | Bill Calculated | 01/01/12-03/31/12 | $16884.17 | $16884.17 |
| 12/30/11 | 12/30/11 15:28 | Bill Calculated | 10/01/11-12/31/11 | $16145.17 | $16145.17 |
| 09/30/11 | 09/30/11 8:34 | Bill Calculated | 07/01/11-09/30/11 | $17206.17 | $17206.17 |
| 06/30/11 | 06/29/11 13:09 | Bill Calculated | 04/01/11-06/30/11 | $17101.17 | $17101.17 |
| 04/04/11 | 04/04/11 8:48 | Bill Calculated | 02/04/11-03/31/11 | $10640.72 | $10640.72 |
| 02/07/11 | 02/07/11 11:22 | Bill Calculated | 01/01/11-02/03/11 | $6254.17 | $6269.17 |
| 02/07/11 | 02/07/11 11:21 | Bill Adjustment | Final Billing Fees | $15.00 | $15.00 |
| 01/04/11 | 01/04/11 8:51 | Bill Calculated | 10/01/10-12/31/10 | $16222.21 | $16222.21 |
| 09/30/10 | 09/30/10 9:24 | Bill Calculated | 07/01/10-09/30/10 | $15967.21 | $15967.21 |
| 07/01/10 | 07/01/10 8:35 | Bill Calculated | 04/01/10-06/30/10 | $15509.71 | $15509.71 |
| 03/31/10 | 03/31/10 8:50 | Bill Calculated | 01/01/10-03/31/10 | $15749.71 | $15749.71 |
| 01/04/10 | 01/04/10 9:14 | Bill Calculated | 10/01/09-12/31/09 | $15605.37 | $15605.37 |
| 09/30/09 | 10/01/09 12:42 | Bill Calculated | 07/01/09-09/30/09 | $15605.37 | $15605.37 |

Total Usage: 0.00